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**Confabulation:  
Constructing Motivated Memories**

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A thesis presented for the degree of  
Doctor of Philosophy

by

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**University of Durham**

Psychology Department

2005



**07 DEC 2005**

## **Confabulation: Constructing Motivated Memories**

### **Aikaterini Fotopoulou**

#### **Abstract**

Neurological confabulation is a prototypical form of false remembering and as such, it can provide insight into the nature of human memory. The main aim of the thesis was to empirically investigate the neuropsychological hypothesis that the content of confabulation is motivated. This was addressed by studying the neuropathological and neuropsychological profiles of 13 neurological patients with severe forms of confabulation, and by conducting three original experimental group studies and two single-case studies. Confabulating patients were compared with frontal and amnesic non-confabulating patients, as well as with neurologically healthy controls.

Neuropathological findings confirmed previous indications of orbital and medial prefrontal cortex (OMPFC) damage or disconnection. Neuropsychological data showed that the presence of amnesia and executive function varied across confabulating patients. The first experimental study revealed that bilateral confabulating patients showed a positive emotional bias in their spontaneous confabulations. The second study, based on a recognition experiment, confirmed the presence of this bias, over and above the deficits of temporality and reality monitoring. The third study was based on an emotional prose recall experiment, in which the self-relevance of the material was manipulated. This revealed that the emotional biases shown by confabulating patients were self-serving, and not explicable by deficits of amnesia or executive dysfunction. These self-serving biases were common to bilateral and unilateral confabulating patients, but their confabulations showed valence differences. Two single-case studies provided further specification to these findings and showed that confabulating patients form confabulations according to the values and goals of their premorbid self-representation.

In conclusion, this thesis provided experimental support for the hypothesis that the content of confabulation is motivated. This finding was conceptualised as a disinhibition of emotional memory associations, most likely caused by damage or functional disconnection of the OMPFC from adjacent limbic structures. These conclusions have wider implications about the role of the OMPFC in mediating the relation between emotion and memory.

## **Declaration**

I declare that no material offered in this thesis has been previously submitted for a degree at this or any other University.

Aspects of Chapters 7 and 8 are based on research carried out in collaboration with Professor Martin Conway and published in:

Fotopoulou, A. & Conway, M.A. (2004). Confabulations Pleasant and Unpleasant: A Commentary. *Neuropsychanalysis* 6, 1, 26-33.

This research was carried out by the candidate and supervised by Professor Conway.

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*This thesis is dedicated to the memory of Dennis*

## Table of Contents

<b>Chapter 1 : Introduction</b> .....	<b>- 10 -</b>
1.1 What is Confabulation?.....	- 10 -
1.2 Varieties, Clinical Features & Subtypes of Memory-Related Confabulation .....	- 17 -
1.3 The Neuropathology of Confabulation .....	- 30 -
1.4 Theoretical Explanations .....	- 36 -
1.5 Motor - Related Confabulation.....	- 58 -
1.6 Main Aims & Hypotheses. ....	- 61 -
<b>Chapter 2 : Patients &amp; Their Neuropsychological Assessment</b> .....	<b>- 63 -</b>
2.1 Introduction .....	- 63 -
2.2 Participants .....	- 63 -
2.3 Confabulation Recruitment Criteria .....	- 64 -
2.4 Classification: Confabulating Versus Control Patients.....	- 64 -
2.5 Confabulation Group.....	- 68 -
2.6 Control Groups.....	- 76 -
2.7 Neuropsychological Investigations .....	- 84 -
2.8 Discussion.....	- 108 -
<b>Chapter 3 : Positive Emotional Bias in Confabulation</b> .....	<b>- 123 -</b>
3.1 Introduction .....	- 123 -
3.2 Materials and Methods .....	- 124 -
3.3 Results .....	- 129 -
3.4 Discussion.....	- 134 -
<b>Chapter 4 : The Role of Emotions in Temporal Confusion</b> .....	<b>- 137 -</b>
4.1 Introduction .....	- 137 -
4.2 Materials & Methods.....	- 140 -
4.3 Results .....	- 145 -
4.4 Discussion.....	- 155 -
<b>Chapter 5 : Is Confabulation Self-Serving?</b> .....	<b>- 159 -</b>
5.1 Introduction .....	- 159 -
5.2 Materials & Methods.....	- 160 -
5.3 Results .....	- 167 -
5.4 Discussion.....	- 176 -

<b>Chapter 6 : A Case Report of Wishful Confabulation.....</b>	<b>- 185 -</b>
6.1 Introduction .....	- 185 -
6.2 Case Report.....	- 185 -
6.3 Neuropsychological Evaluation .....	- 189 -
6.4 Experimental Investigations: Confabulation and the Self .....	- 196 -
6.5 Discussion .....	- 213 -
<b>Chapter 7 : A Case-Report of Paranoid Confabulation .....</b>	<b>- 219 -</b>
7.1 Introduction .....	- 219 -
7.2 Case Report.....	- 220 -
7.3 Neuropsychological Examination .....	- 223 -
7.4 Experimental Investigations: Confabulation and the Self .....	- 228 -
7.5 Discussion.....	- 241 -
<b>Chapter 8 : Discussion.....</b>	<b>- 251 -</b>
8.1 Confabulation: Deficit or Motivation?.....	- 251 -
8.2 Confabulation: Deficit And Motivation .....	- 253 -
8.3 The Neuroanatomical Basis of Confabulation.....	- 254 -
8.4 The Deficits of Confabulation and their Loyal Attendants: Emotions .....	- 261 -
8.5 Confabulation and the Self in Memory .....	- 269 -
8.6 Confabulation and the Bodily Self .....	- 276 -
8.7 Confabulation and Awareness.....	- 283 -
<b>Chapter 9 : Conclusions and Implications .....</b>	<b>- 287 -</b>
9.1 Conclusions .....	- 287 -
9.2 Wider Implications and Future Directions .....	- 290 -
<b>Appendices.....</b>	<b>- 293 -</b>
Appendix A.....	- 293 -
Appendix B.....	- 306 -
Appendix C.....	- 318 -
Appendix D.....	- 320 -
Appendix E.....	- 329 -
Appendix F.....	- 337 -
<b>References.....</b>	<b>- 340 -</b>



## List of Tables

Table 1-1. The Characteristics of Confabulation.....	- 17 -
Table 2-1. Confabulation Ratings of the Confabulation Group.....	- 67 -
Table 2-2. Demographic and Neuropathological Characteristics of the Confabulation Group.....	- 68 -
Table 2-3. Ratings of Qualitative Confabulation Characteristics.....	- 74 -
Table 2-4. Demographic Characteristics by Group.....	- 77 -
Table 2-5. Characteristics of the Amnesic Control Patients.....	- 79 -
Table 2-6. Characteristics of Frontal Control Patients.....	- 81 -
Table 2-7. The WAIS-III and WTAR performance across experimental groups.....	- 91 -
Table 2-8. Group Performances on Neuropsychological Tests of Memory.....	- 93 -
Table 2-9. Groups' Performance on Tests of Executive Functions.....	- 98 -
Table 2-10. Groups' Performance on Tests of Visuo-spatial Neglect.....	- 103 -
Table 2-11. Groups' Performance on the HADS.....	- 103 -
Table 2-12. Groups' Performance on the Confabulation Battery.....	- 106 -
Table 3-1. Mean valence ratings by group.....	- 132 -
Table 4-1. Schematic Representation of Experimental Conditions.....	- 144 -
Table 4-2. Demographic Characteristics and Memory Performance of the Experimental Groups.....	- 146 -
Table 4-3. Groups' Performance on Tests of Executive Functions.....	- 148 -
Table 5-1. Means and SDs for Age, Education and Gender Ratio by Group.....	- 167 -
Table 5-2. Mean Total Scores of Confabulation, Fabrication, Distortion and Perserveration.....	- 171 -
Table 5-3. Examples of Recall Protocols in Negative and Self-referent Conditions.....	- 176 -
Table 5-4. Examples of Recall Protocols in Negative and Other-referent Stories.....	- 180 -
Table 6-1. Neuropsychological Evaluation of LH's Intellectual Abilities.....	- 190 -
Table 6-2. LH's performance on tests of Executive Functions.....	- 191 -
Table 6-3. LH's performance on neuropsychological tests of memory.....	- 193 -
Table 6-4. LH's performance on the Suggestibility Scale.....	- 202 -
Table 6-5. Percentages of Self-representations in True Memories and Confabulations.....	- 209 -
Table 7-1. Neuropsychological Evaluation of AO's Intellectual Abilities.....	- 224 -
Table 7-2. Neuropsychological Evaluation of AO's Executive Functions & Attention Abilities.....	- 225 -
Table 7-3. Neuropsychological Evaluation of AO's Memory.....	- 226 -
Table 7-4. AO's performance on the Suggestibility Scale.....	- 231 -
Table 7-5. Percentages of Self-representations in True memories and Confabulations.....	- 236 -
Table 7-6. AO's Ratings of Recollective Experience.....	- 239 -

## List of Figures

Figure 2-1. Schematic Representation of Confabulation Subgroups .....	- 73 -
Figure 2-2. Schematic Representation of the Experimental Groups .....	- 83 -
Figure 2-3. Primary and Contrast Measures of the DK-EFS. ....	- 88 -
Figure 3-1. Percentages of positive and non-positive self-representation ratings across groups .....	- 131 -
Figure 4-1. Correct Recognition Scores of Currently Relevant Events Across Groups .....	- 149 -
Figure 4-2. False Positives in the Recognition of Currently Non-Relevant Events .....	- 151 -
Figure 4-3. G 'Don't know' Responses across Time and Agent Conditions .....	- 153 -
Figure 5-1. Performance of Semantic Immediate and Delayed Recall across Groups .....	- 169 -
Figure 5-2. Mean Number of Semantic Units Recalled by Groups across Conditions .....	- 170 -
Figure 5-3. Mean Number of Confabulations across Groups and Conditions .....	- 172 -
Figure 5-4. Mean Valence Ratings across Groups, Valence and Perspective Conditions .....	- 173 -
Figure 6-1. LH's CT scan. 10 days post-surgery. ....	- 187 -
Figure 6-2. Percentage of Confabulations in the Confabulation Battery .....	- 196 -
Figure 6-3. Big Five Pre- and Post-morbid Personality Traits: Self- and Carer's Ratings .....	- 203 -
Figure 7-1. AO's CT scan .....	- 221 -
Figure 7-2. Big Five Pre- and Post-morbid Personality Traits: Self- and Carer's Ratings .....	- 232 -

## Chapter 1 : Introduction

*“You have to begin to lose your memory, if only in bits and pieces, to realise that memory is what makes our lives. Life without memory, is no life at all...our memory is our coherence, our reason, our feeling, even our action, without it, we are nothing”.*  
Luis Buñuel

The main aim of the thesis is to address the following hypothesis: “Is neurological confabulation motivated?” The conceptual, clinical and theoretical background of this hypothesis, and more generally of confabulation, is reviewed below. Based on this literature review, the above main hypothesis is broke down into several informed and more specific hypotheses. These are outlined following the literature review and will be further discussed in the chapters that follow.

### 1.1 What is Confabulation?

#### 1.1.1 Fragments of Clinical Sessions: A First Glance

A brief introductory view of the clinical nature of neurological confabulation, as it presented in the patients of the study, is presented in the following examples:

##### **Dora’s ‘yesterday’**

Dora says she was walking out in the garden yesterday. Unfortunately, Dora is no longer able to walk on her own following her stroke. The previous week she dreamt that rats came into her house and she woke up screaming. Today, she told me yesterday rats were in her room. She insisted it happened in reality, as she clearly remembers her fear and panic.

##### **Larry’s ‘business’**

I am getting ready to leave the ward after a very long session with Larry. He was able to talk about his stroke today and he correctly identified some of the subsequent difficulties. Now he appears calm and happy. We chat as I collect the testing material. He offers to help me but he doesn’t appear to recognise the equipment or even to pay much attention to them. He follows me to the door. His mood changes dramatically when the nurse reminds him he cannot leave the ward as I can. In vain I try to explain. Larry is perplexed, appears embarrassed and starts an endless monologue composed of inconsistent work- or holiday-related memories, now out of context, and other more bizarre associations. He is starting to become verbally aggressive. We try to calm him down but we only seem to increase his irritation. I leave my bag with the tests with the nurse and without prior warning I ask Larry about his profession in a jocular way: “I

heard, I say, you were doing so well lately you started to become lazy". His wife had informed me this was the way Larry himself perceived his professional position just before the stroke. Larry laughs, "You are becoming more and more direct", he says. He then goes on to explain the circumstances of his premorbid professional life. He is smiling again. We walk calmly towards the dining room, where I hope his lunch will distract him. As he sits down and the food is served he says to me, "This hotel is actually not that bad. A pity you have to go. You have to go, don't you?" Yes, I reply, I'll see you on Wednesday. "I can't make it Wednesday, he says. I am going hunting. Lets have lunch next week. You'll have to excuse me now", he says and points to his food...

**Anna's 'holiday'**

Anna says her sister recently took her back to their childhood house in Scotland. They had a lovely time. Yet, in fact her sister died more than 20 years ago and Anna has not being to that house for more than 40 years.

**David's 'parents'**

David managed to escape his sister's attention and went back to his mother house. He was worried, he had not heard from her in a while. He was perplexed and upset when strangers opened the door. They seemed to recognise him. He did not recognise them. They told him that they had repeated this information to him several times: They bought the house 15 years ago when his mother and father died. He left. He did not believe them. He would know, wouldn't he? He had never been at the funeral. How could his mother be dead?

**Patrick's 'TV series'**

Patrick's hospital ward has a rare female name. But Patrick is not aware he is in a hospital ward. Even when he admits it, he is not able to remember the ward's or even the hospital's name. Yet this afternoon he remembered his ward's name. In fact, he told me a story involving this very name. Patrick said he saw this woman on television. She addressed him directly and told him to take care of his head. She told him things might try to slip out of the world and get lost. He must stop them and keep them on earth. Patrick said she had a friendly tone but in the end he felt uneasy. When women tell him what to do he feels weaker already, he said and laughed.

**Ron's 'girlfriend'**

Ron claims his girlfriend came to see him yesterday but in fact they never formally went out. They met shortly before his accident and became friends. He hasn't seen her since then. He is expecting her again tonight, he says. Yet, when the time comes, he isn't disappointed. He seems to have forgotten.

**Harry's 'quest'**

At the beginning of last month Harry had a glorious day, which he described to me in detail. The president of the US came to visit him at his office. After Harry showed him around and

explained his business the president wanted to discuss politics. But Harry told him he feels more comfortable discussing sports or social matters. They ended up discussing golf news, which made Harry feel great. He felt his knowledge was comparable to that of the president's and he could have a conversation with him at an equal level. It was important to him to feel this way, he said.

**Tony's 'brain'**

Tony remembers his stroke. He says the images are clear in his mind. He felt a sudden intense pain in his head and then his brain exploded. He saw parts of it, including little bones, falling to the ground. He remembers his daughter picking them up with tweezers.

**Nancy's 'husband'**

Nancy says her husband is the most caring man. After a while, she says her husband is dangerous, selfish and bad mannered. I am perplexed. I point to the inconsistencies. Nancy suddenly takes her gaze away from mine. She appears perplexed too. "I'll tell you a story", she finally says. She tells me a story about a neighbour of hers. It is a confusing story but it seems to concern her friend's search for new furniture. In the end, a third friend assist them both and the neighbour's house is re-furnished. I ask if this story is connected to her husband. "My husband?", she asks in surprise. "He is a very caring man".

1.1.2 The Term & the Concept

*Etymology*

The term 'confabulation' originates from the Latin verb *confabulari* (OED, 1971), meaning to talk together (*con-* together and *fabulari* – to talk, to chat). It is also associated with the word *fabula* meaning tale, fiction, myth, story, which is the root of the English words fable and fabulous. The technical use of the term is most commonly associated with Korsakoff's classic neuropsychological descriptions. In his investigations, which at the time, he characterised as 'medico-psychological', Korsakoff (1889/1996) described a characteristic amnesic syndrome. It occurred in clear consciousness, compromised mostly recent but sometimes also remote memory and was frequently but not always associated with alcohol abuse. Korsakoff observed that a few of his severely amnesic patients "invent some fiction and constantly repeat it ...so that a peculiar delirium develops, rooted in false recollections (pseudo-reminiscences)" (p. 399). In their descriptions of similar phenomena in the early 1900's other authors (Bonhoeffer,

1901; 1904; Kraepelin, 1910; Pick, 1905; Wernicke, 1906) substituted Korsakoff's term 'pseudo-reminiscences' with the term 'confabulation', and thus established its use and its association with amnesic syndromes (in Berrios, 1998).

Nowadays, it is well established that confabulation is a prototypical form of false-remembering, i.e. a neurological memory disorder. Its exact prevalence is unknown but confabulation occurs infrequently following a variety of neuropathologies, including alcoholic Korsakoff disease, ruptured aneurysms of the anterior communicating artery (ACoA), other types of stroke, traumatic brain injury, tumours and dementia (see Johnson, Hayes, D'Esposito, & Raye, 2000 for an extensive empirical review). Yet, even to this day, the technical usage of the term confabulation is wide and its nosological borders are not always well-defined.

#### *Wider Neurological Use*

The term confabulation is used to describe the false statements and inappropriate responses produced by patients, in many other memory-independent neurological syndromes, such as Anton's syndrome (unawareness of blindness), unawareness of hemiplegia, unawareness of hemianopia, Wernicke's aphasia, and cerebral disconnection syndromes (Deluca, 2000; Feinberg & Giacino, 1997; Hirstein, 2004). In these syndromes, patients' memory abilities are not typically compromised by the neurological damage. However, their ability to observe and draw correct inferences about themselves and their environment is defective. Thus, they can unintentionally produce erroneous statements about their condition, their abilities, or their surrounding environment and often behave accordingly. For example, cortically blind patients with Anton's syndrome (Anton, 1983) may deny any subjective experience of visual loss and act accordingly. These patients are not consciously aware of such errors and therefore are not characterised as lying, but as confabulating (Dennet, 1991; Feinberg & Giacino, 1997; Hirstein, 2004). A common denominator in these syndromes is the relation between unawareness of deficit and confabulation (see below).

#### *Psychiatric Applications*

The American Psychiatric Association's official Diagnostic and Statistical Manual of Mental Disorders (DMD-IV-TR, 2000) defines confabulation as the

“recitation of imaginary events to fill in gaps in memory” (p. 173). This definition is built upon the foundations of a long tradition in psychiatry, which describes and defines confabulation in relation to ‘memory gap-filling’, a frequently used and misused description (Berrios, 1998; Deluca, 2000; Talland, 1961; Whitlock, 1981; see also below). Within this psychiatric context, confabulation is typically distinguished from other psychopathological forms of lying. These include conditions, in which patients adopt imaginary qualities, experiences or even single or multiple identities, without evidence of any organic memory deficit (e.g. ‘*pseudologia fantastica*’, Fish, 1967; false identity following fugue episodes, Kopelman, Christensen, Puffet, & Stanhope, 1994; Markowitch, Fink, Thone, Kessler, & Heiss, 1997; dissociative identity disorder). In some of these conditions, as for example in *pseudologia fantastica*, the production of false information and experiences is considered intentional, albeit compulsive. The patient is, in principle, able to have access to the alternative and ‘more accurate’ version of the misrepresented information, irrespective of the fact that in practice he might be motivated not to have access to this information. Thus, the symptom is conceptually distinguishable from neurological confabulation (although see Berrios, 1998). However, some of the other conditions, do not include a conscious intention to deceive one’s listener or even one’s self, and thus are harder to distinguish from confabulation on a purely conceptual level (see Kopelman 1999, for a review). Instead, the differentiation in current practice relies on the careful delineation of associated symptoms and crucially the exact neurological or psychiatric history of each patient.

In addition, the term confabulation is also employed in the context of more general psychiatric diagnostic categories, such as schizophrenia (e.g. Kramer, Bryan, & Frith, 1998; Nathaniel-James & Frith, 1996; Simpson & Done, 2002). However, the distinction of confabulation from other types of false beliefs, such as delusions (“A false belief based on incorrect inference about external reality that is firmly sustained despite what almost everyone else believes and despite what constitutes incontrovertible and obvious proof or evidence to the contrary”, DSM-IV-TR, p. 821) and delusional misidentifications (conditions in which a patient incorrectly identifies and reduplicates persons, places, objects or events, Feinberg & Roane, 1997b) in the context of psychotic illness or delusional disorders (DSM-IV-TR), is harder to establish (see Kopelman, 1999; 2002;

Feinberg & Roane, 1997b). Delusions, and particularly their more rare memory-based form, 'delusional memories' (Buchana, 1991), are generally described as thematically restricted, well-organised, stable, and resistant to correction. They are thus contrasted with the typically ephemeral, multi-thematic and disorganised character of most confabulations (see Feinberg & Ciacino, 1997; Kopelman, 1999; see also below). Yet thematically restricted, pervasive and organised confabulations have also been reported (e.g. Burgess & McNeil, 1999). Moreover, the two symptoms have been reported to overlap in several neurological patients (e.g. Baddeley & Wilson, 1986; Box, Laing & Kopelman, 1999; Dab, Claes, Morais, & Shallice, 1999; Mattioli, Miozzo & Vignolo, 1999; Marshall, Halligan & Wade, 1995; O'Connor et al., 1996; Stuss, Alexander, Lieberman, & Levine, 1978; Talland, 1965). Thus, some authors see certain forms of confabulation as synonymous with delusions (e.g. Feinberg & Roane, 1997a; Johnson, 1991; 2001; Joseph, 1986a), while others stress the possible clinical and anatomical differences between the two symptoms (Baddeley, Thorton, Chua, & McKenna, 1996; Kopelman et al., 1995; Weinstein, 1996).

More generally, it is now well-established that delusions occur both in the context of psychiatric illness and neurological pathologies (e.g. Cummings, 1985; Feinberg & Keenan, 2005; Forstl, Almeida, Owen et al., 1991a; Joseph, 1999; Singer, 1992). Moreover, the emergence of interdisciplinary fields such as 'Neuropsychiatry' has questioned traditional and rigid distinctions between functional and organic conceptualisations of these symptoms (e.g. see Box et al., 1999; Benson & Stuss, 1990; Ellis & Young, 1990; Feinberg & Keenan, 2005; Joseph, 1986b; Staff, Shanks, Macintosh, Pestell, Gemmell, & Venneri, 1999). In conclusion, although the distinction between confabulation and delusion is commonly accepted, its exact grounds remain unclear and await further investigation (see Berrios, 1998; Deluca, 2000; Kopelman 1999 for useful reviews; see also Chapter 7).

#### *Usage beyond Pathology*

Finally, the term confabulation has been used to describe the unintentional memory intrusions, misrecognitions or other memory errors of neurologically healthy individuals in everyday life, in the laboratory or in forensic contexts (e.g. Ackil, & Zaragoza, 1998; Nisbett & Wilson, 1977; Gudjonsson & Clare, 1995;



Read & Lindsay, 1997; Schacter, Norman & Koutstaal, 1998). Similarities between these types of false memories and some less severe forms of confabulation have been pointed out (e.g. Burgess & Shallice, 1996; Johnson & Rayne, 1998; Kopelman, 1987). However, some authors have argued against grouping these behaviours under the common conceptual umbrella of confabulation without appropriate demarcation (e.g. Delbecq-Derouesne et al., 1990; Gilboa & Moscovitch, 2002; Hirstein 2004; Kopelman, 1999; Schacter et al., 1998). These vast discussions regarding the exact interdisciplinary position of the term confabulation lie beyond the scope of this study, which will exclusively focus on confabulation in the context of neurological pathologies. More specifically, the present investigations will address two types of confabulation. Confabulation as a memory disorder, here heuristically referred to as ‘memory-related confabulation’ and confabulation associated with anosognosia for hemiplegia following right-hemisphere lesions, hereafter referred to as ‘motor-related confabulation’ (see below for a description).

#### *An Operational Definition*

Given the above ‘multipurpose’ and interdisciplinary use of the term confabulation, it should not be surprising that more than 100 years since its introduction to neurology no single definition is universally agreed upon (Berrios, 1998; Deluca, 2000; Feinberg & Giacino, 1997; Johnson et al., 2000; Hirstein, 2004; Koehler & Jacoby, 1978; Whitlock, 1981). However, there are two aspects of confabulation that most scholars of the symptom would agree upon. Confabulation is similar to normal lying at *face value*, in that it represents a statement that is not in accordance with reality, as perceived, remembered, interpreted or documented by others in the same social context. Nevertheless, confabulation differs from lying in at least one important aspect. Namely, the production of false statements by confabulating patients is not motivated by a deliberate effort to deceive the listener (see Berlyne, 1972; Burgess & Shallice, 1996; Dalla Barba, 1993a; Hirstein, 2004; Johnson, 1991; Moscovitch, 1989; Talland, 1961). Most other characteristics of confabulation, including its relation to amnesia, are still debated as they are embedded in different theoretical conceptualisations (see corresponding section below). Thus in the present study, confabulations will be broadly and heuristically defined as *erroneous statements*

or misguided behaviours that are made without a conscious effort to deceive (Feinberg & Giacino, 1997).

## 1.2 Varieties, Clinical Features & Subtypes of Memory-Related Confabulation

Several papers have been dedicated to the detailed description of the clinical features of memory-related confabulation. For the present purpose, a few influential reviews and original studies will be used as landmarks. In a series of groundbreaking publications in the 1960's Talland proposed a list of confabulation characteristics, based on an extensive review of the preceding literature and the study of new patients (1961; 1965; et al., 1967). More than twenty years later, Moscovitch (1989) and Burgess & Shallice (1996) revisited this list. The conclusions of these studies, as well as new proposals based on more recent publications are summarised in Table 1-1 below.

**Table 1-1. The Characteristics of Confabulation**

Talland (1965)	Moscovitch (1989)	Burgess & Shallice (1996)	Reformulation
a. Typically, but not exclusively, an account more or less coherent and internally consistent, concerning the patient	Cites original	a1. Most apparent when autobiographical recollection is required	Tallands' comment includes two characteristics: i. context (a1) and ii. form a1. is redundant in context of c1/c2. ii. Not true for all confabulations. Some can be internally inconsistent or, incoherent.
b. This account is false on the context named and often false in details within its own context	Cites original	As original.	As original.
c. Its content is drawn fully or principally from the patient's recollection of his actual experiences, including his thoughts in the past	Cites original	c1. Not true for all confabulators c2. Some aspects are derived from semantic memory	(c) includes two components. The autobiographical content of confabulation (dealt with by Burgess & Shallice, 1996) and the observation that sources of confabulation can include, beyond past memories, thoughts, dreams or fantasies.
d. Confabulation reconstructs this context, modifies and recombines its elements, employing the mechanisms of normal remembering.	Cites original	d1. Confabulations are not intentionally produced – redundant in context of (i) d2. Produced by impaired memory processes and not compensatory mechanisms	D1 is not necessary here d2 is partly true. Normal constructive memory processes, damaged and intact, determine the exact nature of confabulation. See also g.
e. This method is presented without awareness of its distortions or of its inappropriateness	Cites original	Redundant in context of (i)	This is not necessarily redundant in the context of (i), as it also refers to the patient's inability to monitor the implausibility, or incoherence of his false statements.

Talland (1965)	Moscovitch (1989)	Burgess & Shallice (1996)	Reformulation
f. serves no other purpose, is motivated in no other way than factual information based on data	Cites original	Evaluation impossible until further evidence available.	<b>Evaluation will be undertaken by the study</b>
<b>CURRENT ADDITION:</b> Talland (1965) also agrees with g. proposed by Moscovitch (1989), but mostly in the case of the chronic state of the syndrome. "The amnesic deficit creates an occasion for its occurrence, and dispositions characteristic of the individual patient determine its presence, rate and quality" (p. 57).	<b>ADDED IN 1989</b> g. The readiness to confabulate maybe determined by the patient's 'personality structure', his traits evolved in dealing with the environment and in monitoring his self-image'	Evaluation impossible until further evidence available.	<b>Evaluation will be undertaken by the study</b>
<b>CURRENT ADDITION:</b> Talland claims colliding verbal and visual or other behavioural forms of confabulation may lead to conceptual confusion (1965, p. 41-42).	<b>ADDED IN 1989</b> h. Such patients at times act on their confabulations.	As original. (Mentioned and supported by Moscovitch (1989) but actually added to the list and described as 'original' by Burgess & Shallice, 1996).	The term confabulation has being frequently employed to refer to non-verbal behaviour that arbitrary exclusion of such descriptions from its definition would be ineffective. Use of additional criteria (e.g. verbal, visual or acted upon confabulation) is useful.
<b>CURRENT ADDITION:</b> Also mentioned by Talland (1965), although it was not listed – apart from (e).	<b>ADDED IN 1989</b> i. All confabulating patients seem to suffer from anosognosia, an unawareness of their memory deficit, or, at best, a profound lack of concern and lack of appreciation of its severity and extent	As original.	As original. Yet the relation between confabulation and other non-memory related types of unawareness is less clear.
<b>Additions</b>			
j. The duration of confabulation varies among patients. Typically the symptom disappears or is reduced in frequency and variety of content following an acute period but chronic states are also described. The issue awaits further investigation.			
k. The frequency and thematic range of confabulation varies across and within patients. Typically confabulation is considered ephemeral and multi-thematic Yet this issue awaits further exploration.			
l. The nature of confabulation is typically as described by (k) as well as easily directed by questioning and not necessarily consistent across time. However, across patients and within patients confabulations that border with delusional memories also occur. The issue awaits further investigation.			
m. Although confused and thus false memories are present during the acute confusional stage, confabulation proper should be identified if it persists beyond the initial delirium stage.			

Characteristic (a) in fact includes two components. The alleged internal consistency and coherence of confabulations and the fact that they concern the patient's life. Burgess and Shallice (1996) consider only the latter. This is dealt with below (see characteristic c). The alleged coherence is not true for all confabulations. On the contrary, confabulations often involve striking internal inconsistencies and their coherence can be extremely obscure. For example, Baddeley and Wilson (1986) described confabulating patient RJ who narrated detailed circumstances of his brother's alleged death in a car accident, yet, in the

next moment, he described his brother as being alive. Similarly, a patient described by Moscovitch (1989) claimed he had being married for four months, yet also had four children from this marriage. When these inconsistencies were pointed out to the patients, they confabulated further to support their claims. Moscovitch (1989) characteristically noticed that “confronted with the flagrantly inconsistent accounts that such a process will sometimes produce, the patients counters with an explanation that is sometimes more preposterous (and laughable) than the inconsistencies it was meant to reconcile (p. 138). Examples of such internal inconsistencies are found in many other clinical descriptions (e.g. Dalla Barba, 1993b, patient SD; Feinberg, 2001; Fotopoulou et al., 2004; Kaplan-Solms & Solms, 2000; Mercer et al., 1977). In fact, Talland himself (1961) described confabulation as including internal inconsistencies. It seems his reason for de-emphasising them was due to his effort to distinguish confabulation from delusion (see also characteristic (I) below), and what is today known as delirium or an acute confusional state (Lipowski, 1990):

“the content even though coherent is often blurred in outline and frequently couched in general terms where normal discourse would have been specific. This quality as well as the imperfect articulation of any one unit of content with the preceding themes justifies Scheid’s comparison of the Korsakoff patients’ reminiscences with dream memories. Confabulations vary widely in their internal coherence....Undoubtedly the patient’s communications gain in coherence as he progresses from the acute to the chronic phase, though complete incongruity between two or more serially presented themes maybe be found at every stage. In the acute phase total incoherent talk ought probably to be attributed to delirious fantasy...In comparison with the themes of delusion those of confabulation are stable and coherent as well as rational. Delay (10) obscured the definition of confabulation when he presented it as an example of delirium, as outside the realm of logical categories where the distinction between reality and imagination has been abolished” (Talland, 1961, p. 366).

Berlyne (1932) also provides an impressive list of authors who compared the incoherent quality of confabulatory recollection with dream-like states and more recent authors have supported these observations (e.g. Damasio et al., 1985; Kaplan-Solms & Solms, 2000).

Characteristic (b) is agreed upon by most scholars of the symptom. Confabulation seems to involve the distortion, misuse or misinterpretation of both context (including temporality) and content. However, little theoretical agreement exists between the authors, regarding the causative role of these deficits. Thus, while some see a temporal disorder as the primary deficit of confabulation (Van der Horst, 1932; Dalla Barba, 1993; Schnider, 2000), others argue that impaired temporality is merely the secondary effect of more general memory-control impairments (Burgess & Shallice, 1996; Johnson, 1991; Moscovitch, 1989). These views are based on different theoretical conceptualisations and will be examined below.

One of the components of characteristic (c), namely the autobiographical reference of confabulations, has been well-clarified by Burgess & Shallice (1996). Although the issue of whether autobiographical and semantic confabulations are caused by the same or different underlying mechanisms is still under investigation (e.g. see Dalla Barba et al., 1997b; Moscovitch & Melo, 1997), most recent authors would agree with the clinical observations c1 and c2 (e.g. Dab et al, 1999; Dalla Barba, 2000; Gilboa & Moscovitch, 2002; Johnson et al., 2000; Kopelman, Ng, & Van de Brooke, 1997; Moscovitch & Melo, 1997). It also appears that although, in his summary, Talland (1965) emphasises the autobiographical memory content of confabulations, in the main part of the text and in other papers (e.g. 1961) he draws attention to the possible semantic memory elements of confabulation. For instance, he writes: "Confusion between memories of actual experiences and second-hand information or mere ideas also occurs" (p. 57). And a few years earlier "confabulation, according to our definition, would typically contain autobiographical reference, but would neither be restricted to that, nor would that content be a sufficient criterion for classifying a non-veridical narrative under the heading of confabulation" (Talland, 1961, p. 365).

The second component of (c) implies that the source of the information that is used to construct confabulations could include, in addition to memories, other types of self-produced mental content, such as thoughts. This opens the door to include other mental categories among the potential candidates for confabulatory recollection, such as fantasies and dreams. Indeed, certain authors consider confabulation to include such elements and thus to occasionally acquire

bizarre or fantastic content (Berlyne, 1972; Damasio et al., 1985; Fotopoulou et al., 2004; Stuss et al., 1978). However, complications arise as Talland repeatedly argued against including instances of what he called ‘fabrication’ in the definition of confabulation. Several recent authors have followed his example and have defined confabulation as including exclusively distortions and misplacements of past experienced events (e.g. Schnider et al., 1996). Although on the surface this distinction seems to be merely a matter of conceptual classification, it has severe theoretical implications and thus requires careful delineation. Talland’s writings will be once again used as a template in this effort.

Talland’s exclusion of fabrication from the definition of confabulation entailed two separate classes of phenomena. One referred to the process of false remembering, the other to the source of false memories. With respect to the first, he claimed that confabulation, as any act of remembering is constructive, but it should not be confused with imaginative elaboration. His grounds for these claims were mostly clinical. Korsakoff patients appeared to lack creativity and flexibility of thought. Thus, he emphasised that “the question to ask, then, is whether confabulation in the Korsakoff syndrome involves a creative or imaginative feat over and above that which goes into normal remembering”. His answer was clearly negative and hence he emphasised that confabulation is caused by normal memory processes (see characteristic d below). The second notion of fabrication which Talland considers is that of the origins of fantastic false memories. He asks whether they originate from sources others than past experienced events. His answer is once again negative, but this time, is less categorical and is based on conceptual rather than clinical reasons. Thus, he reviews a number of instances of fantastic confabulation and writes:

“Quite another problem is posed by instances of fantastic confabulation which involve the supernatural, the clearly fictitious or the historical past...and indeed examples of autobiographic information more appropriate to the patient’s ideal than actual self are not uncommon in the chronic phase. It is possible to deal with these by including among the pre-morbid memories the patient draws on, his wishful fantasies and imaginary horrors as well as his real experiences. Another solution has been proposed by Williams and Rupp, who distinguish confabulation from fabrication, assigning all the fantastic content to the latter” (1961, p. 364-5).

Talland seems to favour the latter solution. However, he notices that “patient’s behaviour does not respect these considerations” and “often the sorting out of one source of its content from another becomes a detective task insoluble with the information obtainable” (p. 365). Yet he insists in finding it “advisable to restrict confabulation...and to apply a second term, fabrication, to the more fantastic and incongruous material” (p. 365). Interestingly, Talland himself a few years later (Talland et al., 1967) is one of the first researchers to dismiss his own exclusion of fabrication from the notion of confabulation. In his descriptions of confabulation in the context of ACoA aneurysms, he uses the terms confabulation and fabrication almost interchangeably, e.g. “This lighthearted mood continued while confabulation in the sense of fabricating absurd or improbable tales gave way to more plausible errors in temporal or situational placement” (p. 181). Thus, although Talland proposed to separate confabulation from fabrication on a conceptual level, he faced difficulties in trying to clinically establish such a distinction. Similar difficulties are encountered in studies following Talland’s review, and a number of distinctions, most often dichotomous in nature, have been proposed in order to separate the various manifestations of confabulation more clearly.

Berlyne (1972), building upon previous work by Kraepelin (1904, cited in Talland, 1965) and Bonhoeffer (1901, cited in Berlyne, 1972) emphasised the importance of both the source of confabulatory material (minor distortions of time, place, events versus bizarre, exaggerated and florid verbalizations), as well as the different methods used to elicit confabulations. Thus, he distinguished between “fantastic” (i.e. bizarre, exaggerated and spontaneously produced) and “momentary” (i.e. minor and probed distortions). However, later on, Kopelman (1987) noted the doubtful correlation of such criteria and instead proposed to separate them. Thus, he established a more useful distinction, based exclusively on the method of evocation. “Spontaneous confabulation”, was defined as a persistent, unprovoked outpouring of erroneous memories and was linked to the presence of frontal lobe dysfunction. It was distinguished from “provoked confabulation”, in which intrusion errors or distortions are produced when memory is challenged. In this case, frontal lobe damage is not seen as a necessary prerequisite. Although, this terminology is still used by most current investigators, at least descriptively, several other proposals have been put forward.

From a different theoretical perspective (see below), Dalla Barba and his colleagues argued that the bizarreness of confabulations is influenced by the presence or absence of a semantic deficit. If the semantic system is preserved (Dalla Barba, 1993a) confabulations are semantically appropriate and confined to episodic memory, whereas, when semantic processing is affected (Dalla Barba, 1993b), confabulations became anomalous or bizarre. More recently, Schnider and his colleagues (1996) proposed yet another classification criterion. They have classified patients as spontaneous confabulators if they ever acted according to a confabulation, irrespective of its content. Finally, Feinberg & Roane (1997b) have distinguished between 'neutral' and 'personal' confabulation. Neutral confabulation is defined as a non self-referential, domain-specific form of confabulation which can occur in amnesia as well as in other domains. The template for this form is perceptual completion or filling in. By contrast, the content of personal confabulation relates to the patient's self, it has the form of a delusional belief which cuts across sensory domains and it is refractory to correction.

The above multiple classifications point to the fact that most authors would agree there are clinical differences between severe and mild forms of confabulation. However, there is limited consensus on the exact criteria upon which a classification of different manifestations of confabulation can be based. Characteristically, in a careful empirical review, Johnson and colleagues (2000) have placed emphasis on the difficulty of mapping these classifications onto each other, and comparing across studies which use different definitions and different descriptive criteria. Moreover, the proposed categories are not necessarily mutually exclusive and they can overlap (see also Feinberg & Giacino, 1997). More generally, the question of whether these various manifestations represent different extremes of a common underlying disorder (Dalla Barba, 1993a,b; DeLuca & Cicerone, 1991; Fisher et al., 1995; Kapur & Coughlan, 1980; Shapiro et al., 1981) or distinct underlying pathologies and deficits (Berlyne, 1972; Burgess & Shallice, 1996; Burgess & McNeil, 1999; Johnson et al., 1997; Kopelman, 1987; Schnider et al, 1996; Talland, 1965) awaits further exploration. These discrepancies reflect the more general underlying theoretical disagreement about the cognitive mechanisms and brain regions that are impaired in



confabulation (see below), as well as the lack of standardization in assessing, eliciting and describing confabulation across different studies and patients.

In the light of the above difficulties in this study severely confabulating patients will be distinguished from non-confabulating or mildly confabulating amnesic and frontal patients based on multi-dimensional qualitative ratings. These will include ratings of confabulation frequency, plausibility, novelty, conviction and provocation mode (see Chapter 2).

Characteristic (d) refers to the description of the normal constructive memory processes which are responsible for both memory accuracy and distortion. Talland (1961; 1965) considers confabulation as a dysfunction in this constructive process rather than an additional creative process, compensatory or not (see also characteristic c above). In this sense, d2 (Burgess & Shallice, 1996) is valuable in clarifying that compensatory processes in confabulation are secondary to other normal memory mechanisms. The dysfunction of the latter plays a causative role in confabulation (see also following section). However, the statement that confabulation is the result of exclusively impaired memory processes can be misleading. Confabulation is, *by definition*, the result of a combination of impaired and intact memory process, as the patient is actually remembering something (even if totally constructed), rather than nothing as in some cases of amnesia. On an aetiological level of analysis, several recent studies have been able to describe how particular forms of confabulation relate to particular combinations of impaired and preserved memory, as well as other cognitive processes (Dab et al., 1999; Johnson et al., 1997; Fotopoulou et al., 2004; Kopelman et al., 1997). Interestingly, both Dab and colleagues (1999) and Burgess and McNeil (1999) also describe how the relatively rare forms of confabulation showed by their patients are explicable by a combination of damaged and intact memory control processes. However, this issue overlaps with debatable theoretical conceptualisations and therefore will be fully addressed below.

Characteristic (e) is not redundant in the context of (i) as suggested by Burgess & Shallice (1996). This characteristic does not only refer to patients' inability to check their confabulatory statements with external reality and thus realise their implausibility or inappropriateness. It also refers to their inability to

monitor the incoherence of their statements (see characteristic a), as well as their potential inconsistency with other personal memories (Conway & Fthenaki, 2000). This striking inability to notice and correct such conflicting beliefs (a self-monitoring deficit) has been described by many as one of the hallmarks of confabulation (Burgess & Shallice, 1996; Mercer et al., 1977; Moscovitch & Melo, 1997; Stuss et al., 1978; see below).

Characteristic (f) includes the main focus of the present investigation. The related characteristic (g), will also be directly addressed by the present investigations in two case-studies. A review of these hypotheses and their associated theoretical proposals will be undertaken in detail below, given the centrality of these characteristics to the present investigation.

Characteristic (h) is described by several authors (e.g. Baddeley & Wilson, 1986; Fotopoulou et al., 2004; Moscovitch, 1989; Schnider et al., 1996). The reported acting out, as well as the unrealistic action plans confabulating patients often make about their future (e.g. Dalla Barba et al., 1997b; Fotopoulou et al., 2004), seem to provide support for the observation that confabulating patients are convinced about the truthfulness of their recollections (see characteristic (i) below). For example, Moscovitch (1989) notes how the usual apathy with which confabulating patients react to confrontations of their false claims, shifts to strenuous defence, when the content of the confabulation is linked to some aimed action plan. As described above, Schnider and colleagues (1996) even considered the 'acting-upon confabulations' to be the defining factor of spontaneous confabulation. By contrast, other authors conceptualise confabulations exclusively as verbal statements, or more generally, as speech phenomena motivated by the presence of a listener (Berlyne, 1972; Berrios, 1998; Myslobodsky & Hicks, 1994; Talland, 1932). However, given that the term confabulation has by now so frequently been employed to refer to non-verbal memory and other behaviours (e.g. Chatterjee, 1995; Demery, Hanlor & Bauer, 2001; Joslyn, Grundvig & Chamberlain, 1978; Wyke & Warrington, 1960), it would be ineffective to arbitrarily exclude these descriptions from its definition. In this light, the use of additional criteria (e.g. reference to verbal, visual or acted upon confabulation) would be useful, even when discussing exclusively memory-related confabulation.

Characteristic (i) is well-documented in the literature and axiomatic in the definition of memory-related confabulation (see above). In this context, anosognosia, i.e. unawareness of deficit, or anosodiaphoria, i.e. indifference towards one's deficit (Babinski, 1914), is most commonly described in relation to the patients' unawareness of their amnesia (Schacter, 1991). However, in principle it can refer to the unawareness of a variety of deficits, including memory and executive functions difficulties, emotional changes, confabulation and even anosognosia itself (Dalla Barba, Bartolomeo, Ergis, Boisse & Bachoud-Levi, 1999). Moreover, patients may be unaware of their deficits at different cognitive levels. For example, Schacter and Prigatano (1991) have distinguished between the awareness of deficit itself and the awareness of its consequences (see also Fotopoulou et al., 2004). The more general issue of the relation between the awareness of deficit and non memory-related confabulation awaits further exploration (e.g. for reviews see Feinberg & Roane, 1997a; Feinberg & Giacino, 1997). The issue will be further discussed below in specific relation to anosognosia for hemiplegia and its related forms of confabulation.

Characteristic (j) refers to the duration of confabulation. Talland (1961; 1965; Talland et al., 1967) described the course of confabulation in both alcoholic Korsakoff's patients and patients with ACoA aneurysms. At the very early stages of the disease, confabulation has the form of delirious and fantastic statements (see characteristic (m) below). During the acute stage of recovery confabulation mainly includes severe temporal and content distortions. Finally in the chronic stage, confabulation fades away or diminishes to less frequent and severe forms of provoked memory error. However, Talland also did observe exceptions to this pattern and described chronic cases of persistent, and even fantastic, confabulation. Although current clinical wisdom and some followed-up case-reports (Box et al., 1999; Kapur & Coughlan, 1980; Mattioli, Miozzo, & Vignolo, 1999; Schnider, Ptak, von Daniker, Remonda, 2000; Stuss et al., 1978) suggest similar patterns of confabulation duration, little systematic study has been carried out. Comparing across patients with different neuropathologies, Johnson and colleagues (2000) observed that surgical lesions of anterior cingulectomy patients typically produced temporary confabulation lasting several days. In contrast, basal forebrain lesions led to confabulation patterns lasting weeks to months and varied depending on whether damage was restricted to orbitofrontal regions or extended

to other basal forebrain regions and connections (Schnider, Ptak & Remonda, 1999). Finally damage to various other frontal areas may last months to years. Despite these initial indications, further evidence is required regarding the exact duration of confabulation in the various pathologies.

Characteristic (k) refers to the frequency and thematic range of confabulatory behaviour. The latter are reported to differ significantly both within- and across patients (Deluca, 2000; Johnson et al, 2000; Feinberg & Giacino, 1997). However, no systematic investigation of these issues has been undertaken and the neural and cognitive reasons for such diversity remain unclear. As mentioned above, the frequency and thematic range of confabulation may be reduced in time, but several different patterns have been observed. At one extremity, Moll (1915) characteristically described frequent, ephemeral and general confabulations at the initial stages of amnesic syndromes. He wrote that confabulations, to which he referred to as fabrications, “are more prolific in the beginning of the disease. The patients delight in starting long tales, and spinning them out indefinitely. They forget at once what they have been talking about and repeat themselves, intermingling an astonishing mass of irrelevant detail” (p. 429). Similarly, Kopelman (1999) described spontaneous confabulation as a “persistent, unprovoked outpouring of erroneous memories” (p. 197). Dalla Barba and colleagues (1997b) more recently highlighted that such patients confabulate for autobiographical material, which extends from the remote past to present information and even future plans.

By contrast, patients have been described who confabulate only following provocation (Kopelman 1987), exclusively in everyday contexts (Papagno & Muggia, 1996), only regarding particular personally significant information (Conway & Tacchi, 1996) or even only regarding a single topic (Burgess & McNeil, 1999; Downes & Mayers, 1995). The issues of frequency and range are not necessarily correlated, e.g. a patient may be continuously confabulating regarding only one isolated topic (e.g. Downes and Mayers, 1995). However, in the present context, they are considered together, given insufficient evidence of the determining factors that underlie their differences and also due to their common relevance to the distinction of confabulation from delusion (see following characteristic).

Characteristic (l) refers to the distinctive clinical characteristics of confabulation in relation to delusional memories. As mentioned above, confabulation is typically described as disorganised (characteristic a) and ephemeral (characteristic j), as well as multi-thematic (characteristic k). These characteristics contrast with the more organised, persistent, resistant to correction, domain- and theme- restricted nature of delusional memories (Kopelman, 1999; Feinberg & Giacino, 1997). Yet, as delusional-like confabulations have been also described in the literature (see characteristic (k) above) and, as the conceptual borders between the terms confabulation and delusion remain unclear (see above section), the distinctive clinical characteristics of confabulation and delusional memories require further investigation.

Characteristic (m) refers to the differentiation of confabulation from similar symptoms, found in the acute confusional states of various neuropathologies (Lipowski, 1990). The description of confabulation during these states has been frequently integrated in discussions of confabulation. For example, the investigations of Whitty and Levy (1957; 1960), who examined transient confabulation states lasting 24 to 72 hours following anterior cingulectomy, are included in the recent influential review of Johnson and colleagues (2000) without appropriate differentiation. Yet the different clinical and potentially aetiological nature of confabulation during and following such acute states has been repeatedly stressed by several authors (Berlyne, 1972; Deluca, 2000; Talland, 1961; 1965). Characteristically, Deluca and Cicerone (1991) showed that while a number of disorientated haemorrhagic stroke patients confabulated during acute confusional states, only ACoA patients continued to confabulate following the return of orientation. In conclusion, confabulation is shaped by the following clinical features:

- (a). Varying content coherence and internal consistency, ranging from plausible and coherent narratives to dream-like recollections.
- (b). Falsification range including both content distortions and context displacements.
- (c) Content that is most commonly based on autobiographical memory sources but can also contain semantic elements (c1/c2); *Content that includes both the distortion of previous experiences and information, as well as the weaving of thoughts, fantasies, dreams and other internally-generated mental representations (c3). The latter characteristic is not universally accepted and thus it will form part of the secondary hypothesis of this study.*
- (d.) *Its exact nature is determined by the combination of damaged and preserved normal constructive memory processes. The latter characteristic is based on aetiological grounds and thus it will be reconsidered in the following section. It is an intrinsic part of the primary hypothesis of this study.*
- (e) Patients are typically unable to monitor the inappropriateness, implausibility, or incoherence of their false statements (over and above their falsehood) and when confronted appear perplexed, indifferent or simply confabulate further to support their claims.
- (f) *Confabulation is not restricted to intentional gap-filling but the role of motivation awaits further investigation. It will form the main hypothesis of the present study.*
- (g) *The role of premorbid personality traits in confabulation awaits further investigation. It will form a secondary hypothesis in the present study.*
- (h) Memory-related confabulation maybe accompanied by associated actions and other forms of confabulation, such as visual or constructive confabulation.
- (i) All confabulating patients seem to suffer from anosognosia, an unawareness of their memory deficit, or, at best, a profound lack of concern and lack of appreciation of its severity and extent. The more general relation between confabulation and anosognosia for other related deficits awaits further investigation.
- (j) The duration of confabulation varies among patients. Typically the symptom disappears or is reduced in frequency and variety of content following an acute period but chronic states are also described. The issue awaits further investigation.
- (k) The frequency and thematic range of confabulation varies across and within patients. Typically confabulation is considered ephemeral and multi-thematic. Yet this issue awaits further exploration.
- (l). The nature of confabulation is typically as described by (k) and also easily sidetracked by questioning or environmental cues. However, across and within patients confabulations occur, which have delusional characteristics. The issue awaits further investigation and conceptual clarification.
- (m). Confabulation is distinct from the similar phenomena observed in acute confusional states.

Characteristics c3, d, f and g (in *italics* above) are not widely accepted. Instead, they are central to discussions of the aetiological grounds of memory-related confabulation and thus they will be presented in further detail in the corresponding section below. Crucially, their validity will be directly addressed by the experimental (see Chapters 3, 4 and 5) and clinical investigations of the thesis (see Chapters 2, 6 and 7). The rest of the characteristics will be considered in the clinical description of the patients' behaviours and performance in neuropsychological tests (see Chapters 2, 6, and 7). However, these characteristics will not be at the focus of the study's experimental investigations, as they do not concern the main hypotheses of the study. In particular, they are unrelated to the role of motivation in confabulation (see below).

### 1.3 The Neuropathology of Confabulation

Memory-related confabulation in its severe forms has been most commonly reported in Korsakoff patients, individuals who suffered rupture and repair of an aneurysm of the anterior communicative artery (ACoA), other types of stroke, and traumatic brain injury (for extensive empirical reviews see Gilboa & Moscovitch, 2002; Johnson et al., 2000). More rarely, confabulation has been associated with lesions resulting from thalamolysis (Watkins and Oppenheimer, 1962), i.e. a surgical intervention for treatment of Parkinsonian tremor, multiple sclerosis (Feinstein, 2000), tumor (Cunningham et al., 1997; Fotopoulou et al., 2004; Luria, 1967; Morris et al., 1992), rupture of the posterior communicative artery (Dalla Barba et al., 1997a; Mercer, 1977), Alzheimer's disease (Kern et al., 1992; Kopelman, 1987; Dalla Barba, 1999), fronto-temporal dementia (Nedjam et al., 2000), herpes simplex encephalitis (Moscovitch & Melo, 1997) and anterior cingulectomy for the treatment of obsessive compulsive disorder (Whitty & Levin, 1957; 1960). However, the presence of confabulation in some of these latter reports may be including descriptions at the conceptual borders of confabulation, such as memory intrusions and memory errors during acute confusional states (see previous section).

### Most Common Pathologies

Patients with ACoA aneurysms typically have lesions in the basal forebrain and the frontal lobes, with possible associated damage to the stratum (e.g. Alexander & Freedman, 1984; Beekmans, et al., 1998; Damasio et al., 1985; Diamond et al., 1997; Irle et al., 1992; Phillips et al., 1987). In a recent and extensive review of published confabulation cases Johnson and colleagues (2000) identified ACoA patients as the fourth most common aetiology of confabulation, following alcoholic Korsakoff syndrome, trauma and stroke (see also Gilboa & Moscovitch, 2002). These patients do not typically show lesions in the structures traditionally implicated in amnesia (i.e. mesial temporal and diencephalic structures). However, confabulation is thought to occur as a consequence of the memory impairments caused by the disruption of the significant cholinergic projections of the basal forebrain nuclei (Alexander & Freedman, 1984; Beekmans, et al., 1998; Damasio et al., 1985; D'Esposito et al., 1996; Diamond et al., 1997; Parkin et al., 1988; 1996; Phillips et al., 1987; Volpe & Hirst, 1983). Nevertheless, following Luria and colleagues (Luria et al., 1970) several investigators have noted that the nature of the resulting confabulatory amnesia may be qualitatively different from classic amnesic presentations and subject to the influences of executive dysfunction, which is also common in ACoA patients (see also Deluca, 1993; Fisher et al., 1995; Johnson et al., 2000; Kopelman, 2002).

Confabulation in alcoholic Korsakoff patients is also very frequent (Johnson et al., 2000). It is thought to relate to the extensive retrograde amnesia and the severe learning difficulties accompanying the characteristic neuropathology of this syndrome (Korsakoff, 1889/1996; Victor et al., 1971). The latter is mainly caused by thiamine deficiency and it includes pathological abnormalities in the paraventricular and peri-aqueductal grey matter, the walls of the third ventricle, the floor of the fourth ventricle, and the cerebellum (for reviews see Kopelman, 1995; Verfaellie, 1997). Although debates have ensued regarding the exact critical sites (e.g. the anterior versus the medial dorsal thalamic nucleus) necessary for the development of the chronic memory disorder, the mammillary bodies and the thalamus are among the most commonly identified sites of neuronal loss and atrophy (for review see Kopelman, 2002).



However, there is also increasing neuropathological and neuroimaging evidence, demonstrating that there is additional general cortical atrophy in Korsakoff patients, particularly involving the frontal lobes (Colchester et al., 2001; Jacobson & Lishman, 1990; Jernigan et al., 1991; Harper et al., 1987; Shimamura et al., 1988; Torvik et al., 1982). The latter is also supported by neuropsychological findings of 'frontal' dysfunction in Korsakoff patients (e.g. Leng & Parkin, 1988; Jacobson et al., 1990; Shoqeirat et al., 1990; Kopelman, 1991). It thus appears that in this case, as in ACoA patients, superimposed frontal lobe dysfunction may have a critical role in the resulting neuropsychological profile. More specifically, features that have been proposed as distinguishing between Korsakoff patients and patients with amnesia from other aetiologies include the increased propensity of the former to commit prior-item intrusions, their failure to demonstrate release from proactive interference, their deficit in temporally contextualising memories, their severe retrograde amnesia, and their confabulation (for review see Verfaellie, 1997). Despite the increasing support for this view, it is of note that a number of studies have cast doubts on the exclusivity of the above features in Korsakoff's amnesia and their relation to frontal dysfunction (for reviews see Kopelman, 1995; 2002; Verfaellie, 1997). Thus, the issue awaits further exploration.

Traumatic brain injury (TBI) appears to be one of the most frequent aetiologies of confabulation (Johnson et al., 2000), although confabulation is present less frequently in the chronic stage of TBI (e.g. Weinstein & Lyery, 1968; Baddeley & Wilson, 1986; Demery et al., 2001; Stuss et al., 1978; Weinstein & Lyery, 1968). The neuropathology caused by severe close head injury frequently entails a significant degree of generalised cerebral damage, mainly caused by rotational and acceleration-deceleration forces giving rise to axonal injury (Povlishok, 1992; Oppenheimer, 1968), but focal lesions may also occur. These most frequently result from localised skull fracture, contre-coup damage, intracranial haemorrhage and focal contusion. Most frequent areas of such lesions are the frontal and anterior temporal lobes (Teasdale and Mendelow, 1984) and thus focal TBI can result in profound impairments in memory, executive functions and attention. Furthermore, secondary brain damage may be caused, including swelling (edema), increased intracranial pressure, hypoxic-ischemic injury, haematoma and seizures (Povlishok, 1992). Given the multiple neuropathologies

that can result from severe TBI it is not always possible to determine which kind of lesion and which site are responsible for lasting amnesia and confabulation (for discussions see Hoofien, Gilboa, Donovick, & Vakil, 2001; Kapur, 1994).

Finally, it is important to note that the structural damage caused by the above pathologies is not sufficient to explain the evolution of confabulation. As described above, confabulation is a dynamic phenomenon; typically its frequency, quality and content evolve with time and confabulation progressively dissolves. Such a dynamic presence cannot be explained by structural lesions alone and might require neurochemical considerations, as suggested by similar phenomena in cases of more generalised disorders (Deluca & Cicerone, 1991) or metabolic dysfunctions (Kopelman et al., 1997). However, very few studies have examined the evolution of confabulation in time (Benson et al., 1996; Box et al., 1999; Kapur & Coughlan, 1980; Mattioli et al., 1999; Schnider, Ptak, von Daniker, Remonda, 2000; Stuss et al., 1978) and most of the proposed neurocognitive accounts are static and therefore fail to accommodate such characteristics.

### 1.3.1 Implicated Neuroanatomical Circuits

Although some consensus regarding the neuroanatomical basis of confabulation has been achieved through the years, the variety of its associated neuropathologies and clinical forms has led to the development of several distinct proposals regarding the neuroanatomical regions associated with confabulation. As reviewed above, the most common neuropathologies of confabulation involve distinct yet highly interconnected areas of the basal forebrain, the orbital and ventromedial prefrontal cortex regions and diencephalic regions such as the mammillary bodies and the thalamus. Some authors have reported that confabulation can occur following damage to any of these regions. Other authors have argued that only one of these areas is critical for confabulation to occur, while a third approach postulated the requirement of a combination of distinct lesions (for reviews Deluca, 2000; Gilboa & Moscovitch, 2002).

Damasio and his colleagues (1985) studied a subset of confabulating patients with aneurysms of the ACoA or anterior cerebral artery, which typically resulted in damage to basal forebrain structures (septal nuclei and related structures). They argued in favour of the significance of the damage to these areas

for confabulation. These researchers also emphasised the bi-directional connectivity between the basal forebrain and the medial temporal lobes and the role of such connections in the formations of memories. Similarly Deluca (1993; 2000), in what he termed the 'dual-lesion hypothesis', argued that confabulation results from amnesia associated with basal forebrain damage, or other lesions, in combination with prefrontal cortex damage. Benson and his colleagues (1996) reported a confabulating patient, who presented decreased perfusion of the orbitofrontal cortex bilaterally. Crucially in this patient, the decrease of confabulation severity was accompanied by increased frontal lobe perfusion, while the severity of his amnesia remained the same. Other researches showed that both mild and severe confabulation involves damage to septal areas, yet severe confabulation also requires medial frontal damage (Kapur & Coughlan, 1980; Kopelman, 1987) and possible damage to the striatum, precisely the head of the caudate (Fisher et al, 1995).

Moscovitch and Melo (1997) identified the ventromedial prefrontal cortex, given its neuroanatomical proximity to basal forebrain and medial temporal regions, as responsible for confabulation. More controversially, they claimed that even discrete lesions to this area were sufficient to cause severe confabulation, while lesions in other associated regions (e.g. the basal forebrain) might not be sufficient or necessary to cause confabulation. In a more recent literature review, Gilboa and Moscovitch (2002) re-asserted this hypothesis, as they found no basal forebrain lesions in 28 out of 47 ACoA patients who had lesions to the ventromedial prefrontal cortex. In addition, 10 of them presented no other lesions. Nevertheless, this result should be treated with caution, given the neuroradiological difficulties in detecting basal forebrain lesions beyond the surgical artefact in such patients.

Other investigators have implicated similar but wider functional circuits in the production of confabulation. Johnson and her colleagues, in drawing on a great amount of research on memory-related confabulation, concluded that confabulations of increasing duration and severity are associated respectively with lesions in anterior cingulate, basal forebrain, and prefrontal cortex structures, particularly in the ventromedial and orbital regions (Johnson, 1991; Johnson et al, 2000). Schnider and his colleagues (Schnider et al, 1996; Schnider & Ptak, 1999)

have highlighted that spontaneous confabulation, as measured by the patient's readiness to 'act upon' his confabulations, is associated with lesions involving one or more anterior limbic structures. In particular, critical lesion sites involve the orbitofrontal cortex or its connections to the basal forebrain and, less often, the amygdala and the contralateral perirhinal cortex, the anteromedial hypothalamus, or even just the genu of the right internal capsule. Crucially, this group (Schnider et al, 2000a) also studied the impact of lesion site on the clinical course of the confabulatory syndrome. They found that duration of confabulation decreases as damage varies from extensive orbitofrontal and contralateral perirhinal cortex lesions to basal forebrain lesions and finally to isolated orbitofrontal lesions.

Finally, Markowitsch and his colleagues (Kroll et al, 1997) put forward the so called "temporofrontal hypothesis". According to this framework, confabulation results from damage to a memory circuit, involving the inferolateral prefrontal cortex, temporopolar cortex, unciniate fascicle and mediodorsal thalamic networks. However, as Conway and Fthenaki (2000) note, the difference between this hypothesis and other proposals mentioned above, such as the studies by Damasio and colleagues (1985) or Moscovitch and Melo (1997) could merely reflect the investigation of behaviourally different patterns of confabulation. In particular, Kroll and colleagues (1997) have described cases of dense retrograde amnesia but mild confabulation. The other two studies refer to patients who freely confabulate, whilst presenting some remaining retrograde memory abilities.

### 1.3.2 Laterality

Similar discrepancies have been observed regarding assumptions made about laterality in confabulation. There have been suggestions that confabulation is more often associated with right rather than left hemisphere damage (Belyi, 1988; Joseph, 1986). However, Johnson's et al. (2000) extensive review found no evidence in support of this claim or the claim that confabulation is more common after bilateral than unilateral damage (see also Gilboa & Moscovitch, 2002). In fact, these conclusions may not be as contradictory as they might appear at first sight. They may merely reflect observations made on different subpopulations of confabulatory patients. The various investigators who have associated confabulation primarily with right hemisphere damage studied patients whose confabulations related to their perceptual difficulties e.g. confabulation in the

context of anosognosia for hemiplegia, hemianopia and Caprgas syndrome. However, Johnson and colleagues' review (2000) focused on memory confabulation and thus had excluded such patients.

In conclusion, some of the differences in the various neuroanatomical models put forward to explain confabulation might stem from the different measures and criteria used to behaviourally assess the presence and the type of confabulation observed. Thus, these models may not necessarily represent controversial and competing accounts, rather they may be regarded as complementary in describing different patterns of confabulation. The various lesions or combinations of lesions that lead to different forms of confabulation remain to be specified. The following section discusses the implications of the above neuroanatomical hypotheses for the neurocognitive and motivational models of confabulation.

#### 1.4 Theoretical Explanations

The several proposed aetiological accounts of memory-related confabulation can be summarised under three main types: (a) Those explanations which consider confabulation as a dysfunction of *the normal memory retrieval mechanisms* and try to identify the *cognitive impairment(s)* responsible for confabulation; (b) Those accounts which consider confabulation as a *compensating mechanism* resulting from memory loss or distress and try to explain *the motivational aspects* of the symptom; and finally (c) those models which aim to explain both *the negative and positive features of confabulation* (in the Jacksonian sense, 1932). In other words, they try to assess the aetiological role of *both cognitive and emotioal mechanisms*.

##### 1.4.1 Damage to "Normal" Cognitive Mechanisms: Deficit Theories

###### *Memory Deficit*

Confabulation is traditionally linked with severe amnesia, yet the exact aetiological role of amnesia in confabulation is debated among researchers. Certain authors have considered amnesia as the necessary prerequisite for some forms of memory-related confabulation (e.g. Talland, 1965; Berlyne, 1972; Deluca, 2000). Characteristically, the descriptive use of the expression 'memory

gap-filling' has been employed by some authors in this sense, i.e. to highlight the association of confabulation to organically-produced amnesia (see Berrios, 1998 for discussion; see also below). However, it has also been argued that in order to explain confabulation, particularly in its more severe forms, amnesia is not sufficient (e.g. Moscovitch & Melo, 1997; Benson et al., 1996; Johnson et al., 1997; Kapur & Coughlan, 1980; Kopelman et al., 1997; Talland, 1965; Wyke & Warrington, 1960) and perhaps not even necessary (Dalla Barba, Cipolotti, & Denes, 1990; Dalla Barba, 1993a; Papagno & Baddeley, 1997; Nedjam, Dalla Barba & Pillon, 2000; Villiers, Zent, Eastman & Swinger, 1996). The simplest evidence against the impaired memory explanation of confabulation is the fact that not all amnesic patients confabulate. This is particularly true for patients with discrete lesions of limbic and medial temporal lobe regions (e.g. Parkin, 1984; Moscovitch & Melo, 1997). In addition, patients have been reported whose confabulation cleared after a few weeks, while their memory impairment remained unaffected (Benson et al., 1996; Kapur & Coughlan, 1980). Furthermore, patients have been reported who confabulate without being clinically or globally amnesic (Nedjam et al., 2000; Papagno & Baddeley, 1997; Villiers et al., 1996) or who do not confabulate in tasks in which their memory is defective (Dalla Barba et al., 1990; Dalla Barba, 1993a).

Thus, it appears that although the clinical association of amnesia and memory-related confabulation is well-established, general memory impairment is not sufficient to explain the presence of confabulation in certain patients and clinical amnesia may not be necessary for confabulation to occur. The possibility remains that certain specific memory processes, e.g. control of retrieval or temporal confusion, have an aetiological role in the production of confabulation. These will be addressed below.

#### *Executive Functions Deficit*

Spontaneous confabulation has by some authors been attributed to general executive dysfunction, resulting from frontal lobe lesions and leading to disinhibition, perseveration, defective self-monitoring, lack of awareness and other related deficits (Baddeley & Wilson, 1986; Benson et al., 1996; Joseph, 1999; Kapur & Coughlan, 1980; Luria, 1976; Papagno & Baddeley, 1997; Stuss et al., 1978). Commonly this view explains the degree of incidence and bizarreness

of confabulation, or the spontaneity of its production (Kopelman, 1987) as determined by the degree of executive (“frontal lobe”) dysfunction, superimposed on amnesia (Stuss et al, 1978; Deluca, 1993; Fisher et al, 1995). This explanation has not gone unchallenged. For example, Dalla Barba (1993a) described a patient showing profound confabulation in the absence of any direct evidence of frontal lobe pathology, although further testing might have indicated otherwise (see also Dalla Barba et al., 1990; 1997a; 1999; Delbecq-Derouesne et al., 1990). Moreover, performance on standardised tests of executive functions has been known to vary significantly both within- and across patients with frontal lesions. Thus, frontal tests cannot be used to differentiate between patients who do and do not confabulate (Schnider et al., 1996; Stuss & Benson, 1986; Vilkki, 1985). Most importantly, the lesions of confabulating patients frequently involve ventromedial prefrontal cortex and associated regions (see below). Such lesions have been most frequently associated with disinhibited or socially inappropriate behaviour, impairments in decision making and emotional regulation (e.g. Bechara et al., 2000; Berlin, Rolls & Kischka, 2004; Stuss & Benson, 1986). However, standardised frontal tests are not sensitive to such impairments. Crucially, a general executive dysfunction is not sufficient to explain content specific confabulation (Burgess & McNeil, 1999). Indeed, more recent studies have argued that frontal lobe damage, i.e. a constellation of various and potentially dissociable functional circuits, is not sufficient to explain confabulation (Burgess & McNeil, 1999; Benson et al, 1996; Cunninham et al, 1997; DeLuca, 1993; Kopelman et al., 1997; Johnson et al., 1997; 2000; Moscovitch & Melo, 1997). Thus, some have argued in favour of assuming specific rather than general executive dysfunction as causative of confabulation. These approaches will be examined next.

*Deficit in the Control of Recollection ('Retrieval Theories')*

According to the memory control explanations, confabulation arises when the executive components of memory recollection are specifically impaired (Burgess & Shallice, 1996; Moscovitch & Melo, 1997; Schacter et al., 1998). These models emphasise that confabulation is associated with the retrieval rather than the encoding or the storage stages of memory (Moscovitch, 1995; although see below, Schacter et al., 1998). This is mainly based on the observation that

patients tend to give erroneous accounts of events that occurred prior to their lesion, i.e. events that were normally encoded and stored. Thus, for example, Moscovitch (1989) postulated a deficit in the strategic component of retrieval processes. This results in memory retrieval being guided solely by associative cue-dependent rules, instead of by the appropriate effortful and goal-directed processes of editing and monitoring stored information. Somewhat similarly, Kopelman (1987) attributed spontaneous confabulation to the “completely incoherent and context-free retrieval of memories and associations”. These views also approximate Luria’s descriptions of the phenomenon of “equalization of excitability” of traces, i.e. the lack of selectivity of traces, leading to confusion and confabulation (Luria, 1973).

In Burgess and Shallice’s (1996) variant of this hypothesis, confabulation may occur in various forms, depending on the damage to the three principal memory control systems. Specifically, these include “description” mechanisms (specifications of what it is that is being asked of the memory store); “editing” operations (i.e. verification, checking and comparison operations); and “mediator” processes (i.e. pure problem-solving routines involved in reasoning). Hence, according to this model, bizarre or fantastic confabulations are evidence of damaged ‘mediator’ processes and more generally reasoning errors, while the possible lack of self-correction can be linked to impaired ‘editor’ processes. Finally, impaired cue retrieval (ambiguous and misleading cues) is evidence of damaged ‘descriptor’ processes (see also Burgess & McNeil, 1999; Dab et al., 1999).

Similarly, Schacter, Norman, & Koutstaal (1998) have recently put forward a general “constructive memory framework” (CMF), emphasising both encoding operations (binding the different features of events to form a coherent representation and also representing similar features in distinguishable ways) and retrieval processes (focusing retrieval descriptions of the sought-after event and also monitoring retrieval information according to source and contextual information). Confabulation in this framework would result from a deficit in either focusing processes (failure to discriminate between the sought-after trace and competing episodes) or monitoring processes (verifying or rejecting



information according to the individual's present internal and external environment).

These explanations are particularly informative with regard to the specification of the memory processes affected and unaffected by confabulation. For example, they have been employed to explain why recall tests and episodic tasks pose greater challenges for confabulating patients than recognition or semantic tasks. According to Moscovitch and Melo (1997) the latter pose fewer challenges to memory search mechanisms and are thus less likely to be affected in confabulating patients (Moscovitch & Melo, 1997; Dab et al., 1999). More generally, these accounts are able to explain why specific memories cannot be appropriately identified, selected, monitored and even "deactivated". However, they cannot explain which memory traces are actually selected and activated. These are eventually turned into simple or more elaborate confabulations, which patients believe are real and even part of their own personal history. In other words, such models have difficulty in addressing some of the positive features of confabulation and lead to the assumption that confabulatory content is random.

More recently, some of these theorists acknowledged that certain features of confabulation, e.g. the potential selectivity and stability of confabulations (Burgess & McNeil, 1999; Conway & Tacchi, 1996), require a change of emphasis within these models. Specifically, both preserved and impaired recollective processes need to be considered and assumed to be responsible for confabulation (see Burgess & McNeil, 1999; Dab et al., 1999 for discussions). Thus, for example, Burgess and McNeil (1999) proposed 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" and thus lead to the 'intrusion' and 'schematisation' of certain specific confabulations (e.g. Burgess & McNeil, 1999). Yet, as Fotopoulou and colleagues have argued (2004), this process is not specifically anticipated 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 any possible emotional valence and significance dominating memory

search. This is achieved by their power as “starting values” of the recollection process (Burgess & McNeil, 1999), i.e. without the need for further “motivation”, or “personal significance”. Hence, the specific issue of selection between the various possible generic memories remains unexplained by the descriptor process dysfunction itself. Therefore, their model can address confabulation content specificity and constancy. However, it does not provide an adequate explanation of potential emotional specificity and constancy in the content of confabulation (Conway & Tacchi, 1996; Fotopoulou et al., 2004; Turnbull et al., 2004a).

More generally, although some of these models allow for preserved memory processes to be implicated in the construction of confabulations, their conceptualisations tend to emphasise the observed cognitive impairments. In parallel, they tend to deemphasise some of the emotional features of confabulation and their potential explanation.

#### *Temporal Context Deficit*

In this type of model, “context” or “source” information forms the core element in explaining confabulation. This is a persistent view in the literature on confabulation. Korsakoff (1889/1996) had first placed emphasis on the temporal confusions observed in confabulating Korsakoff patients and this explanation was taken up by many other authors (e.g. Moll, 1915; Talland, 1961; 1965; et al., 1967; Van der Horst, 1932). More recently, Dalla Barba and his colleagues (1993a; 2000; Dalla Barba et al, 1997b) described dysfunctions in the subjective experience of temporality. This led patients to make temporal judgments based only on information about temporality, well established in their long-term memory stores, but irrelevant to their present situation or to specific points in episodic memory.

Somewhat similarly, Schnider and his colleagues (1996) emphasised temporal context memory impairments, resulting in confusion about the temporal relevance of memory information. Indeed, in a series of more recent studies, Schnider and his colleagues (see Schnider, 2001 for review) demonstrated that confabulating patients with orbitofrontal and basal forebrain lesions showed increased temporal memory confusion in comparison with amnesic patients of other aetiologies. This emanated from the inability of the confabulating patients to

suppress previously activated, but currently irrelevant memory traces. Furthermore, in a recent high resolution event-related potential study, Schnider and colleagues (Schnider, Valenza, Morand & Michel, 2002), have provided evidence for the assumption that normal subjects filter, or deactivate, currently irrelevant memory traces (e.g. memories of a different temporal source), before the conscious stages of learning and recognition. On this basis they have argued, that the deactivation of currently irrelevant memories is a pre-conscious mechanism, intervening before the content of a memory is consciously recognised and consolidated. These findings were confirmed by PET investigations that demonstrated circumscribed posterior medial orbitofrontal activation in healthy adult volunteers, during a specific experimental task which required the sorting out of mental associations that pertain to ongoing reality (Schnider, Treyer, & Buck, 2000).

However, not all patients with temporal context memory impairment show confabulation (Shimamura, Janowsky, & Squire, 1990; Kopelman, 1989) and some confabulating patients do not show temporal confusion (e.g. Dab et al., 1999; Johnson et al., 2000). Thus, as Kopelman has supported (Kopelman et al., 1997) context memory impairment may be a necessary, but not a sufficient condition for spontaneous confabulation to occur. Moscovitch (1995) has even more controversially supported that deficits in chronology are prominent yet secondary features of confabulation. They merely represent the consequences of other primary retrieval impairments. Crucially, deficits in temporality alone would not easily account for the bizarre, unrealistic stories told by some confabulating patients (e.g. Damasio et al., 1985). Dalla Barba (1993a; 1993b) has explained these on the basis on an additional impairment in semantic abilities. This proposal however would only explain confabulations which are internally inconsistent and incoherent, but it does not explain confabulations which are bizarre in their content and irrelevant with one patient's life, without being incoherent, e.g. alleged trips to space (Damasio et al., 1985), or even previously desired, but never actualised trips to other countries (Villiers et al., 1996; see also Kopelman et al., 1997). Thus, this type of explanation, as the previous one, is capable of explaining some of the 'negative' characteristics of confabulation (e.g. temporal displacement), but it cannot address some of the 'positive' features of the symptom (e.g. bizarre content and motivation).

*Source Deficit*

More generally, Johnson and her colleagues (for reviews see Johnson, 1991; Johnson et al., 2000) proposed an explanation of confabulation based on a “source monitoring framework” (SMF). This model emphasises the role of a set of “source or reality monitoring” processes, involved in making attributions about the origins of memories, knowledge and beliefs. More generally, source monitoring is defined as the ability to attribute a mental representation to its appropriate source (e.g. a past true experience, a dream etc). Its related dysfunction in memory has been termed ‘source amnesia’ (Schacter, Harbluk, & McLachlan, 1984). Johnson proposed that confabulation is not caused by the inability to monitor the correct chronology of events, as the previous explanations have. Confabulation is caused by a more general inability to monitor the source of mental representations that reach consciousness (e.g. internal mental association versus external perception, past versus current representation). In Moscovitch’s terms (1989) “confabulation is source amnesia magnified and extended to include an entire life-time of experience” (p. 138). In this framework, confabulation may result from a wide range of source monitoring deficits such as (1) inadequate feature binding, (2) disrupted reactivation and consolidation processes, (3) failure to engage in evaluation processes or to use situationally appropriate feature weights and criteria, (4) poor self-initiated cuing and retrieval of supporting information, (5) failure to access or to use general knowledge generating appropriate retrieval cues, weighting features, and crucially distinguishing between “the real” and “the imagined” (Johnson & Raye, 1998). This hypothesis initially emphasised specific processes of reality and source monitoring, over and above other memory processes and influences. However more recently, Johnson and colleagues have acknowledged that the exact nature of confabulation depends on a constellation of different intact and preserved memory control processes as well as other emotional and social factors (Johnson et al., 1997; Johnson et al., 2000). Thus, this view will be reconsidered in section (C) below.

1.4.2 Compensatory Psychological Mechanisms

In the beginning of the 20th century several clinicians observed the presence of motivational and emotional biases in confabulation. These fell under five different, yet at times overlapping, categories which are still discussed in

recent studies on confabulation. (a). The motive of embarrassment; (b). The motive of suggestibility; (c). Motives based on patients' premorbid personality; (d). The motive of denial; (e). Other psychodynamic models.

#### *The Motive of Embarrassment*

The "gap-filling" hypothesis is perhaps the oldest motivational theory of confabulation. According to it, 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 (Bonhoeffer, 1901, cited in Talland, 1961). This perspective, explains confabulation as the result of *some compensatory motivational mechanism*, which is essentially unrelated to normal memory processes. However, as we have seen this hypothesis is untenable even at a conceptual level, as confabulation is by definition exclusive of conscious intention to deceive one's listener. Furthermore, given the associated unawareness of deficit, it is clinically invalid to describe confabulating patients as consciously attempting to conceal what they seem to ignore, i.e. their memory deficit. Finally, this hypothesis has been countered by experimental evidence. A number of confabulating patients did not show a tendency to increase their confabulation rate when they were confronted with questions to which they did not know the answer (e.g. Dalla Barba et al., 1997b; Kopelman et al., 1997; Mercer et al., 1977; Schnider et al., 1996). Despite all these counter indications, the gap-filling hypothesis has had a lasting impact in the literature on confabulation. It has persisted and has dominated definitions of confabulation for decades (see Whitlock, 1981) and it is still mentioned in most recent papers, even if only to be rejected. This rather unusual persistence of a highly controversial hypothesis relies on the multiple and often conflicting uses of the gap-filling notion (see Berrios, 1998). A brief clarification will be undertaken below.

At least four other interrelated, yet distinct, uses of gap-filling have been described in the literature. (a) On a first descriptive level, 'gap-filling' has been used to highlight the occurrence of confabulation against the background of amnesia, i.e. confabulation appears when accurate memory is absent. More recently, these gaps have been conceptually extended to include not only memories, but other types of unavailable or inaccessible knowledge (e.g. Joseph, 1986a; Hirstein, 2004); (b) on a related aetiological level, the tendency to fill

memory or knowledge gaps with false answers has been considered as evidence for the aetiological role of amnesia in confabulation (see Berrios, 1998; Deluca, 2000 for discussions). This view has been addressed in detail above; (c) on a second descriptive level, the notion of 'gap-filling' is used to provide a classification of confabulation severity. Gap-filling confabulations represented simple, momentary, passive or reactive, i.e. provoked only by questioning, confabulations (e.g. see Berlyne, 1972; Whitlock, 1981). These are contrasted with fabrications or fantastic confabulations produced spontaneously (e.g. Bonhoeffer 1901 in Talland, 1961; Berlyne, 1972; see also above). More recently, Moscovitch (1989; see also Gilboa & Moscovitch, 2002) has noted that such gap-filling confabulations do in fact make their appearance in confabulating patients. They represent efforts to correct or further support their previous claims. However, they should not be identified with provoked or less severe forms of confabulation. Instead, they should be considered as secondary forms of the symptom and explained as such. Interestingly, almost 100 years ago in a systematic exploration of types of confabulation Moll (1915) had ascribed a similar and peripheral role to *ad hoc* concoctions, i.e. gap-filling confabulations; (d) on a second aetiological level, the tendency to confabulate by filling memory gaps has been linked to the potential aetiological role of suggestibility in confabulation (Pick, 1905 in Talland, 1961). This view will be addressed below.

In light of the above, any theoretical or empirical consideration of the gap-filling hypothesis that does not carefully clarify whether it addresses the motivational claims of embarrassment, the descriptive or aetiological association to amnesia, the clinical description of a secondary form of confabulation or the causative role of suggestibility, is likely to cause conceptual confusion. This is exactly what has taken place in the literature (for critical reviews see Deluca, 2000; Berrios, 1998; Gilboa & Moscovitch, 2002). This conceptual confusion has also, at least in part, contributed to certain superficial rejections of *any* type of motivational aetiology in confabulation (e.g. Schnider, 2003; Whitlock, 1981).

#### *Suggestibility Motives*

Pick (1905, 1915 in Talland, 1961) and Korner (1935 in Talland, 1961) noticed that the statements of confabulating patients can be easily steered by leading questions. Thus, they argued that 'suggestibility' has a causal role in the

gap-filling forms of confabulation. This explanation relates to the above discussions about the complex connotations of the gap-filling notion. Specifically, the motive of suggestibility has been treated as synonymous with the embarrassment gap-filling motive. Furthermore, it has been rejected as such, i.e. by asking confabulating patients to answer questions with generally 'unknown' or 'hard to access' answers (e.g. Berlyne, 1972; Dalla Barba, 1993a,b; Mercer et al., 1977; Schnider et al., 1996), or by measuring the amount of prompting patients require, before confabulating (e.g. Moscovitch & Melo, 1997). However, this hypothesis also includes a different component. Berlyne (1972) notes how suggestibility in Pick's descriptions, is dependent on clouded consciousness, weakened judgement and lively fantasy. The latter has been supported by Johnson and colleagues (1997) who recently have reported a patient who among other deficits showed 'a propensity towards detailed imaginations' (Johnson et al., 1997, p. 203; see also Johnson et al., 2000). In this sense, suggestibility may be seen as part of one's personality structure, or more generally an individual predisposition to external suggestion and compliance.

The only study, known to the author that directly addressed suggestibility in this context is by Mercer and colleagues (1977). They deceived their patients into believing that they had responded earlier to questions, in which in reality they had responded 'I don't know' and asked them to re-answer the questions. The results indicated that severe confabulators changed their replies on 31% of the occasions, while mild confabulators did so on 28% of the occasions. Based on this similarity, the authors concluded that their results did not support the suggestibility hypothesis. However a re-examination of their results leads to a more complex interpretation. First of all, the study does not report the percentage of change of responses in non-confabulating patients. If the latter did not change their responses at all, then suggestibility might have a role in confabulation, albeit a secondary one. In addition, the authors report that mild confabulators never produced a confabulation when altering their responses, while severe confabulators did so at every question. The latter finding suggests that the production of confabulations is influenced by suggestion. However, the question of whether the influence of suggestibility is causative of confabulation across patients or whether it is a secondary phenomenon (e.g. Moscovitch, 1989) requires further investigation. Interestingly, similar phenomena have been

observed and studied in a forensic context (e.g. Gudjonsson & Sigurdsson, 1995; see also Kopelman, 2002 for review). Although confabulation in these contexts may represent a different phenomenon, the conclusions of these studies about the partial role of suggestibility in ‘forensic confabulation’ warrants direct investigation of the phenomenon in the case of neurological confabulation. Thus, the role of suggestibility will be directly investigated in the present study in two case-reports.

*Motives Based on Premorbid Personality*

Williams and Rupp (1938) attributed the occurrence of confabulation, in part at least, to tendencies inherent in the patient’s premorbid personality structure. They emphasised that confabulating patients combine the extremes of introversion and extraversion, including uncommunicativeness and apathy at the one end, and superficial sociability and realism, at the other. Talland (1961) noted that confabulation is “an interaction effect of the amnesic syndrome and basic personality structure” (p. 380). More specifically, he concluded that confabulation was secondary to amnesic derangement. The latter “creates an occasion for each occurrence, and dispositions characteristic of the individual patient will determine its presence, rate and quality”. Berlyne (1972) confirmed the above views. He observed that five out of the seven Korsakoff patients he studied were premorbidly extraverts and “no less than four showed features of Schneider’s ‘hyperthymic’ personality type (Schneider, 1958)”. He also observed three cases of fantastic confabulation of paranoid content in patients with senile dementia. All three had a ‘sensitive’ premorbid personality. Berlyne concluded that premorbid personality traits may determine the content of confabulation.

In a study on confabulation in the context of senile dementia, Gainotti (1975) conducted what remains until today the most systematic study of this hypothesis. He asked relatives to describe the premorbid personality of eight confabulating patients and 22 non-confabulating control patients. Specifically, he investigated the following features: (i) attitudes towards work, health and illness; (ii) interpersonal patterns, e.g. need for prestige and superiority, tolerance or hypersensitivity to criticism; and (iii) reaction to stress, e.g. depression, overt anxiety. The results indicated opposite personality traits between the two groups. More specifically, 75% of the target patients were described as having a strong



tendency to deny, ignore or rationalise illness. In addition, the predominant feature of their interpersonal relationships was the need for prestige and domination, over emotional and intimacy concerns. None of the confabulating patients were hypochondriacal or concerned with their somatic functions but five of them were described as having violent reactions to anxiety. The control group showed a very different balance of personality characteristics along all three axes. Gainotti concluded, similarly to Talland (1961), that although the memory and intellectual deterioration observed in this neuropathology is necessary for confabulation to occur, the presence of confabulation in some, but not other patients, suggests a role of personality traits and coping mechanisms in the emergence of the symptom. Finally, given that most of the confabulating, but not the control, patients of the study came from particular social and national backgrounds, the study also highlighted the influence of cultural norms and expectations in the formation of confabulation (see also Kopelman, 1997).

Similar conclusions about the role of premorbid personality traits in confabulation have been drawn by Weinstein and his colleagues in a series of clinical studies (Weinstein & Kahn, 1955; Weinstein, Kahn & Malitz, 1956; Weinstein & Lyerly, 1968). They found that the patients most likely to show confabulation and denial of deficit, were the ones characterised by their relatives as premorbidly stubborn, introverted with regard to their feelings, prestige- and power-seeking. In addition, these patients had premorbidly been using coping mechanisms such as denial and minimisation, when confronted with other health issues. This view will be considered in detail below.

Finally, in a more recent case report, Conway and Tacchi (1996) investigated mood and personality changes in a selectively confabulating patient. While these authors did not report any specific premorbid personality pattern, they did argue that the patients' current goals and preoccupations had influenced the content of her confabulations (see below). In conclusion, although this hypothesis has received some support, it remains unclear how, and at what aetiological level, the individual's personality interacts with the neurocognitive dysfunction in order for confabulation to occur, or in order for the content of confabulation to be coloured in a particular way. Thus, the issue awaits further investigation. In the

present study the role of premorbid personality in confabulation will be investigated in two single case studies.

*The Motive of Denial*

Lidz (1942 in Talland, 1961) had discussed confabulation as a response to overwhelming anxiety and Zangwill (1953 in Berlyne 1972) had conceptualised confabulation as a defence against 'a catastrophic reaction', i.e. a depressive reaction to one's illness. However, the hypothesis that confabulation is a form of 'psychological denial', i.e. a compensatory coping mechanism instigated by excessive anxiety, is mostly related with the work of Weinstein and his colleagues (for a review see Weinstein, 1996). It was their studies on anosognosia and a number of other related syndromes that led to the formulation of this psychodynamic hypothesis. This theory did not only focus on the premorbid predispositions of certain individuals to confabulate (see above), but further emphasised two aspects of the syndrome; the symbolic nature of its content and the accompanying implicit awareness of deficit (see also Feinberg, 2001). Thus, Weinstein and colleagues claimed that although confabulations frequently involve references to past events, they are to some degree, symbolic representations, dramatisations, or explanations of some current personal experience, preoccupation or disability (Weinstein, Kahn & Malitz, 1956). These symbolic functions are based on kernels of awareness of deficit, i.e. confabulations implicitly express illness preoccupations and anxieties, which the patient is not capable of fully appreciating and explicitly expressing. More generally confabulation itself represents an indication of a selective and partial awareness of deficit (Weinstein & Kahn, 1955). Finally, the symbolic function of confabulation, although is at *face value* aberrant with reality, it seems to have an ultimate adaptive role. Weinstein observed, following Bonhoeffer (1901, cited in Weinstein, 1996) that during the narration of confabulations, patients become engrossed in detail, lose their previous irritability and then appear utterly relaxed.

Although these views have highlighted the positive aspects of confabulation, there has been little experimental evidence in their support. Moreover, these psychological coping mechanisms are considered independent of the specific neuropathological features of the syndromes they aim to explain. Thus, their explanatory power with regards to the syndromes themselves is

limited. Indeed, Weinstein (1996) acknowledged that the above descriptions are less likely to be relevant to spontaneous confabulation with vivid imagery, as reported in patients with ACoA aneurysms and anterior cingulectomy.

*Other Psychodynamic Models*

In the early explorations of the nature of confabulation a series of clinicians observed motivational biases in the manifestations of confabulation. For example, Moll (1915) noted the influence of former habits and emotional complexes. Some psychoanalytically-oriented clinicians recognised in the content of confabulation the mark of psychodynamic mechanisms (for reviews see, Berlyne, 1972; Bettlheim & Harman, 1924; Davidson, 1948). For example, Bettlheim and Hartman (1924) noted “If we start out from the general view that there is a close relationship between-organic-cerebral and psychic mechanisms, it seems justified to raise the question whether the psychologically well-described and well-known processes of repression, displacement and condensation have their counterpart in the realm of organic disorders” (p. 288). Most importantly, the disorganised, a-temporal, free of counter-ideas, and at times, wishful and vivid quality of confabulations was reminiscent of the recollective quality of dreams (Berlyne, 1972; Bettlheim & Hartman, 1924; Pick, 1905; 1915 in Talland, 1961; Scheid, 1934 in Berlyne, 1972; Van der Horst, 1932; Whitty & Levin, 1957; see also Damasio et al., 1985; Stuss et al., 1978). This led some authors to suggest that the individual’s wishes and interests guided confabulation in the same way as they controlled dream fantasy (Berlyne, 1972; Bettlheim & Hartman, 1924; Van der Horst, 1932).

However, these explanations, unlike the ones examined above, did not consider these emotional mechanisms in isolation. Instead, they regarded the emotional manifestations as the direct consequence of the cognitive dysfunction. For instance, Bettlheim and Hartman (1924) argued that the characteristic amnesic derangement of the Korsakoff syndrome, caused a lack of cognitive restraint. This in turn, allowed the normally implicit effect of primitive, emotion-based forms of cognition to become more explicit and colour recollection even under controlled experimental conditions. These views echoed Korsakoff’s (1889) initial suggestion that the frequency of death and funeral themes in these patients’ false memories was based on unconscious associations (in Talland, 1961).

Although at first sight, these psychodynamic views appear similar to the denial hypothesis, in fact they are significantly different in at least one fundamental aspect. Confabulation in these psychodynamic theories is not conceived as caused, nor coloured, by any compensatory defence, filling-in tendency, or personality-related mechanism. Instead confabulation, including its negative and positive features, is regarded as the direct result of an organically-caused dysfunction of the normal mechanisms of remembering. Given this dysfunction, the necessary mixing and editing of memory material, has now produced an almost grotesque outcome. Yet it still bears the influence of its basic ingredients, including basic emotional tendencies and cognitive elaborations. In Bertlheim and Hartman's (1924) terms,

“that the memory disorder of the Korsakow syndrome is organically founded is conceded by all investigators. But one can assume as Bonhoeffer did long ago, that there is also a functional factor and that only its interaction with the organic-cerebral factor yields the total psychological picture of the Korsakow syndrome. The functional factor of the memory disorder seems clearest in post-traumatic cases. Even if we consider the functional factor secondary, it is permissible to assume that in our cases too, psychologically demonstrable tendencies make use of organically pre-formed distortion mechanisms. The aim of our investigation was to demonstrate through the study of symbolic distortions how the deliberate application of psychological insight affords a partial glimpse into the operation of these organic mechanisms” (p. 307).

Yet in the following decades this perspective received little experimental attention. Perhaps given that the neurocognitive basis of confabulation remained obscure until a few decades ago (Schnider, 2003), this early and rather ambitious effort to explain the emotional features of the syndrome in organic terms fell into a theoretical vacuum. Instead, the more simple defence or filling-in explanations were established as *the* motivational hypotheses, only to be deemphasised and largely dismissed as more sophisticated neurocognitive models of confabulation came to the foreground (for review see Deluca, 2000). The subsequent revision of some of the above psychodynamic hypothesis will be addressed in the following section.

1.4.3 Combinations of Damaged and Spared Mechanisms

The discussion of the aforementioned controversial theoretical explanations of confabulation has hinted at the fact that the endeavour to define a single cognitive deficit, or a single compensatory mechanism, underlying confabulation has proven far from straightforward. Indeed, more recently various investigators have noted that the variety of reported features of confabulation requires a theoretical account capable of incorporating multiple contributing factors (Burgess & McNeil, 1999; Fotopoulou et al., 2004; Johnson, et al., 1997; 2000; Kopelman et al., 1997; Shapiro et al., 1981). Crucially, any appropriate theory should be in the position to integrate both 'negative' and 'positive' features of confabulatory manifestations, since positive or adaptive aspects of confabulation have been reported in confabulation case studies in parallel with negative ones (e.g. Burgess & McNeil, 1999; Conway & Tacchi, 1996; Downes & Mayes, 1995; Jorn & Rybarczyk, 1995; Sabhesan & Natarajan, 1988; Villiers et al., 1996).

For example, Villiers and his colleagues (1996) report a patient who was found confused in his hotel room and who, although presenting no amnesia or confabulation upon formal neuropsychological testing (see also Papagno & Muggia, 1996; Conway & Tacchi, 1996), repeatedly described an alleged one-day trip to Tokyo on the day before his admission. Relatives verified that, although the patient had always wished to work at Tokyo, he had never been there. Therefore it appears that in such cases, although confabulation may involve 'some kernels of truth of genuine experience' misattributed in time and space (Talland, 1965), it may also be influenced by factors of great affective stamp (Mercer et al, 1977), marked personal significance (Burgess & McNeil, 1999), or, wish-fulfillments (Berlyne, 1972; Betlheim & Hartman, 1924; Downes & Mayes, 1995; Van der Horst, 1932; Flament , 1957 cited in Berlyne, 1972; Clarke, Wyke, & Zangwill, 1958 cited in Talland, 1961).

As described above, initial attempts to address these 'positive' features and adaptive functions within neurology and psychiatry have been rather unsuccessful. However, recent advances in neuroscience and the broadening of its interests to topics which were once considered not amenable to empirical research (e.g. affective regulation) have allowed emotional features of confabulation to be

reconsidered. This happened within two different traditions, cognitive psychological research on 'normal' memory distortion and a small branch of psychodynamically-informed neuroscience.

#### 'Combination Models'

Following the pioneering studies of Bartlett (1932), a tradition within cognitive psychology focused on the constructive nature of memory. Within this paradigm, memories are understood as dynamic, fluid and situationally-bound constructions, which are influenced by the context in which they are produced (Conway, 1992). A number of emotional and cognitive factors render memories prone to distortions and misattributions (Johnson & Raye, 1998). More generally errors of commission are considered as defining for the nature of memory as errors of omission (e.g. Conway & Pleydell-Pearce, 2000; Christianson, 1992; Gudjonsson, 1992; Johnson et al, 2000; Loftus, 1993; Ochsner & Schacter, 2000; Schacter, Norman & Koutstaal, 1998).

Similarly, investigations of autobiographical memory within cognitive and social psychology (Conway & Pleydell-Pearce, 2000; Ross, 1989; Pillemer, 2001; Singer & Salovey, 1996; Woike, 2003) have put forward an equally dynamic conceptualisation of remembering. For example, in a series of studies McAdams (for review see McAdams, 2001), argued that individuals reconstruct the past in terms of an internalised and evolving self-story, a coherent narrative of self that weaves together diverse experiences and creates a sense of unity over time and a defined purpose for future action. Crucially, "these life stories are based on biographical facts, but they also go considerably beyond the facts as people selectively appropriate aspects of their experiences and imaginatively construe both past and future to construct stories that make sense to them and to their audiences, that vivify and integrate life and make it more or less meaningful" (p. 101).

Stemming from these traditions, certain models have proposed equally dynamic conceptualisation of memory distortion and falsification in neurological syndromes (for review Conway & Fthenaki, 2000). They suggest that memory following brain damage, will remain constructive in nature and show similar patterns of source misattributions, distortions, and fabrications as observed in normal memory distortion, albeit in an exaggerated form. *Thus, confabulation*

*may be best understood as the magnification of existing 'normal' misremembering experiences, rather than a dysfunction of the previously flawlessly functioning memory system* (Burgess & Shallice, 1996; Conway & Fthenaki, 2000; Fotopoulou et al., 2004; Johnson, 1991; Schacter et al., 1998). Moreover, the particular combination of preserved and impaired memory processes, will determine the exact form and content of confabulatory memories, including both 'positive' and 'negative' features. Indeed, as also described above, some studies have already begun to recognise and address such complexities in the production of confabulation (Burgess & McNeil, 1999; Conway & Tacchi, 1996; Johnson et al., 1997; Kopelman et al., 1997). For example, Kopelman and his colleagues (1997) concluded that frontal lobe pathology and context memory disorders are not sufficient to produce confabulation. Instead, factors such as a high rate of perseverations and a tendency to respond indiscriminately to the immediate social and environmental context may have some role in causing confabulation.

However, while some of the above models have focused on the cognitive mechanisms of memory distortion, other emphasised both cognitive and emotional critical factors (Conway & Fthenaki, 2000; Fotopoulou et al., 2004; Johnson et al., 2000). For instance within the proposed source monitoring framework (SMF), Johnson and colleagues (for reviews see Johnson et al., 2000; Johnson, 2001) have recently broadened their conceptualisation of confabulation. They (Johnson et al., 1997) emphasised that source-monitoring deficits alone could not account for all the instances of confabulation in their patient, since the latter is based on a confluence of factors, such as source monitoring deficits, impoverished autobiographical memory retrieval and a propensity towards vivid imagination. More generally, in their model, the retrieval of memories is not described as a process of search and identification of memory traces. Rather mental experiences and representations are attributed to memory by ongoing judgment processes (Johnson, 1991). In a recent review paper, Johnson (2001) outlined four key features of these complex attribution mechanisms. (a) They are depended upon the qualitative characteristics of mental experience, including perceptual, spatial, temporal and emotional details; (b) They are influenced by the embeddedness of mental experiences, i.e. the availability of supporting memories, the consistency with previous knowledge, and their internal consistency; (c) They are based on flexible criteria, which may vary according to the context in which

mental experiences are judged; (d) Goals, beliefs, motivational and social factors influence what characteristics are looked for, how much embedding occurs and which criteria are applied. In other words, *motivational factors have a determining role on all three other key aspects*. More generally, all these components are imperfect and interact in a dynamic way to produce both accurate and faulty attributions. Based on this framework, Johnson and colleagues (e.g. Johnson and Raye, 1998) proposed that deficits in one or more of these components will lead to confabulation. The nature of the latter will depend on the exact amount and combination of processes impaired and preserved.

In a similar model, Conway and colleagues (for a review see Conway, 2001) stressed the interdependence of motivation and autobiographical memory. They have conceptualised autobiographical memory as a database of information in the service of the 'working-self', which is conceived as a hierarchical template of currently active goals. The latter, in conjunction with input from the autobiographical memory base, sets goals, determines accessibility to autobiographical memory and supervises its output. Within this model, confabulation is regarded as resulting from a combination of preserved and damaged memory processes in autobiographical memory 'construction' (Conway & Tacchi, 1996; Conway & Fthenaki, 2000; Fotopoulou et al., 2004). Dysfunctional executive control processes compromise both the search in autobiographical memory and the evaluation of long-term memory output. Thus, patients are unable to distinguish between memory constructions created by the 'current self', and the ones grounded in and constrained by autobiographical knowledge. As a consequence, the degree of involvement in memory construction of the wished-for-self (ungrounded goals and plans) is disproportionately larger than of the "actual" self (Conway & Pleydell-Pearce, 2000). For example, the frontal patient OP, reported by Conway & Tacchi (1996) persistently maintained a set of plausible but confabulated memories. These rewrote the disappointments in familial interactions of her past into a history of successful and supportive intimacy with certain family members.

From a different perspective, Solms and his colleagues (for review see Solms, 2000) have proposed a neuroscientific revisiting of old psychodynamic hypotheses of confabulation. More generally this approach, summarised under the



term ‘neuro-psychoanalysis’, aims to assess the validity and scope of fundamental psychoanalytic hypotheses using empirical neuropsychological and neuroscientific research. This endeavour has met with significant obstacles, mainly due to the scepticism of clinical and experimental neuroscience towards psychoanalysis, as well as the retreat of the latter into scientific isolation (see for discussion Solms & Turnbull, 2002). This mutual avoidance of the two fields is also rooted in the historical discrediting of psychoanalysis by biologically orientated psychiatry during the second half of the twentieth century. However, as misleading concepts such as the rigorous distinction between ‘functional’ and ‘organic’ have recently become outdated, various scientific authorities have begun to recognise the benefits of reconciliation (e.g. Nobel-laurate Eric Kandel, 1999). Simultaneously, the softening of positivism within neuroscience has allowed the study of topics such as emotions and ‘the self’, on which psychoanalysis has traditionally focused, to gain scientific credibility (e.g. Adolphs, Tranel & Damasio, 2003; Ledoux, 2000; Markowitch, 2003; Panksepp, 2003).

Confabulation has served as a particularly useful arena for this interdisciplinary exchange (e.g. Deluca, 2000; Fotopoulou & Conway, 2004; Johnson, 2000; Feinberg, 2004; Kinsbourne, 2000; 2004; Schnider, 2004; Turnbull, 2004b). Based on the description of a series of severely confabulating patients with bilateral ventromedial prefrontal cortex lesions, Solms and colleagues (Kaplan-Solms & Solms, 2000; see also Turnbull et al., 2004b) proposed that the characteristics of confabulation result from the combined effect of executive disinhibition, disorganisation of memory recollection and the release of primitive mental mechanisms. This view is grounded in traditional psychodynamic models (Freud, 1915). In such models, mental functioning is conceived as dominated by mature conscious and unconscious cognitive functions of self-representation and organisation, termed ‘ego functions’, which include processes of inhibition, selectivity, binding, pacing, organisation and control. These are further conceived as built upon the phylogenetic and ontogenetic foundations of more primitive and largely unconscious mental functions. According to this perspective, the latter are persisting in implicit form and under the dominating supervision of ‘ego functions’. Nevertheless, unconscious mental processes continue to exert an effect on more mature cognitive operations, particularly when the latter are defective or simply overwhelmed.

Solms (2000) focused on the similarity of these primitive unconscious processes and the clinical characteristics of confabulation. These include tolerance of mutual contradiction, timelessness, attribution of internal representations or emotions to external sources, associative thinking, i.e. frequent superficial displacements and condensations of thoughts and memories. These very characteristics, observed directly by several neurologists and neuropsychologists in confabulating patients, have been also described in traditional psychodynamic models. However in the latter case, these characteristics had been inferred from psychoanalytic inquiry into psychopathological symptoms and certain everyday phenomena such as dreams (Freud, 1915). Based on this similarity, Solms (2000) proposed that in confabulating patients damage to the ventromedial prefrontal cortex and the resulting lack of executive control of memory recollection (a deficit hypothesis), leaves memory at the mercy of disproportionately powered inner needs and desires, with little regard for adaptive considerations (a complementary motivational hypothesis).

In a recent case-report, Fotopoulou and colleagues (2004) provided experimental support for the above motivational hypotheses. The study investigated patient ES, who developed a striking confabulatory syndrome following removal of a meningioma in the pituitary and suprasellar region. ES's executive and memory abilities were severely compromised, and he confabulated continuously, spontaneously and bizarrely. Naïve raters presented with transcriptions of his confabulations found them to represent significantly more pleasant experiences than their corresponding, misrepresented realities (see also Turnbull et al., 2004a). This finding suggested that confabulations include motivated (or 'wishful') contents. The influence of this motivational feature of confabulation was considered in parallel with the memory and executive deficits which contributed to the occurrence of confabulation. The study concluded that a complex combination of damaged (poor retrieval control) and spared (emotionally driven retrieval) processes apparently interacted in generating false beliefs and memories in this patient.

Despite this increased theoretical attention to the potential motivational nature of confabulation, there has been little experimental work investigating these issues (Fotopoulou et al., 2004; Turnbull et al., 2004a). Instead the

motivational accounts outlined above are based mostly on anecdotal clinical descriptions of a few confabulating patients (e.g. Conway & Tacchi, 1996; Kaplan-Solms & Solms, 2000). The present study aims to place the cognitive and the emotional features of confabulation under direct empirical scrutiny and to provide further experimental support for the above models, based on group investigations, albeit of a small number of severely confabulating patients. Before turning to the specific aims and hypotheses of the present study, it is necessary to consider the literature on a different form of confabulation, namely confabulation in relation to anosognosia for hemiplegia. This will constitute an additional focus of the present study.

### **1.5 Motor - Related Confabulation**

Confabulation is associated with a number of other neurological syndromes in which amnesia is not directly implicated. In the present study we will consider the relation of confabulation to anosognosia for hemiplegia (AHP) (Babinski, 1914). Although there might be many forms and degrees of unawareness, in this study the term ‘anosognosia’ will be used to refer to “diminished awareness of the existence of a neuropsychological deficit itself”. The term ‘implicit knowledge, or awareness’ of deficit will refer to “knowledge that is expressed in task performance unintentionally and with little or no phenomenal awareness” (Schacter, 1990, p. 157). In addition, the distinction between unawareness of deficit itself, and unawareness of its consequences, will be taken into account when necessary (Schacter & Prigatano, 1991). More generally, the term awareness will be used to refer to “the running span of subjective experience” (Dimond, 1976, in Schacter, 1990, p. 157).

The first descriptions of AHP coincide in time with the first descriptions of confabulation in the Korsakoff syndrome. Von Monakow (1885), Anton (1893) and Pick (1898) first described patients who denied their left-sided hemiparesis (in Bisiach & Geminiani, 1991). In 1914 and 1918, Babinski described further patients and coined the terms anosognosia and anosodiaphoria. The latter referred to the apparent indifferent attitude certain patients show in acknowledging their hemiparesis. A variety of clinical and experimental reports of this relatively rare condition have followed (for reviews see McGlynn & Schacter, 1989; Heilman et al., 1998). These have showed that AHP is a complex syndrome with several

manifestations. While some patients appear simply unaware of their paralysis, their false claims may turn out to be refractory to correction and supported by a number of false beliefs. Even upon demonstration patients might insist the limb moved. In addition, they may confabulate supporting ‘memories’ of recent activities involving their limb, or even confabulate irrelevant excuses of why the limb did not move, e.g. it was tired or lazy. In more extreme cases the patients might reject ownership of the limb (asomatognosia) and even attribute it to someone else. Alternatively, they might treat and address their own limb with apparent hostility and hatred (misoplegia) (Critchley, 1974).

AHP is most frequently associated with right-hemisphere lesions in parietal, and less frequently, frontal and temporal lobe regions. Possible subcortical involvement, e.g. basal ganglia, thalamus, has also been noted (Feinberg & Roane, 1997a; Heilman et al., 1998). Beyond the limits set to investigation by severe aphasia, the syndrome has also been observed following corresponding left-sided lesions. However, this issue remains poorly investigated (for reviews see Bisiach & Geminiani, 1991; Feinberg & Roane, 1997a; Frith, Blakemore, & Wolpert, 2000; Heilman et al., 1998; Vuilleumier, 2004). The association of AHP and confabulation is frequently reported. Specifically, patients with AHP often confabulate, i.e. their confabulations support their explicit unawareness of their hemiparesis and they appear unaware of the inaccuracy of their confabulations (Babinski, 1914). Similarly, as described above, amnesic confabulating patients of various pathologies are typically unaware of their memory gaps and confabulatory tendencies (Luria, 1976; Moscovitch, 1989; Talland, 1961). In addition, although anosognosia for hemiplegia, like confabulation, is most commonly transient, less frequent chronic types have also been described (Berti, Lavadas, & Della Corte, 1996; Berti, Lavadas, Stracciari, Giannarelli, & Ossola, 1998; Cocchini, Berschin, & Della Sala, 2002; Gold, Adair, Jacobs, & Heilman, 1994; Rode, Perenin, Honore, & Boisson, 1998; Venneri & Shanks, 2004). Despite this co-occurrence and the common duration of confabulation and anosognosia, the direct relation between the two symptoms and their potential interdependence remains controversial (see Feinberg & Roane, 1997b; Heilman et al., 1998 for reviews) and it has received limited systematic study (Feinberg et al., 1994; Lu et al., 1997; Venneri & Shanks, 2004). Finally, no

clear distinction exists between the two types of related confabulatory behaviour, i.e. memory- versus motor-related confabulation.

Furthermore, the theoretical history of confabulation and anosognosia bears some similarities. Although there is no generally accepted theory of anosognosia for hemiplegia (Bisiach & Geminiani, 1991; Frith, Blakemore, & Wolpert, 2000; Heilman et al., 1998; Vuilleumier, 2004), the symptom has been explained from both motivational and neurocognitive perspectives. More specifically, some clinical reports have described emotional and motivational contributions to anosognosia and have postulated compensatory defence mechanisms of denial (Goldstein, 1939; Weinstein & Kahn, 1955). By contrast, neurocognitive models have proposed single or multiple cognitive deficits to explain anosognosia (Bisiach & Geminiani, 1991; Frith et al., 2000; Heilman et al., 1998). Although experimental investigations thus far have mainly targeted such cognitive impairments (e.g. see Vuilleumier, 2004 for discussion), little agreement exists even between cognitive models of anosognosia. The latter have implicated modular (Bisiach et al., 1990; Levine, Calvanio & Rinn, 1991), or centralised (McGlynn & Schacter, 1989) higher order systems capable of generating bodily awareness or allocating attention. Alternative cognitive models have explained anosognosia as a disconnected verbal response (Geschwind, 1965; Joseph, 1986a). In more recent hypotheses, anosognosia is thought to result from a lack of the intention to move and an associated perceptual mismatch (Heilman et al., 1998). Similarly, anosognosia has been described as the result of dysfunctional motor intentions and related anticipations, which in turn influence the perception and monitoring of motor difficulties (Blakemore, Wolpert, & Frith, 2002).

Nevertheless more recently, a series of authors have argued that anosognosia is, like confabulation, a multi-component phenomenon, consisting of a number of different patterns of emotional and cognitive disturbances that are not likely to be explained by a single mechanism (Cocchini et al., 2002; Marcel et al., 2004; Venneri & Shanks, 2004; Vuilleumier, 2004; Kaplan-Solms & Solms, 2000; Turnbull et al., 2005a). Thus, an integration of cognitive and motivational abnormalities might provide a more comprehensive understanding of at least some unawareness phenomena. However thus far, direct experimental investigation of motivational influences in anosognosia remains scarce (e.g. Marcel et al., 2004;

Ramachandran, 1995; Turnbull et al, 2005a). More generally, few studies have focused on the nature of confabulation in the context of anosognosia for hemiplegia. The present study aims to provide some insight into these complicated discussions by studying the confabulatory behaviour and the related anosognosic statements of right-hemisphere patients with left-sided hemiplegia. Furthermore, their neuropsychological profile and their performance in experimental investigations will be explicitly compared with the corresponding behaviour of amnesic confabulating patients.

### **1.6 Main Aims & Hypotheses.**

In conclusion, significant progress has been achieved in the last hundred years in defining, describing and explaining confabulation in neurobehavioural terms, but several key issues remain unclear and controversial. By investigating a small number of severely confabulating patients, the present study aims to carefully describe the clinical manifestations of confabulation, explore its corresponding neuropsychological deficits and most importantly experimentally investigate the potential role of emotional and motivational influences. As the above review described, such influences have received very little systematic study. Thus, their relation to the cognitive deficits associated with confabulation remains elusive. The present study aims to experimentally assess the potential manifestations of such influences in confabulation, i.e. to document the phenomenon, as well as empirically investigate the mental and neural mechanisms that might contribute to such influences.

More specifically, the first three hypotheses of the present study are mainly concerned with the neuroanatomical and cognitive basis of confabulation and are based on the 'retrieval theories' outlined above:

*1) Direct damage or functional disconnection, involving the ventromedial and orbitofrontal cortices, is implicated in confabulation.* This hypothesis will be addressed in Chapter 2 by examining the neuropathological and neuroradiological findings of confabulating and non-confabulating amnesic and frontal control patients.

*2) Severe memory impairment commonly, but not necessarily accompanies confabulation and it is not sufficient for its occurrence.* This hypothesis will be

addressed in Chapter 2 by assessing the performance of confabulating and non-confabulating control patients on standardised tests of memory.

3) *Executive dysfunction is a common, but variable component of confabulatory syndromes.* This hypothesis will be addressed in Chapter 2 by assessing the performance of confabulating and non-confabulating amnesic and frontal control patients on standardised tests of executive function.

The following four hypotheses focus on the potential motivational aspects of confabulation and are consistent with the ‘combination models’ of confabulation outlined above.

4) *The content of spontaneous confabulation is wishful, i.e. it shows a positive emotional bias.* This hypothesis will be addressed in Chapter 3 by comparing the valence of false statements produced spontaneously by confabulating patients and the ones induced experimentally in amnesic non-confabulating patients and normal controls.

5) *The content of memory-related confabulation shows a positive bias, over and above temporal source confusions.* This hypothesis will be addressed in Chapter 4 by comparing the recognition errors of confabulating and non-confabulating amnesic patients on a temporal source memory task, which controls for the emotional valence of memories to be recognised.

6) *The content of confabulation is self-serving, over and above the memory and executive deficits that might influence memory recall.* This hypothesis will be addressed in Chapter 5 by comparing performance of confabulating and non-confabulating amnesic and frontal control patients on an emotional prose-recall experiment, which manipulates the self-reference of the information to be remembered.

The above primary hypotheses, as well as a number of secondary hypotheses, e.g. the role of suggestibility and premorbid personality traits in colouring the content of confabulation, will be addressed in Chapters 6 and 7. These chapters will describe in detail the neuropsychological profile and the confabulation characteristics of two patients; one with memory-related confabulation (Chapter 6) and one with motor-related confabulation (Chapter 7).

## **Chapter 2 : Patients & Their Neuropsychological Assessment**

### **2.1 Introduction**

The experimental investigations undertaken in the present thesis will be presented in the following chapters. However, before proceeding to these experiments, it is necessary to include a separate chapter that aims to describe the inclusion and classification criteria of the confabulating and control patients recruited in the study, as well as their demographic, neuropathological and neuropsychological characteristics. Two main hypotheses were addressed by the neuropsychological assessments of the present chapter. These involved the potential association of confabulation with amnesia and with executive functions impairment. Finally, a third hypothesis was addressed by the neuroradiological and neuropathological data presented in this chapter. This concerned the potential association of confabulation with lesions in the OMPFC and associated areas (see Chapter 1 for discussion of these hypotheses).

### **2.2 Participants**

Twenty three neurological patients in total participated in the study. These included 17 in- and out-patients of Newcastle General Hospital, and six in- and out-patients of Groote Schuur Hospital in Cape Town, SA. The patients were selected from a large, mixed group of brain-damaged patients according to the inclusion criteria described below, the availability of collaborating carers and the availability of satisfactory medical files. These were the only patients observed over a period of 21 months who met these criteria and who agreed to participate in the study. Another eleven patients (two with indications of confabulation, four with indications of severe memory problems and five with indication of executive functions problems) were invited to participate in the study but they refused (four patients), or medical and time-restrictions on their part prevented them from participating (seven patients). Data reported for each patient were gathered within 20 - 45 days. Neurologically intact individuals were also tested as control participants in each experiment. Their demographic characteristics and



performance are reported in the corresponding chapters below. All subjects gave written informed consent. The study was approved by the local NHS Trust and the University of Durham's Ethical Committee.

### **2.3 Confabulation Recruitment Criteria**

Thirteen confabulating patients in total participated in the study. These were in- and out-patients of Newcastle General Hospital (nine patients), or in- and out-patients of Groote Schuur Hospital in Cape Town, SA (four patients). Most patients were hospitalised at the time of assessment and remained hospitalised until the end of the study. The three patients who were not hospitalised were living under residential 24-hour care. In each case, substantial care was taken to ensure as undisturbed a testing environment as possible. Patients were recruited if they met the following recruitment criteria:

#### General Inclusion Criteria:

- (a) Adults with confirmed diagnosis of brain pathology.
- (b) Indication of confabulation as described by carers, medical files or by the referring consultant.
- (c) Available neuroimaging examination (CT or MRI head scan).

#### General Exclusion Criteria:

- (a) Less than seven years of education, or an estimated premorbid Full Scale Intelligence Quotient (FSIQ) based on the Wechsler Test of Adult Reading (WTAR) less than 70.
- (b) Severe impairments in language (unsatisfactory communication).
- (c) Presence of a delirium or acute confusional state (forward digit span < 5, abnormal sleep-wake circle, see also Schnider et al., 1996).
- (d) Previous psychiatric history, other than Korsakoff's psychosis.
- (e) Presence of dementia, or other degenerative brain conditions.
- (f) Current medication with known effects on mood or cognition.

### **2.4 Classification: Confabulating Versus Control Patients**

The classification of confabulation has been a source of difficulty for previous studies and has necessitated the establishment of arbitrary qualitative or quantitative criteria (see DeLuca, 2000; Hirstein, 2004; Schnider et al., 1996 for discussions). Specific issues of difficulty are (i) the observed dissociations between the presence of confabulation in neuropsychological assessment and in

everyday situations (Conway & Tacchi, 1996; Papagno & Muggia, 1996); (ii) the presence of confabulation in different neurological syndromes, e.g. patients with aneurysms of the ACoA and patients with right-hemisphere syndrome; (iii) the complications involved in identifying and quantifying reliably the presence of 'spontaneous', i.e. experimentally un-triggered, versus provoked confabulation (e.g. Cunningham et al., 1997; Fisher et al., 1995; Kern et al., 1992; Kopelman, 1987; Schnider et al., 1996; see also Chapter 1); (iv) finally the previous use of single dichotomous and arbitrary distinctions of confabulatory types, which compile different, and possibly dissociable, qualitative labels (e.g. 'momentary' versus 'fantastic'; Berlyne, 1972; see also Chapter 1).

#### 2.4.1 Classification Interview

In the present study, a preliminary unstructured interview was conducted with each patient and his relatives in order to verify the presence and nature of confabulation. Caring staff and medical files were also consulted. Questions of interest included patients' personal and medical history, current medication, premorbid personality traits, professional and personal habits and attitudes, current personality changes, orientation, memory and executive functions abilities, as well as confabulation examples. During the preliminary interview, patients were also asked to recall the prose material of the Logical Memory Wechsler Memory Scale -3<sup>rd</sup> Edition subtest (see below).

#### 2.4.2 Scoring

In order to classify confabulating patients a set of behavioural criteria was applied to the information collected by the interview. These criteria did not attempt to quantify confabulations, as in some previous studies (e.g. Kopelman, 1987; Kern et al., 1992; Cunningham et al., 1997). Instead, the use of these criteria allowed the qualitative description of confabulatory behaviours. Each patient's overall confabulatory behaviour was rated on a number of scales. The extreme points of these scales were based on descriptions of 'extreme' forms of confabulation as previously noted in the literature and in their 'opposite' milder forms (Berlyne, 1972; Bonhoeffer, 1901; Damasio et al., 1985; Kopelman, 1987; Schnider et al., 1996; Talland, 1961; Stuss et al., 1978). The five-point scales included measurements of:

**I. Confabulation Frequency: Rare (1) – Dominant (5)**

Dominance was defined as: Confabulations were dominating the patient's speech during unstructured interviewing, and/or similar observations of confabulation dominance were noted by relatives or professionals in the everyday management of the patient, and/or the tendency to confabulate constantly and unselectively was noted during the prose recall testing.

**II. Confabulation Plausibility: Plausible (1) – Bizarre (5)**

Bizarreness was defined as: The patient produced 'bizarre autobiographical memories' (unrealistic or, non-logically valid events, e.g. a 46-year old lawyer stated: "I was brought into the hospital to join their rugby team. I threw the ball backwards last WK but they won't let me go") during unstructured interviewing, and/or the patient produced 'bizarre autobiographical memories' in everyday life contexts, and/or the patient produced 'bizarre intrusions' (intrusion of impossible events or details of non-logical implications) in the LM subtest of the WMS-III investigation (immediate or delayed recall).

**III. Confabulation Novelty: Distortion (1) – Fabrication (5)**

Fabrication was defined as: The patient produced 'autobiographical memory fabrications' (events apparently and according to relatives unrelated to his/her life, e.g. "I had lunch with G. Bush last week") during unstructured interviewing, and/or the patient produced 'autobiographical memory fabrications' in everyday life contexts, and/or the patient produced 'fabrications' (intrusion of categorically, semantically and phonemically unrelated information; see Cunningham et al., 1997) in the LM subtest of the WMS-III investigation (immediate or delayed recall).

**IV. Confabulation Conviction: Non-Acted Upon (1) - Acted-Upon (5)**

Acting-Upon was defined as: The patient appeared convinced about the truthfulness of his claims to the point that he acted according to his confabulations (Schnider et al., 1996) during unstructured interviewing, and/or in everyday life contexts (e.g. a patient tried in vain to find the way to the second floor. He was in a single-floor building. He was convinced beyond persuasion that his wife was waiting for him upstairs with his favourite meal).

**V. Confabulation Production: Mode: Provoked (1) – Spontaneous (5)**

Spontaneity was defined as: The patient produced apparently spontaneous confabulations (i.e. unprovoked by apparent environmental cues; see also Kopelman, 1987) during unstructured interviewing (e.g. During the first meeting and without any verbal probe from the examiner a patient started narrating how he had lunch that day with an alleged close friend of the examiner) and/or during formal assessment, and/ in everyday life contexts.

These qualitative criteria were used to establish the presence of confabulation and to characterise its nature. An arbitrary criterion of confabulation severity was established in order to distinguish between confabulating and non-confabulating patients, who nevertheless might produce memory errors during testing or in everyday life. Patients were classified as confabulating if they were rated as equal or above the scale's middle point ( $\geq 3$ ) in one or more of the above dimensions.

Given the specialised knowledge required for these ratings, as well as the necessary acquired familiarity with each patient, the examiner was the sole rater. Although this decreased the reliability of the rating, every possible effort was made to consult relatives and professionals and ensure their perspectives were taken into consideration. Four clinicians, familiar with the patients, were also consulted for their clinical impressions on their confabulatory behaviour. These were clinical neuropsychologists, Dr. Pippa Griffiths and Dr. Shannaz Awan, who were directly involved in the management of the British patients, clinical neuropsychologist Prof. Solms, who examined the South African patients and consultant physician Dr. Tim Cassidy, who was the head of the clinical stroke service in Newcastle General Hospital.

### 2.4.3 Results

Thirteen patients met the above classification criterion, and formed the ‘Confabulation Group’ of the study. Their confabulation ratings are shown in Table 2-1 below (see Appendix A2 for individual ratings).

**Table 2-1. Confabulation Ratings of the Confabulation Group**

Group	Frequency	Plausibility	Novelty	Conviction	Production Mode
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
<b>Confabulation</b>	4.1 (0.8)	4.4 (0.7)	4.6 (0.5)	4.5(0.5)	4.5 (0.7)
<b>Controls</b>	1	1	1.5( 0.6)	1.2 (0.5)	1

Note. Higher scores indicate more severe confabulatory behaviour

Among the referred cases only one patient (patient A1) did not meet such criterion and he was classified as a non-confabulating control amnesic patient (see below). During the initial weeks post-injury he was severely confused, but at the time of assessment (eight months post-injury) he showed only occasional and non-severe memory errors. This observation was also confirmed by relatives, caring staff and medical notes and by the fact that the patient was living independently, under the care of his partner, at the time of assessment. By contrast, the 13 confabulating patients, were still hospitalised or living under 24-hour care at the time of their assessment. The severity of each patient’s confabulation was also explicitly confirmed by relatives and caring staff and was consistent with medical notes.

## 2.5 Confabulation Group

The demographic and the neuropathological characteristics of the confabulation group are presented in Table 2-2 below.

**Table 2-2. Demographic and Neuropathological Characteristics of the Confabulation Group**

Patient/ Sex	Age	Educ.	Profession	Months	Lesion	Lesion	Locus	Pathology	Subgroup
	Years			From onset	U/B	Kind	Lesion		
LH/M	60	9	Salesman	4	B	SAH	F	ACoA	C1
RM/M	19	11	Window Fitter	6	B	SAH	FT	TBI	C1
OT/M	41	9	Salesman	9	B	SAH	F	ACoA	C1
BA/M	46	15	Lawyer	8	B	Hypoxia	Gen atrophy/ L F	MI	C1
MS/M	55	15	Lawyer	2	B	Diffuse	Gen atrophy/ R T contusion	TBI	C1
IR/F	45	9	Household	3	B	SAH	F	ACoA	C1
PT/M	64	17	Veterinary Surgeon	8	B	SAH	F	Basal Cistern	C1
WM/M	56	11	Upholsterer	12	B	ETOH/I	Gen/ R F	Alch.Korsakoff	C2
FM/M	71	9	Builder	240	B	ETOH	Gen atrophy	Alch.Korsakoff	C2
CM/F	67	11	Hairdresser	246	B	ETOH	Gen atrophy	Alch.Korsakoff	C2
AO/F	87	11	Civil Clerk	24	U	I	R ic (ACA)	CVA	C3
DO/F	71	14	Teacher	5	U	I	R (MCA)	CVA	C3
JO/M	73	9	Football Coach	3	U	H	R In (MCA)	CVA	C3
Mean	58.7	11.53		43.8					
SD	17.46	2.78		88.57					

*Note.* Lesion: U = Unilateral, B = Bilateral; Lesion Kind: I = Ischaemic, H = Haemorrhagic, SAH = Subarachnoid Haemorrhage, ETOH = Ethanol; Locus: F = Frontal, P = Parietal, T = Temporal, nb = Basal Ganglia, ci = Internal Capsula, In = Lentiform Nucleus, R = Right, L = Left, ACA = Anterior Cerebral Artery Territory, MCA = Middle Cerebral Artery Territory; Pathology: ACoA = Aneurysm of the Anterior Communicating Artery, CVA = Cerebrovascular Accident, Alch. Korsakoff = Chronic Alcoholic Korsakoff Syndrome, TBI = Traumatic Brain Injury, MI = Myocardial infraction; Classification: Subgroup C1 = patients with bilateral or diffuse lesions meeting confabulation criteria, Subgroup C2 = Korsakoff's patients with bilateral or diffuse lesions meeting confabulation criteria; Subgroup 3 = Right hemisphere patients meeting confabulation criteria. All patients were right handed except patient RM.

Nine confabulating patients were British citizens, while the three Korsakoff patients and patient MS were Caucasian, English-speaking South Africans, tested in Groote Schuur Hospital, Cape Town. Nine patients were male and four were female and all patients, except patient RM, were right-handed. Neuroradiological reports and copies of the original CT or MRI scans were available for all confabulating patients, except patient CM, for whom only a report was available. Dr. Daniel Birchall, neuroradiologist at Newcastle General Hospital was consulted for the analysis of the brain scans. Given that these

confabulating patients showed distinct neuropathologies they were divided into confabulation subgroups based on neuropathological findings. The behavioural, neuropsychological and experimental investigations of the study took into account the potential differences between these subgroups. These subgroups are presented in turn below.

### 2.5.1 Confabulation Subgroups: Neuropathological Characteristics

#### *1<sup>st</sup> Subgroup: Bilateral Patients*

##### **Medical History**

Seven patients with bilateral prefrontal cortex lesions, as detected in CT or MRI scans or as inferred from their neuropathologies (See Table 2-2 above), formed the first confabulation subgroup (hereafter referred to as C1). Five of these patients had suffered subarachnoid haemorrhages (SAH). In patient RM this was caused by a road traffic accident (see Case Report 1 in Appendix A3). Three patients (LH, OT and IR) had ruptured and operated aneurysms of the anterior communicating artery (ACoA). Patients LH and IR underwent left fronto-temporal craniotomy and clipping of aneurysm. In patient LH, haemorrhage was also seen in the medial right frontal lobe (see also Chapter 6). Patient OT had a recurrent saccular aneurysm at the junction of the A1 segments of the right anterior cerebral artery with the anterior communicating artery. He had a coil embolisation. The fifth patient had a lumbo-peritoneal shunt inserted, following a basal cistern SAH, complicated by hydrocephalus and by a secondary interventricular haemorrhage. All these patients had detectable lesions in the orbital or and medial area of the prefrontal cortex bilaterally. The ACoA patients could have also sustained damage to the basal forebrain but this was not detectable on CT scans, as the artifact from the nearby surgical clip obscured the areas of interest (see also Alexander & Freedman, 1984; Deluca, 1993). Patient MS was involved in a high-velocity road traffic accident and sustained a severe traumatic brain injury (TBI) leaving him in a coma for one week. He remained in an acute confusional state for approximately another two weeks. His radiological investigations upon admission revealed a diffuse picture comprising widespread generalised atrophy, with right temporal lobe contusion. Patient BA suffered hypoxia, secondary to myocardial infarction. His CT examinations revealed

generalised atrophy and an area of marked low density in the posterior left frontal region.

#### **Summary of Lesion Localisation**

Five of the seven patients (patients LH, RM, OT, IR, and PT) had detectable lesions in the medial and orbital area of the prefrontal cortex bilaterally, and two (patients RM and MS) also showed indications of additional detectable damage to the medial temporal-lobe structures. Thus, not all patients had focal lesions and lesion localisation, based on available CT or MRI scans, was not equally precise across patients. However, the confirmed and the pathology-deferred lesions were consistent with that reported by other investigators to be associated with confabulation (Baddeley & Wilson, 1986; Deluca & Diamond, 1995; Fisher et al., 1995; Kapur & Coughlan, 1980; Luria, 1976; Moscovitch & Melo, 1997; Schnider, 2003; Shapiro et al., 1981; Stuss et al., 1978). This issue is further addressed in the discussion section below.

#### **Clinical Progress**

All of these patients were in-patients at the time of the assessment, undergoing rehabilitation following brain injury and requiring 24-hour care. Their confabulation, cognitive and behavioural changes were evident to staff and relatives and a source of difficulty in their management. All patients had undergone a period of acute confusional state and as they emerged from it their severe amnesia and persisting confabulation had become apparent. Telephone communications and visits three to six months following the end of the study provided some brief information about their progress. All patients were discharged to their homes under the full-time care of relatives and professional, except patient OT who was transferred to a 24-care nursing home. Information on his confabulation state was not available. The same applied to patients MS and BA, who were still severely confabulating when discharged, one month following the completion of the study. Confabulation was reported as minimised in all other patients and as present only in the 'provoked' form and in situations of over-stimulation or anxiety. Patient RM was the only patient able to live independently and to find paid employment, although he still faced everyday memory difficulties.

*2<sup>nd</sup> Subgroup: Korsakoff Patients*

**Medical History & Clinical Progress**

Given the distinct pathology and the chronic nature of the three Korsakoff patients recruited (see above Table 2-2) they were considered a subgroup of the confabulation group and examined separately when necessary (hereafter referred to as C2 Group). All three patients had a history of heavy and prolonged alcohol abuse over a period of mean duration of 18 years (range 16 to 26 years). All three patients were hospitalised and treated soon after (maximum three weeks) an acute episode of disorientation, confusion, and marked confabulation. In patient FM this was also accompanied by ataxia. Patients CM and FM were in a 'dry' period for about 20 years, since their initial hospitalisation. They were still severely affected by their mental disorder and were unable to live independently (see Appendix A3 for a case description).

Patient WM was temporarily admitted to the hospital one year previously following an acute episode of disorientation and confabulation. He was equally incapacitated and was living under the 24-hour care of his sister. His more recent admission was initiated by the latter who found it increasingly difficult to cope with his care. According to his relatives, WM had not abused alcohol in the last year, but his exact consumption prior to this period was less clear. Two months following the study his relatives reported his mental and physical condition was unchanged. The same applied to the other two hospitalised patients. It should be noted that given that two of these patients were first treated 15 to 20 years prior to the study, it was impossible to verify with certainty the circumstances of their illness prior to admission, other than what was reported by hospital files and relatives' accounts. It thus remains possible that their severe confabulatory state relates to insufficient initial treatment of their disease.

**Lesion Localisation**

The CT scans of all three patients demonstrated indications of generalised cortical atrophy involving the frontal regions bilaterally, as well as indications of peri-ventricular white matter density changes. No focal lesions were noted, although in the CT of patient WM low density was most marked in the right frontal region. Although these findings are not informative with respect to the



exact localisation of brain structures responsible for confabulatory behaviour they were consistent with the literature on the characteristic neuropathology of the ‘Wernicke-Korsakoff’ syndrome. The latter is thought to involve neuronal loss, micro-haemorrhages and gliosis in the paraventricular and peri-aqueductal grey matter (Victor et al., 1971), particularly in certain diencephalic and frontal structures (see Kopelman, 2002 for review). This issue is further addressed in the discussion section below.

*3rd Subgroup: Unilateral Patients*

**Medical History & Clinical Progress**

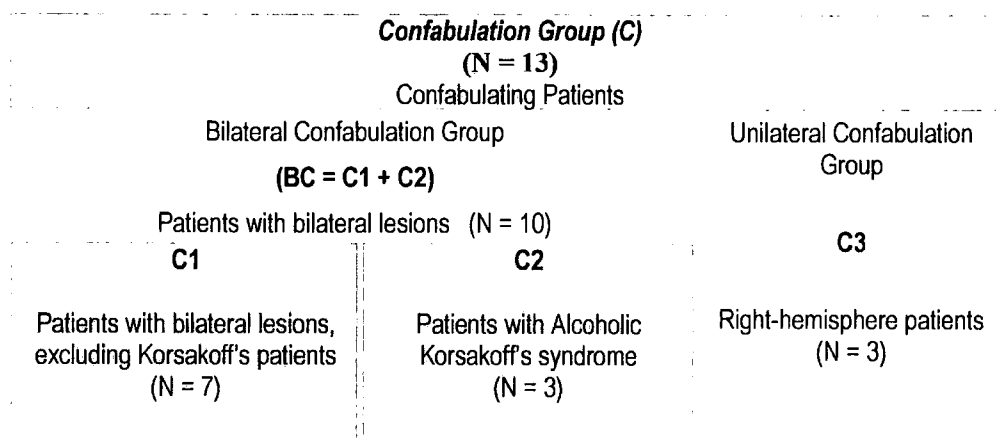
Three patients of the confabulation group had exclusively right-hemisphere lesions following stroke. These patients showed classic right parietal symptoms, such as left-sided neglect and left-sided hemiplegia, for which they were anosognosic (see case report in Appendix A3). Given their unilateral lesions, these patients were considered a subgroup of the confabulation group and examined separately when necessary (hereafter referred to as C3 Group). JO and DO were tested three and five months following their strokes, respectively (see Table 2-2 above). On the contrary, AO was tested two years post-onset. Three months following the completion of the study the contacted relatives and staff members reported that the mental condition of AO and DO was unchanged. JO’s confabulation was noted to be reduced and more plausible. All three patients required 24-hour care.

**Lesion Localisation**

The lesions of the patients of this subgroup involved the territories of the anterior and middle cerebral arteries. Affected areas in DO’s presentation included anterior and lateral regions of the right temporal lobe, posterior regions of the right frontal lobes and anterior regions of the right parietal lobe. JO’s CT scans demonstrated an acute lacunar haematoma in the right lentiform nucleus and AO’s CT scan detected only a small lesion in the right internal capsule (see also Schnider et al., 1996).

In summary the confabulation group included three distinct subgroups, C1 patients with bilateral lesions, excluding Korsakoff patients; C2 the Korsakoff patients group; and C3 the unilateral, right-hemisphere confabulation group.

Groups C1 and C2 included patients with bilateral lesions and thus together they formed the Bilateral Confabulation Group (BC) of the study. Figure 2-1 below depicts the schematic representation of these groups.



**Figure 2-1. Schematic Representation of Confabulation Subgroups**

### 2.5.2 Demographic Characteristics

Differences between the three confabulation subgroups on (i) age, measured in years, (ii) education, measured in years and (iii) time lapse from onset, measured in months were analysed. Given the groups' small and unequal number of patients, non-parametric tests were used to analyse these differences. The critical level of significance was set at .05 for all analyses (see below for justification). The three subgroups differed in age,  $\chi^2(2) = 8.4, p < .05$ . They also showed non-significant differences in their time lapses from onset,  $\chi^2(2) = 5.7, p = .06$ . Non-parametric Mann-Whitney tests revealed that the patients of the C3 subgroup were significantly older on average than the patients of the C1 group,  $Z = 2.3, p < .05$ . Mean age of the C1 group was 47.1 (SD = 14.1), while mean age of the C3 subgroup was 77 (SD = 8.7). The C1 differed from the C2 subgroup on the average amount of months elapsed from onset,  $Z = 2.4, p < .05$ . In the C1 subgroup mean number of months-from-onset was 5.7 (SD = 2.8), while in the C2 group mean number of months-from-onset was 166 (SD = 133.4). These differences were taken into account in the following experimental investigations. There was no other significant difference on demographic characteristics between these confabulation subgroups (See Table 2-4 below for mean scores).

## 2.5.3 Qualitative Confabulation Ratings

Table 2-3 below presents the mean ratings of confabulation quality in each subgroup.

**Table 2-3. Ratings of Qualitative Confabulation Characteristics**

Group	Frequency	Plausibility	Novelty	Conviction	Production Mode	Total
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
<b>Confabulation</b>	4.1 (0.8)	4.4 (0.7)	4.6 (0.5)	4.5 (0.5)	4.5 (0.7)	4.4 (0.6)
Subgroup 1 – C1	4.6(.5)	4.3(.5)	4.9 (0.3)	4.4 (0.5)	4.9 (0.4)	4.6 (0.4)
Subgroup 2 – C2	4	4.3(1.2)	4*	4.7 (0.6)	3.3 (0.6)*	4.1 (1.3)
Subgroup 3 – C3	3(0)*	4.6(0.5)	4.7 (0.6)	4.7 (0.6)	4.7 (0.6)	4.3 (0.5)
<b>Controls</b>	1	1	1.5 (0.6)	1.2 (0.5)	1	1.1 (0.2)

Note. Higher scores indicate more severe confabulatory behaviour. \*Significant differences between the confabulation subgroups at  $p < .05$

Although all confabulating patients showed severe forms of confabulation, the statistical association, analysed using Pearson's correlation, between their ratings on the above qualitative criteria revealed only one significant correlation. More specifically, confabulation Novelty was found to correlate with Production Mode,  $r = .7$ ,  $p < .01$ . This finding suggests that possible dissociations may exist between different forms of confabulation. In this study, qualitative differences in confabulation were examined between three confabulation subgroups, as divided based on neuropathological data. Given the small and unequal number of patients in the confabulation subgroups, these differences were analysed using non-parametric statistics, Kruskal-Wallis tests. The critical level of significance was set at .05 for all analyses (see below for justification). The groups differed significantly on ratings of frequency,  $\chi^2 (2) = 8.7$ ,  $p < .05$ , novelty,  $\chi^2 (2) = 6$ ,  $p < .05$ , and production mode,  $\chi^2 (2) = 7.6$ ,  $p < .05$ . Post hoc Mann-Whitney tests revealed that the C1 differed from the C2 subgroup on ratings of novelty,  $Z = 2.4$ ,  $p < .05$ , and production mode,  $Z = 2.5$ ,  $p < .05$ , while the C1 differed from C3 on ratings of frequency,  $Z = 2.5$ ,  $p < .05$ . No other difference between the subgroups was significant. The qualitative character of the confabulations of each subgroup is briefly described below.

*Confabulation Quality in the C1 Subgroup*

These patients showed on average the highest score on qualitative criteria of confabulation (see Table 2-3 above), and scored lower than the other subgroups only on ratings of conviction. These patients confabulated constantly and both their verbal output and their behaviour appeared totally contaminated by their false memories. Although their confabulations were occasionally unrealistic or even illogical, did not always take the form of strenuously believed claims. Hence, this subgroup scored lower than other groups on measures of confabulation conviction (see Table 2-3 above). Often they accepted their errors but showed utter indifference for both their implausible claims and the counter evidence. In other occasions they gave the momentary impression of trying to correct their mistakes only to relapse in alternative confabulations in a few seconds. More generally, although they would defend their confabulations if challenged, they gave the impression of not remembering their own false memories, of being easily sidetracked from what they intended to remember and of constantly engaging in chaotic thought processes and poorly organised memory searches. For more details see exemplary case-report in Appendix A3. Although this finding, i.e. their lower ratings in confabulatory conviction than in other confabulation measures, was not significant in the present study, future work could ascertain whether this is a dissociable feature of this type of extreme confabulation.

*Confabulation Quality in the C2 Subgroup*

The confabulatory behaviour of this group was equally striking as that of the C1 subgroup in that their confabulations were frequent, often bizarre in content, and defended with actions. For example, patient WM, who confabulated recent events involving his interactions with his mother, would frequently leave his residence without permission only to be found several days later wandering in the location of his mother's former house. The latter had died more than 10 years previously and the house was occupied by different owners who were often confronted by WM and treated like intruders (see also Chapters 1 and 8). However, these patients appeared to produce confabulations mainly when asked memory questions and mainly regarding certain self-relevant issues, e.g. their character, their close relatives, their profession, their pre- and post-morbid

abilities. Hence, these patients scored significantly lower than the other bilateral confabulating patients (C1 subgroup) on measures of confabulation Frequency and Production Mode (see above). In addition, these patients gave the impression of remembering their own false memories and of having progressively created a set of consistent, almost delusional, set of false beliefs by which they described and apparently experienced their self-identity. This was often depicted in a grandiose manner. For more details see exemplary case report in Appendix A3. Finally, it should be stressed that the patients of this group were assessed while in the chronic stage of their disease, and thus generalisations about these qualitative characteristics should take this factor into consideration (see below).

#### *Confabulation Quality in the C3 Subgroup*

The confabulatory behaviour of these patients presented some qualitative differences from the one of the other subgroups. Their memory was not dominated by confabulation during interviewing or, in everyday settings. Instead, during initial interviewing they presented as cognitively intact. Only occasionally and when issues relating to their whereabouts, their disabilities and their pathology were discussed, they showed extreme confabulation which extended to their autobiographical memory, could be bizarre and novel in content and was strenuously defended. Hence these patients received significantly lower ratings of confabulation Frequency than the other confabulation subgroups (see above). Moreover, these right hemisphere patients did not show 'fabrication' in the LM subtest of the WMS-III, while the patients of the C1 and C2 confabulation subgroups did. The right-hemisphere patients produced only distortions and source misattributions during the task, similarly to the control participants. For more details see the corresponding case-report in Appendix A3.

## **2.6 Control Groups**

The two deficits most commonly associated with confabulation in previous studies are memory and executive functions impairment (for reviews see Deluca, 2000; Hirstein, 2004; Johnson et al., 2000; see also Chapter 1). Thus, patients with indications of amnesia or dysexecutive syndrome were also recruited to the study. The first 10 consecutive patients with lesions involving the prefrontal

cortex, medial temporal lobe cortex or diencephalic areas, who did not meet the above general exclusion criteria (see list above) or confabulation criteria (ratings < 3) and who agreed to participate in the study were recruited as control participants. These were further classified into amnesic and frontal control groups based on neuropsychological investigations (see below). The demographic characteristics of these control groups are presented in Table 2-4 below. These characteristics, as well as their neuropathological and clinical characteristics of these groups are presented in turn below.

**Table 2-4. Demographic Characteristics by Group**

Group	Age in Years		Education in Years		Months from Onset	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<b>Confabulation Groups</b>						
Total	58.7	17.5	11.5	2.8	43.8	88.6
C1	47.1	14.1	12.1	3.4	5.7	2.8
C2	64.7	7.8	10.3	1.15	166	133.4
C3	77	8.7	11.3	2.5	10.7	11.6
<b>Control Groups</b>						
Frontal	52	22	12.4	1.7	7.1	7.5
Amnesic	44.3	19	10.7	2	6.3	2

### 2.6.1 Amnesic Control Group

#### *Recruitment*

Neurological patients with lesions in diencephalic and medial temporal lobe structures and indications of amnesia were classified as ‘amnesic’ control patients. In previous studies of confabulation the degree of memory impairment has been classified on the basis of verbal memory performance in anterograde memory tasks (e.g. Schnider et al., 1996). This approach fails to take into account the visual anterograde memory component of amnesia, which has been implicated in confabulation studies (e.g. Demery, Hanlon & Bauer, 2001) and may lead to variability within and between groups. Thus, for the purposes of this study, amnesic patients were selected on the following criterion: a score of > 2 SD below the mean on the WMS-III Auditory Delayed Memory Index Score, as well as on the corresponding Visual Delayed Memory Index Score (Scores ≤ 69).

## *Chapter 2: Patients & their Neuropsychological Assessment*

The selected patients were the first three consecutive patients observed who agreed to participate in the study, met the above criteria for amnesia and did not meet any of the criteria for confabulation described above. Instead, these patients showed only occasional, provoked and selective confabulation, which often took the form of distortions in memory tests or easily reversible confusion in everyday life (see Table 2-3 above). Another four amnesic patients were invited to participate in this study but two of them refused and two discontinued the study following medical complications. Although this sample is small ( $N = 3$ ), it was decided to include these patients in the experimental investigations and compare their performance with the other larger experimental groups using non-parametric statistics which are appropriate for testing small and unequal samples. In addition, this small sample warranted limited generalisation and this was taken into consideration in the interpretation of the experimental findings.

### *Neuropathological Data*

The lesions of the patients of this group, caused by stroke, meningitis and traumatic head injury, involved mainly bilateral regions of the thalamus, hippocampus and medial temporal lobes. The pre-operative CT examination of patient A1 showed acute parafalcine subdural haemorrhage, blood in third ventricle and associated contusions involving areas of the frontal and occipital lobes (post-operative scans were not available). The patient was initially confused, but during the assessment period, eight months post-injury, he was fully alert and cooperative. MRI structural imaging of patient A2 demonstrated bilateral infarction of the hippocampi and peri-hippocampul gyris in addition to posterior thalamic infarctions. Patient A3 showed bithalamic and cerebellar infarcts on MRI examination. These findings are summarised in Table 2-5 below.

**Table 2-5. Characteristics of the Amnesic Control Patients**

Patient/ Sex	Age	Educ.	Profes.	Months	Lesion	Lesion	Locus	Pathology	Confab	Group
	Years			From onset	U/B	Kind			Type	
A1/M	45	9	Builder	8	B	H	F,O	TBI	No	A control
A2/M	63	10	Joiner	7	B	I	Hipp,Th	CVA	No	A control
A3/F	25	13	Chef	4	B	I	Th,Cer	Meningitis	No	A control
Mean	44.33	10.66		6.33						
SD	19	2.08		2.08						

Note. Lesion: U = Unilateral, B = Bilateral; Lesion Kind: I = Ischaemic, H = Haemorrhagic; Locus: F = Frontal, P = Parietal, T = Temporal, O = Occipital Lobe, Hipp = Hippocampal region, Th = Thalamus, Cer = Cerebellum, R = Right, L = Left; Pathology: CVA = Cerebrovascular Accident, TBI = Traumatic Brain Injury; Classification: A Control = Control Group of amnesic, non confabulating patients. All patients were right handed.

#### *Demographic Data*

One patient was female and two were male and all were right-handed. Mean age was 44.3 (SD = 19), mean years of education were 10.7 (SD = 2) and mean number of months from onset was 3.6 (SD = 1.5) (see Table 2-5 above). These demographic characteristics differed from the confabulation group in that amnesic non-confabulating patients were younger on average than the confabulation group and much younger on average than the C2 and C3 confabulation subgroups. However, non-parametric Mann-Whitney tests revealed that these differences were not significant. The only difference in age that approached significant levels was between the C3 subgroup and the amnesic group,  $Z = 1.9, p = .05$ . In addition, less time had elapsed from the onset of neuropathology when the amnesic patients were tested than when the above confabulation groups were tested (see also Table 2-4 above). Non-parametric Mann-Whitney tests revealed that these differences were not significant. The only difference that approached significant levels was between the C2 subgroup and the amnesic patients,  $Z = 1.9, p = .05$ . Given the small samples of the study these differences, although not significant, were taken into account in the experimental comparisons of the following chapters.

#### *Clinical Progress*

Patient A3 was assessed in hospital during a rehabilitation phase, while patients A1 and A2 had just return to their homes under the care of their partners. They both made substantial progress in orientation and learning in the following



two months but they remained severely amnesic. Patient A3 also eventually returned home, although she too had to be substantially supported by her relatives, as her memory abilities remained very poor.

### 2.6.2 Frontal Control Group

#### *Recruitment*

Neurological patients with indications of frontal lobe damage were also recruited as 'frontal' control patients. The selected patients were the first seven consecutive patients seen, who agreed to take part in the study, showed indications of frontal lobe lesions and performed accordingly in tests of executive functions, such as the Delis-Kaplan Executive Function System Battery (D-KEFS, 2001). These patients did not meet any of the confabulation or amnesia classification criteria outlined above. Although these control patients did perform memory errors these were mainly occasional, plausible distortions, or other errors provoked by questioning and produced without extreme certainty by the participants (see Table 2-3 above).

#### *Neuropathological Data*

Three of the patients in the frontal group had suffered SAH following rupture and surgical repair of aneurysms of the ACoA. Their damage included bilateral frontal lesions, and possible, although not detectable, involvement of the basal forebrain (see above). In the case of patients F3 and F4, the frontal damage was more prominent on the left than on the right. Patient F3 was tested two years following her operation while the rest of the patients in this group were tested within 6 months of onset. Two patients (F5 and F6) showed predominately right hemisphere lesions, mostly affecting fronto-parietal regions, caused by anterior circulation strokes. These patients also showed left-sided motor impairments and left-sided visuospatial neglect. Finally, two patients (F1 and F7) suffered severe traumatic brain injuries (TBI) following motor accidents and were recruited and tested in Groote Schuur Hospital in Cape Town, South Africa. Both of them were in coma for seven and four days respectively and patient F7 underwent surgery. CT examination of patient F1 upon admission demonstrated soft tissue swelling overlying the left frontal region and possible fracture of the left frontal bone. Findings of the post-surgery CT scans of patient F7 revealed depressed skull

fracture of the left frontal bone with contusion of the underlying left frontal lobe and mild dilatation of the temporal horn of the right lateral ventricle. Both patients were assessed three months post-injury, when their initial confusion and post-traumatic amnesia had cleared. However, during interviewing both patients showed signs of frontal lobe damage, including distractibility, naming difficulties, inappropriateness, blunt affect and disinhibition (see below for formal assessment scores). The neuropathological and demographic characteristics of this group are summarised in Table 2-6 below.

**Table 2-6. Characteristics of Frontal Control Patients**

Patient/ Sex	Age	Educ. Years	Job	Months From onset	Lesion U/B	Lesion Kind	Locus	Pathology	Confab Type	Group
F1/M	19	13	Student	3	B	Contusion	LF, bg	TBI	No	F control
F2/F	55	13	Teacher	6	B	SAH	FT	AcoA	No	F control
F3/F	61	9	Clerk	24	B	SAH	FT	AcoA	No	F control
F4/M	70	14	Salesman	5	B	SAH	FT	AcoA	No	F control
F5/F	59	12	Musician	5	U	H	R,F,P	CVA	No	F control
F6/M	76	12	Mechanic	4	U	I	R,F,P	CVA	No	F control
F7/M	24	14	IT consultant	3	B	Contusion	LF	TBI	No	F control
Mean	52	12.4		7.1						
SD	22	1.7		7.5						

Note. Lesion: U = Unilateral, B = Bilateral; Lesion Kind: SAH = Subarachnoid Haemorrhage, I = Ischaemic, H = Haemorrhagic; Locus: F = Frontal, T = Temporal, bg = Basal Ganglia, R = Right, L = Left; Pathology: TBI = Traumatic Brain Injury, AcoA = Aneurysm of the Anterior Communicating Artery; CVA = Cerebrovascular Accident; Classification: F control = non confabulating patients with dysexecutive syndrome; Confabulation Type, No = not meeting any of the established criteria for confabulation. All patients were right handed.

#### *Demographic Data*

All patients were right-handed and their first language was English. Further demographic characteristics of this group are summarised in the Table 2-6 above. These characteristics were compared to those of the confabulation and amnesic groups using non-parametric Mann-Whiney tests. These revealed that there was no significant difference between the characteristics of the confabulation and frontal groups. However, there was a significant difference in the amount of months elapsed post-onset between the frontal group and the C2

## *Chapter 2: Patients & their Neuropsychological Assessment*

confabulation subgroup,  $Z = 2.1$ ,  $p < .05$ . In addition the difference in age between the frontal and the C3 groups approached significant levels,  $Z = 1.9$ ,  $p = .05$ , as did the difference in education between the frontal group and C2 group,  $Z = 1.8$ ,  $p = .07$ . Given the small sample sizes in the present study, these differences, although not significant, were taken into account in the experimental comparisons of the following chapters.

### *Clinical progress*

At the end of assessment period, four of these patients (F1, F3, F5 and F7) were already living independently under the partial care of family members, friends or social workers and carers. However, none of them had returned to paid employment. The remaining three patients (F2, F4, and F6) were released from hospital after the end of the study. All three patients were capable of living independently under the care of relatives or friends, but due to lack of such support they were transferred to residential care units.

In summary, the patients of the study were classified in the following groups: The Confabulation Group consisting of 13 patients and subdivided in three groups, C1, C2 and C3; and the Control Group consisting of 10 patients and subdivided into two groups, the Amnesic and the Frontal group. The Figure 2-2 below offers a schematic representation of these groups.

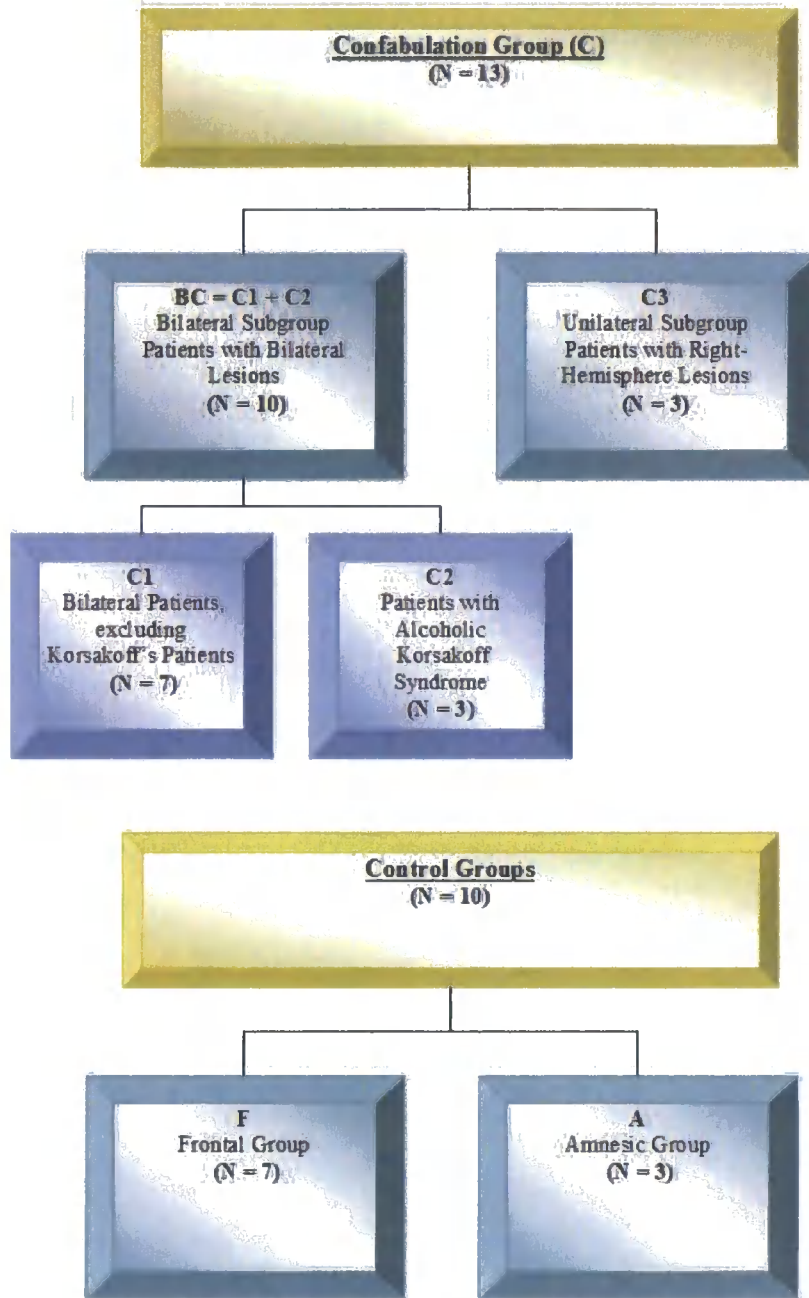


Figure 2-2. Schematic Representation of the Experimental Groups

## 2.7 Neuropsychological Investigations

Confabulation has been associated with a variety of underlying cognitive dysfunctions (see Chapter 1). In order to examine the possible cognitive components of confabulation, several neuropsychological measures were employed to assess the performance of confabulating patients and to compare it with that of the control groups. Tests that required knowledge of British or European facts (e.g. WMS-III subtests) were adjusted appropriately as to minimise cultural bias. This involved simple substitutions as opposed to fundamental alterations to the materials, e.g. 'Pounds' was changed to 'Rands' in the LM subtest of the WMS-III. The cognitive abilities tested and the tests used were as follows:

### 2.7.1 Materials & Methods

#### *Intelligence.*

Premorbid intelligence estimations were mainly assessed using the Wechsler Adult Reading Test (WTAR) (2001). They were also based on the patients' education level and profession; particularly in the few cases the WTAR test could not be administered. Postmorbid verbal and performance intelligence was assessed using the third Edition of the Wechsler Adult Intelligence Scale, UK adaptation (WAIS-III<sup>UK</sup>, 1998). These tests allowed direct comparisons between predicted and actual intelligence, as the WTAR was specifically developed and co-normed with the WAIS-III in order to provide normative data on such comparisons.

#### *Anterograde Memory*

The third Edition of the Wechsler Memory Scale, UK adaptation (WMS-III<sup>UK</sup>, 1998) was used to assess working memory, verbal and visual anterograde memory. The latter was further examined using the Rey Complex Figure Test (RCFT) (Meyers & Meyers, 1995; see also Rey, 1941; Osterreith, 1944). These tests, reliably standardised and widely used in both neuropsychological research and clinical practice, have been also specifically used in a variety of recent confabulation studies (e.g. studies that employed WMS or, WMS-R subtests: Burgess & McNeil, 1999; Cunningham et al., 1997; Dalla Barba, 1993a; Dalla

Barba et al., 1997b; Demery et al., 2001; Kopelman 1987; Moscovitch & Melo, 1997; Stuss et al., 1981; studies that included versions of the Rey Complex Figure Test: Kapur & Coughlan, 1980; Hashimoto, Tanaka & Nakano, 2000; Schnider et al., 1996; or studies that included version of both tests: Benson et al., 1996; Destreri et al., 2002; Phillips et al., 1987; Ptak et al., 2001).

#### *Autobiographical Memory*

Autobiographical memory was assessed using the Autobiographical Memory Interview (Kopelman, Wilson & Baddeley, 1990), which assesses the recollection, in response to specific cues, e.g. “a wedding in your early 20s”, of both personal semantic information (i.e. ‘facts from one’s own past life’, Kopelman et al., 1990), and autobiographical memory experiences (i.e. personally experienced events) across different life periods. Responses are scored in terms of the descriptive richness of the memories produced and their specificity in time and place. This test has been used in previous studies on confabulation and was proven sensitive to confabulation (Dab et al., 1999; Kopelman et al., 1997; Kroll et al., 1997). Most crucially, the presence of confabulation in everyday life seems to correlate with the presence of confabulation in assessments of the autobiographical memory domain, even in cases where the symptom is not present during the formal testing of other memory domains, such as new learning (Conway & Tacchi, 1996; Papagno & Muggia, 1996). In order to have a solid basis for scoring the patients’ answers their relatives were interviewed following the assessment and asked to verify their answers. Responses which included information impossible to verify, e.g. events taking place during patients’ early childhood years were accepted at face value, provided the patient gave a similar account in the same question posed in a following session. Medical and nursing notes were also consulted when necessary.

#### *Executive Functions*

A variety of executive dysfunctions has been associated with confabulation (Berlyne, 1972; Cunningham et al., 1997; Fisher et al., 1995; Kopelman, 1989; Luria, 1977; Mercer et al., 1977; Shapiro et al., 1981; Stuss et al., 1978; Talland, 1961). Thus, a detailed battery of executive tests, the Delis-Kaplan Executive Function System (D-KEFS) (Delis, Kaplan & Kramer, 2001)

was used to assess confabulating and control patients. When testing time constraints or the patient's medical condition did not permit full administration of the D-KEFS (see below for description), only selective tests were administered and efforts were made to complement the assessment using other less time-consuming tests (e.g. the BADS battery).

Given that the D-KEFS is a relatively new test, a brief description of it follows. The battery includes a set of standardised tests for comprehensively assessing higher-level cognitive functions and offers wide normative data. It consists of nine tests, derived from previously developed procedures (e.g. the 'Tower building', 'Card-Sorting' and 'Stroop' procedures), which are adapted to provide a diverse and relatively comprehensive set of tests for testing this multifaceted domain of cognition (Delis, Kaplan, & Kramer, 2001). Following the convention of the WAIS and WMS batteries raw scores of the D-KEFS are converted to age-corrected scale scores, with a mean of 10 and a standard deviation of three. The tests and some of the main functions they tap are the following: Trail Making (cognitive flexibility in visuo-motor sequencing, simultaneous processing, multi-tasking, divided attention), Verbal Fluency (cognitive flexibility, strategic retrieval search, initiation, rule following, processing speed), Design Fluency (cognitive flexibility, response inhibition, initiation of problem solving, non-verbal creativity, simultaneous processing), Color-Word Interference (inhibition of over-learned verbal responses, cognitive flexibility), Sorting Test (concept formation, reasoning skills, problem-solving initiation, abstract thinking), Twenty Questions Test (abstract thinking, concept formation), Word Context Test (deductive reasoning, abstract thinking), Tower Test (spatial planning, rule learning, inhibition of impulsivity, problem solving), Proverb Test (concept formation, abstract thinking) (Delis, Kaplan, & Kramer, 2001). Most of these functions, although potentially dissociable, have been associated with confabulation and particularly the extreme form of the symptom, e.g. spontaneous or severe confabulation (e.g. Beekmans et al., 1998; Burgess & McNeil, 1999; Dab et al., 1999; Damasio et al., 1985; Fisher et al., 1995; Kapur & Coughlan, 1980; Kern et al., 1992; Kopelman, 1987; Luria, 1976; Moscovitch & Melo, 1997; Shapiro et al., 1981; Stuss et al., 1978).

Most of the above D-KEFS tests measure both the basic cognitive skills that each task requires, as well as the higher-level executive function that the task taps. For example, the primary executive function measured by the Color-Word Interference Test (based on the 'Stroop' procedure) is the examinee's ability to inhibit an overlearned verbal response (reading printed words) in order to generate a conflicting response of naming the dissonant ink colours in which the words are printed. The test has also two baseline conditions that measure key component skills of the high-order tasks: basic naming of colour patches and basic reading of colour-words printed in blank ink. Figure 2-3 below includes the various primary, contrast (contrast between baseline and high-level conditions) and error measures used for each subtest. The contrast measures included were considered important in order to delineate between the potential difficulties confabulating, frontal or amnesic patients might have in fundamental cognitive abilities and their more higher-order cognition difficulties.

The D-KEFS was also complemented in most patients by the Cognitive Estimates Test (Shallice & Evans, 1978), which has been directly linked to the presence of bizarre and spontaneous confabulation in some studies (e.g. Burgess & McNeil, 1999; Dab et al., 1999; Kopelman et al., 1997) but not others (e.g. Kroll et al., 1997; Shapiro et al., 1981). The Hayling Test (1997) was also administered as a verbal measure of task initiation speed and response suppression. In the first part of the test, the patient is asked to complete the sentence with an appropriate word, while in the second the patient has to complete the sentence with a word unrelated to the sentence (e.g. 'Most cats see very well at...tree'). Response latencies and potential errors are recorded and transformed into scale scores. The functions tapped by the latter test have been implicated in the production of certain types of confabulation (e.g. see Burgess & McNeil, 1999; Dab et al., 1999 for discussions). Although these measures are not exhaustive of the long list of abilities included under the conceptual 'umbrella' of executive functions, they were selected to assess, both in the verbal and visual domains, a relatively wide range of deficits associated with executive dysfunction, such as inhibition, flexibility, abstract thinking and reasoning.



Subtest	Conditions	Measures: Raw Score Computation
Trail Making	1: Number Sequencing 2: Letter Sequencing 3: Number-Letter Sequencing	<b>Primary Switching Measure:</b> Condition 4 Completion Time (in seconds) <b>Switching Errors:</b> Total Number of Omission & Sequencing Errors <b>Contrast Measure:</b> Condition 4 Scaled Score minus Conditions 2 + 3 Composite Scale Score
Verbal Fluency	1: Letter Fluency (LAT) 2: Category Fluency	<b>Primary Fluency Measures:</b> Number of Correct Responses Summed across Three letter trails and two category trials respectively <b>Errors:</b> Total Number of Repetition and Set-loss Errors
Design Fluency	1: Filled Dots Design 2: Empty Dots Only Design 3: Switching	<b>Primary Switching Measure:</b> Number of Correct Designs <b>Contrast Measure:</b> Condition 3 Scale Score minus Conditions 1 & 2 Composite Scale Score <b>Errors:</b> Total Number of Repeated Designs Summed across Conditions 1-3
Color-Word Interference	1. Color Naming 2. Word Reading 3. Inhibition 4. Inhibition/Switching	<b>Primary Measures: Naming and Reading:</b> Sum of Scaled Scores on Conditions 1 & 2 <b>Condition 3:</b> Seconds to Complete <b>Condition 4:</b> Seconds to Complete <b>Contrast Measure:</b> Condition 4 Scale Score minus Condition 1 Scale Score <b>Errors:</b> Sum of Corrected and Uncorrected Errors in Conditions 3 & 4
Sorting Test	1. Free Sorting & Describing of 2 Sets of 6 Cards	<b>Primary Measures: Sorting:</b> Total Number of Initial Target Sorts with at least 1 correct description <b>Description:</b> Sum of Correct Description Scores <b>Errors:</b> Number of Sorts Repeated within a Card Set
Twenty Questions	1. Identification of 4 Items by Yes/No Questions	<b>Primary Measures:</b> Total Number of Questions Asked Summed Across Items 1-4. Sum of Weighted Achievement Scores Across Items 1-4
Word Context	1. Identification of 10 words by combining 5 clue sentences per word	<b>Primary Measure:</b> Total Consecutively Correct Score Summed Across Items 1-10
Tower Test	1. Building 9 designated Towers in the fewest number of moves possible	<b>Primary Measures:</b> Item Achievement Scores Summed Across All Items Administered <b>Errors:</b> Total Number of Rule Violations/Total Number of Items Administered
Proverbs	1. Interpretation of 8 Proverbs	<b>Primary Measures:</b> Accuracy Score Plus Abstraction Score Summed Across Items 1-8

Figure 2-3. Primary and Contrast Measures of the DK-EFS.

*Visuospatial Neglect*

The Letter, Line Cancellation and Line Bisection, Sub-tests of the Behavioural Inattention Test (BIT) were used to assess visuospatial neglect in right-hemisphere patients. Their copying abilities were also examined through the

Rey Complex Figure Copy, administered to all patients. Additional information about the patients' motor, sensory, perceptual, spatial, and constructional abilities was taken from recent neurological reports. Identified difficulties were further explored (see results of C3 group below).

### *Mood*

The Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) was used to assess patients' mood following their injury. When patients' clinical presentation included aberrant (e.g. euphoric) or exaggerated (e.g. high levels of anxiety) mood states additional information was taken from recent psychiatric evaluations (see groups C2 and C3 below). These were carried out in most instances due to caring staff's concerns about patients' emotional lability.

### *Confabulation*

Collecting systematic data on confabulating patients presents several difficulties, especially as regards quantifying and characterizing the confabulatory material (for discussion see Johnson & Raye, 1998). Very few formal measures of confabulation have been used across studies, and thus comparison between patients is complicated by tests differences. The Dalla Barba Confabulation Battery (1993a) has been used in a number of studies by different authors (e.g. Dalla Barba, 1993a; Fotopoulou et al., 2004; Kopelman et al., 1997) and can thus provide a common basis for comparing patients' confabulatory characteristics across different studies.

The battery was administered to all patients. This test consists of six subsections of questions, concerning episodic, personal, and general semantic memory, orientation in time and place and "I don't know" semantic and episodic memory sections. The last two sections include questions whose answer is generally unknown or difficult to access e.g. "What was the profession of Marilyn Monroe's father?" or "How did you spent Christmas in 1985?" It has been shown that confabulating patients try to provide answers for these questions more frequently than controls (Dab et al, 1999; Dalla Barba, 1993a; Kopelman et al., 1997; Mercer et al., 1977; Papagno & Baddeley, 1997).

The test was administered in one session. Questions were read out to patients and their answers were recorded verbatim. In order to corroborate

patients' memory statements, interviews were conducted with the patients' relatives. In cases where relatives could not confirm an answer the patient was asked the same question on a different session. Repeated answers were considered truthful (see also Moscovitch & Melo, 1997). Finally, additional verification information was collected from medical records. Dalla Barba's (1993) scoring criteria were followed as closely as possible and comparisons between groups were based only on their 'confabulation' scores. The criteria for distinguishing confabulations from wrong answers were the insertion of new material and other intrusions. In the case of orientation items, answers were considered "wrong" if they were out by less than 10 years, 2 seasons, 3 months, 15 days, 3 days, or 6 hours to questions concerning the current year, season, month, date in month, day of the week, and hour of the day, respectively. Beyond this, errors in orientation were considered to be confabulations. "I don't know" answers referred to responses in which the question was not really addressed or when no response was given. The last two sections do not have correct answers since appropriate responses are considered the "I don't know" ones.

### 2.7.2 Results

Given the groups' small and unequal number of patients, non-parametric tests were used to analyse differences in neuropsychological performance between the groups. Overall differences between the three main groups of the study, namely, confabulation, amnesic and frontal control groups, as well as between the three confabulation subgroups of the study, i.e. C1, C2 and C3 subgroups, were analysed using the Kruskal-Wallis Test. Meaningful post hoc comparisons were performed using the Mann-Whitney test. Despite the use of multiple measures to assess neuropsychological performance, the level of significance was set at .05 for all analyses. Although this measure did not control for familywise error rate and thus increased the probability of Type I error, it ensured that minor differences between groups would be noted (i.e. it reduced Type II error) and taken into consideration in the following experimental chapters. This increased statistical power was considered preferable for the analyses of this chapter, as the latter's main aim was to explore the neuropsychological characteristics of groups already formed based on neuropathological differences. Significant findings and single

non-significant findings are reported in full. Only the probability value of multiple non-significant results is reported.

*Intelligence*

The performance of the patients in pre- and post-morbid tests in summarised in Table 2-7 below.

**Table 2-7. The WAIS-III and WTAR performance across experimental groups.**

Patients	WAIS-III IQ Scores (WTAR Prediction)					
	VIQ		PIQ		FSIQ	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<b>Confabulation Groups</b>						
<b>Total (N = 13)</b>	87.5(92.6)	14.7 (10.1)	70 (95.9)	11.1 (9.4)	79.9 (94.5)	10.2 (11)
<b>C1 Bilateral (N = 7)</b>	85 (93.1)	11 (12.5)	72 (97.6)	11 (11.7)	79.2 (96)	12.1 (13.5)
<b>C2 Korsakoff (N = 3)</b>	79 (87.6)	3.6 (6.7)	76.5 (90)	9.1 (5.2)	76 (88.3)	7 (7.2)
<b>C3 Unilateral (N = 3)</b>	107.7(96.3)	15 (6.8)	57.7 (98)*	4.5 (5.2)	83.7 (97)	10.5 (7.6)
<b>Control Groups</b>						
<b>Amnesic (N = 3)</b>	91.7 (98)	11 (10.6)	87.7 (100)	10.2 (9.6)	88.7 (99)	11.7 (11.3)
<b>Frontal (N = 7)</b>	97.4 (90.25)	2.2 (11.9)	81.7 (93.25)	12.1 (6.6)	91.9 (91.25)	6 (9.9)

*Note.* VIQ = Verbal IQ Score; PIQ = Performance IQ Score; FSIQ = Full Scale IQ Score. WTAR Prediction = Scores in parentheses represent the premorbid IQ scores as predicted by the WTAR and demographic characteristics. \* = Scores more than 2 SD below the normative mean.

Both the confabulation and control groups showed a mild intellectual deterioration (mean FSIQ  $\geq$  2 SD below the general mean) from their mean estimated premorbid intelligence level (mean FSIQ  $\geq$  1 SD below the mean). None of the groups showed a marked intellectual deterioration in general intellectual abilities, although typically the deterioration from their premorbid intellectual level was more marked on the PIQ score, than the VIQ score. This was particularly true for the confabulation groups and the frontal group. The C3 confabulation subgroup showed a marked deterioration in abilities tested by the performance tasks of the WAIS-III (see Appendix A1 for individual scores). This finding could be at least in part explained by the impaired visuo-spatial abilities these patients showed (see below). Non-parametric, Kruskal-Wallis tests were used to assess differences between the intelligence abilities of the groups. There was no difference between the groups on verbal,  $\chi^2(2) = 4.2, p = .1$ , performance  $\chi^2(2) = 3.3, p = .2$ , or full scale WTAR predicted scores,  $\chi^2(2) = 3.9, p = .1$ . There was a difference in Full Scale IQ between the main groups (confabulation, frontal and amnesic groups) but it failed to reach significant levels,  $\chi^2(2) = 5.1, p = .08$ . In addition, there was no significant difference in Full Scale IQ between the three

subgroups of the confabulation group,  $\chi^2(2) = .9, p = .6$ . Finally, there was no significance difference in Full Scale IQ between the subgroups of the confabulation group and the two control groups,  $\chi^2(4) = 5.8, p = .2$ .

Significant differences between the performances of the confabulation, amnesia and frontal groups were observed on scores of PIQ,  $\chi^2(2) = 13.4, p < .001$ , with the amnesic group scoring higher than the other groups. Similar differences in the VIQ scores were not significant,  $\chi^2(2) = 3.2, p = .2$ . By contrast, differences in the VIQ scores of the three confabulation subgroups were significant,  $\chi^2(2) = 6.06, p < .05$ , with the unilateral subgroup showing higher performance than the other groups. By contrast, this subgroup performed worse than the other groups on measures of PIQ, but this effect failed to reach significant levels,  $\chi^2(2) = 5.8, p = .05$ . The implications of these differences are discussed below.

#### *Orientation and Information*

Confabulating patients performed worse than the non- confabulating control groups on correctly recalling orientation and other personal or general semantic information, as measured by the WMS-III Information and Orientation subtest,  $\chi^2(2) = 10.6, p < .005$ . In addition, there were no significant differences between the three confabulation subgroups,  $\chi^2(2) = 2.3, p = .2$ . Confabulating patients mainly lost points in the temporal and spatial orientation questions of this task, as well as the questions about the current and past Prime ministers as some patients named politicians that held office in the past. Neither amnesic, nor frontal control patients showed this tendency and thus the scores of the confabulation group were significantly lower than both the ones of the amnesic,  $Z = 2.5, p < .01$ , and the frontal control groups,  $Z = 2.6, p < .01$ .

#### *Memory*

The performance of the experimental groups on neuropsychological tests of memory are summarised in Table 2-8 below.

Table 2-8. Group Performances on Neuropsychological Tests of Memory

Test	Confabulation Group & Subgroups				Control Groups	
	Total N = 13	Bilateral – C1 N = 7	Korsakoff – C2 N = 3	Unilateral – C3 N = 3	Amnesic N = 3	Frontal N = 7
<b>WMS-II Index Scores</b>	Mean(SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Auditory Immediate	68.4 (20.2)*	55.5 (5.5)*	63 (9.6)*	99.6 (8)	58 (7.5)*	83 (13.6)
Visual Immediate	73.5 (16.7)	77.3 (19.4)	60.3 (15)*	79 (3.4)	59.7 (4.6)*	77.9 (8.3)
Immediate Memory	63.5 (16.9)*	58.5 (15.1)*	55 (12.5)*	82 (12.1)	50.3 (4.6)*	76.5 (10.1)
Auditory Delayed	69 (19.7)*	58.2 (6.4)*	64.3 (6.5)*	95.7 (23.2)	55.3 (3)*	81.2 (13.9)
Visual Delayed	66.2 (16.9)*	72.5 (17.9)	56.3 (11.5)*	63.3 (18.9)*	54 (4.5)*	72.5 (5.6)
Auditory Recognition Delayed	70 (18)	61.7 (7.5)*	61.7 (11.5)*	96.7 (5.8)	62.5 (10.6)*	85 (8.2)
General Memory	63 (16)*	57.8 (12.1)*	55 (12.5)*	80.3 (17.7)	48.7 (4.7)*	73 (8)
Working Memory	82 (13)	86 (16.4)	76.3 (4.6)	80.3 (14)	79 (22.9)	83 (7.1)
<b>WMS-III</b>						
Info & Orientation	50.5(13.5)%	43.2 (15)%	56%	57 (18)%	81 (8.7) %	82.8 (16.5)
<b>R-CFT</b>						
Copy	18.4 (12.7)**	24.9(10.3)**	25 (4.2)**	3.2 (3.9)**	31.3 (3.6)	30.3 (3.4)
Immediate	3.4 (3)**	4.2 (3.9)**	3 **	2 (1.4)**	4.7 (4.7)**	16.3 (9)
Delayed	2.1 (2.7)**	2.6 (3.6)**	2**	1 (1.4)**	3.3 (4.9)**	15.6 (10.2)
<b>AMI</b>						
<i>Personal Semantic</i>						
Childhood	13.5 (3.4)	12.9 (4.1)*	13 (3.5)	14.8 (2.9)	17.5 (1.3)	17 (1.9)
Adult life	11.6 (4)*	10.1 (2.3)*	9 (3.6)*	18.5 (16.8)	16.2 (3.5)	17.8 (1.6)
Recent life	9.3 (5.7)*	7.7 (5.1)*	6.2 (3.6)*	15 (5.1)*	9.2 (3.3)*	18 (1.7)
Total	34.3 (10.3)*	30.7 (7.5)*	28.2 (9)*	46.7 (3.7)*	42.8 (3.7) *	52.8 (3.2)
<i>Autobiographical</i>						
Childhood	3.4(2.7)*	1.8 (1.9)*	2.7 (1.5)*	6.7 (2.3)	3 (3.6)*	5.6 (2.4)
Adult life	3.4 (2.2)*	2.2 (1.3)*	3.3 (3)*	5.3 (1.2)	2 (1)*	6.5 (1.3)
Recent life	2.9 (2.4)*	1.4 (1.5)*	2.3 (1.2)*	6 (1.7)	1.7 (1.5)*	5.5 (1)
Total	9.6 (6.2)*	5.4 (3.5)*	8.3 (3.2)*	18 (2.6)	6.7 (4.7)*	17.5 (3)

Note. WMS-III = Wechsler Memory Scale –3<sup>rd</sup> Edition; R-CFT = Rey Complex Figure Test; AMI = Autobiographical Memory Test; \* = Indicates mean scores more than 2 SD below the normative mean. \*\* = Indicates mean scores below the 1<sup>st</sup> percentile.

Although all groups showed some degree of memory impairment on the WMS-III this was more prominent in the confabulation and amnesic groups. Non-parametric Mann-Whitney Tests confirmed that there was no difference between the latter two groups in degree of memory impairment, *ps* ranging from .1 to .8. By contrast, frontal non-confabulating patients showed milder memory impairment (within 2 SD from the mean) across all index scores. Mann-Whitney tests revealed that there were significant differences between the memory scores of this group and those of the amnesic control patients on all WMS-III measures,  $Z = 2.2 - 2.4$ ,  $ps < .05$ , except index scores of Auditory Delayed Memory ( $Z = 1.49$ ,  $p = .07$ ), Auditory Recognition Memory ( $Z = 2.09$ ,  $p = 0.6$ ), and Working Memory ( $Z = .34$ ,  $p = 0.8$ ). Working memory was relatively preserved in all

groups, irrespective of poor performance on other measures of memory. For example, there was a marked discrepancy between the performance of amnesic patients on working memory subtests and that on subtests that assess immediate and general memory. The same applied to the C1 and C2 confabulation subgroups. Such dissociations have been observed before in the literature and the issue is further discussed below.

Differences in memory performance were also observed among the patients of the confabulation group. Non-parametric, Kruskal-Wallis tests revealed that these differences were significant for index scores of Auditory Immediate Memory,  $\chi^2(2) = 7.5, p < .05$ , Auditory Delayed Memory,  $\chi^2(2) = 7.1, p < .05$ , and Auditory Recognition Memory,  $\chi^2(2) = 6.8, p < .05$ . Korsakoff patients (C2) showed marked anterograde memory impairment across most memory domains, as tested by the WMS-III subtests. The same was true for the C1 confabulation subgroup, although they showed higher scores in visual than verbal subtests. The unilateral confabulation group showed substantially milder memory impairment in verbal immediate and delayed memory (within 2 SD from the mean) but their performance in visual memory subtests was more impaired, approximating the one of amnesic and confabulating patients in delayed visual memory. In particular, the delayed visual memory of right-hemisphere patients with confabulation was extremely low on average (more than 2 SD below the mean) in comparison with their verbal memory abilities, although it did show substantial variability between patients. This low performance could be explicable with respect to these patients' more general impairment in perceptual and visuo-constructional skills, as also shown on the WAIS-III (low Performance IQ and Perceptual Organisation Index Scores) and other visuospatial tests (see below). It should however, be noted that some of these patients also suffered from non-neurological visual problems (e.g. operated cataracts) which were only partially corrected and thus could influence their performance on visual tests.

These findings were consistent with the performance of the groups on another test of visual learning, the RCFT. This test was not administered to two patients of the C1 group (SA and PT) due to time restrictions and to one patient of the C2 group (FM) due to his visual difficulties. The confabulating patients and the amnesic control group showed abnormal levels of immediate and delayed

recall during the RCFT test, while the frontal control patients scored within the normal range. A non-parametric Kruskal-Wallis test revealed that there was a significant difference between the three main groups of the study (Confabulation group, Amnesia and Frontal control groups) on Immediate,  $\chi^2(2) = 9.8, p < .01$ , and Delayed Recall,  $\chi^2(2) = 10.5, p < .01$ . Although there were not significant differences between the recall performance of the three confabulation subgroups,  $ps > .7$ , their memory impairment maybe related to different underlying problems. More specifically, the poor performance of right-hemisphere confabulating patients could be attributed to their defective visual and perceptual abilities, as well as their markedly impaired visuo-constructional abilities, as shown by their extremely low score on the copying component of the task. The other confabulating subgroups also showed impaired performance on the Copy condition of the RCFT. Although this impairment was less severe than that of the C3 group, the difference between the three confabulation subgroups on the copying component of the test did not reach significant levels,  $\chi^2(2) = 5.8, p = .06$ . Amnesic and frontal control patients performed better on average on the copying part of the task but there was no significant difference between these groups and the confabulation group on this component of the task,  $\chi^2(2) = 4.2, p = .1$ .

Patients' Autobiographical Memory as measured by the AMI showed different patterns of impairment between groups. This test was not administered to patients MS and F7 due to time restrictions. The total scores of confabulating, amnesic and frontal patients were compared using non-parametric Kruskal-Wallis tests. These revealed the groups differed significantly on personal semantic,  $\chi^2(2) = 12.1, p < .005$ , and autobiographical memory total scores,  $\chi^2(2) = 7.5, p < .05$ , with the frontal control group performing better than the other two groups on both measures. Significant differences were not observed between the confabulation and amnesia groups on any life-time period. Significant differences were observed between the three confabulation subgroups on total personal semantic,  $\chi^2(2) = 6.1, p < .05$ , and total autobiographical memory scores,  $\chi^2(2) = 6.6, p < .05$ , with the unilateral confabulation group performing better than the other two groups.

More specifically, frontal control patients and unilateral confabulation patients showed borderline scores across most of the sections of the battery (i.e. scores falling between one and two standard deviations below the mean of



controls) and did not show a temporal gradient. By contrast, confabulation subgroups C1 and C2 and amnesic control patients showed abnormal recollection of personal semantic information and autobiographical incidents for most lifetime periods. These groups showed a mild temporal gradient in recollecting personal semantic information. This appeared as steeper in the amnesic group, which also showed a temporal gradient, albeit milder, in the recall of autobiographical incidents. However, the performance of this small group on the AMI should be interpreted with caution, particularly given the fact that one of its patients was only 24 years old and hence some of the battery sections were not applicable. In addition, the difficulty of these groups (amnesic and confabulatory) in recalling recent information and events may reflect their anterograde amnesia, with patients having difficulty recalling events that took place following the onset of their illness. This is particularly applicable to the Korsakoff patients of the study who were tested on average more than 10 years following the onset of their disease. It also applies to the unilateral confabulating patients, who were particularly impaired in the recollection of recent personal semantic information.

Patients from all groups showed a small amount of memory distortion and produced intrusions during the verbal subtests of the WMS-III and the AMI. However, confabulation subgroups, with the exception of the right-hemisphere patients, showed also fabrications (see above for definition) during testing. For example, in the LM immediate and delayed recall tasks they distorted the facts of the story, usually by combining them in erroneous ways, as well as by inventing information that was unrelated semantically and phonemically to the tests' prose material. E.g. patient LH in response to the 'Joe Grant' story, 'recalled' how "John somebody was short of cash and he decided to get some by stealing somebody else's wallet. He was very fond of eating, you see (perseveration and fabrications)". Right-hemisphere groups did not produce fabrications during the WMS-III but they did so in the AMI, particularly in relation to questions relating to their recent life, e.g. the period of their hospitalisation following the onset of their pathology (postmorbid period). For example, patient JO described how hospital staff were refusing to give him exercise and laughing at his expense. He insisted the examiner was present during this event.

## *Chapter 2: Patients & their Neuropsychological Assessment*

In summary, confabulating patients with bilateral lesions, including Korsakoff syndrome patients, and non-confabulating amnesic patients showed comparable degree of anterograde memory impairment and impoverished autobiographical memory recall including distortions. The confabulation subgroups produced also fabrications. Frontal non-confabulating patients showed greater preservation of memory abilities, better orientation and less tendency for confabulation, and unilateral right-hemisphere patients with confabulation (C3 subgroup) showed better preservation of verbal memory abilities and less tendency for fabrication during testing, although they had selective deficits in visuospatial memory and showed marked confabulation for postmorbidity events.

### *Executive Functions*

The full administration of the D-KEFS battery was not always possible due to time-restrictions or, patients' visual problems. Only a small selection of verbal subtests of the D-KEFS was administered to patients of the C3 confabulation subgroup. However, data from the Behavioural Assessment of the Dysexecutive Syndrome (BADS, 1996) were also available for patients AO and DO and these will be described below. Patient FM could not complete four of the tests due to visual problems. Patients PT and IR completed only five subtests of the battery. All patients except frontal patient F7 completed the cognitive estimation task. All patients except from two patients of the C1 group (SA and PT) completed the Hayling Test. The performance of all groups on tests of executive functions is summarised in Table 2-9 below.

**Table 2-9. Groups' Performance on Tests of Executive Functions**

Test	Confabulation Group & Subgroups				Control Groups	
	Total C N = 13 Mean(SD)	Bilateral - C1 N = 7 Mean (SD)	Korsakoff - C2 N = 3 Mean (SD)	Unilateral- C3 N = 3 Mean (SD)	Amnesic N = 3 Mean (SD)	Frontal N = 7 Mean (SD)
Hayling Test	2 (1.3)**	2.4 (1.3)**	1**	2.3 (1.5)**	5.7 (1.5)**	2.5 (1.4)**
Hayling Errors Score	2 (1.5)**	1.4 (.9)**	2.3 (2.3)	2.6 (1.5)	6.3 (.6)	3.5 (1.9)**
Cognitive Estimates	12 (5.4)**	12.8 (4.6)**	13 (4.3)**	9.3 (8.5)*	4.7 (1.2)	8.8 (3.5)*
BADS Profile Score	-	-	-	8 (1)*	-	-
<b>D-KEFS</b>						
<i>Trail Making</i>						
Switching	2.4** (2.3)	1.8** (1.6)	4* (4.2)	n.a.	6* (5)	2.3** (3)
Errors in Switching	7.5* (3.6)	7* (4.3)	9 (1.4)		13.3 (4.2)	8 (3.3)
Switching Vs Number & Letter Reading	8.6 (3.7)	8.5 (4.3)	9 (1.4)		11 (2.6)	7.1* (2.9)
<i>Verbal Fluency</i>						
Letter	6.2* (2.6)	6.3* (2.7)	4.3* (2)	8 (1.7)	8 (3)	6.6* (3)
Category	2.8** (2.4)	3** (2.6)	1.3** (0.6)	3.7** (0.6)	6* (1.7)	6* (2)
Set-Loss Errors	7.8* (3.1)	8.1 (3.2)	6* (4.3)	9 (1)	10.6 (2.5)	10.1 (0.8)
Repetition Errors	7.7* (3.7)	7.1* (4.6)	7.3* (2)	9.3 (2.3)	7.3* (5.7)	10.6 (2)
<i>Design Fluency</i>						
Switching	4.1* (2.2)	4.2* (2.5)	4* (1.4)	n.a.	7.3* (1.2)	7.6* (3.6)
Switching Vs Filled & Empty Dots	8.4 (2.5)	8.7 (2.7)	7.5* (2.1)		12 (1.7)	10.5 (3)
Repetition Designs	10.1 (2.4)	10.2 (2.7)	10 (1.4)		9	10.3 (3.4)
<i>Color-Word Interference</i>						
Naming & Reading	5.8* (3.9)	6.8* (3.9)	2.5** (0.7)	n.a.	4.7* (3.2)	6.6* (2.5)
Inhibition	4.5* (4.3)	5.6* (4.3)	1**		9 (2)	6.8* (3.4)
Inhibition/Switching	3.2** (4.6)	4* (5.3)	1**		7.7 (5.7)	5.8* (3.4)
Inhibition Vs Naming	8.6 (3.9)	8.3 (4.5)	9.5 (0.7)		11 (3.6)	10.4 (4.1)
Inhibition Errors	4.4* (4.1)	4.3* (4.5)	5* (4.2)		6.7* (4.9)	7 (1.8)
Switching Errors	1.3** (1)	1.4** (1.1)	1**		6* (4.4)	4.8* (2.7)
<i>Sorting</i>						
Correct Sorts	7.6 (2.6)	7.2 (1.3)	8.7 (4.7)	n.a.	13 (5.7)	7.5 (3.1)
Description Score	5.2* (2.1)	6.3* (1.6)	3**		5.7* (2.5)	6* (3.6)
Repeated Sorts	1.6** (1.1)	1.5** (0.8)	2** (1.7)		7.3 (4.1)	6.8* (2.3)
<i>20 Questions</i>						
Questions Asked	3.2** (2.7)	3** (2.5)	6*	1**a	11 (1)	10.8 (1.6)
Achievement Score	5* (4.7)	5.2* (5.3)	6*	2**a	10.3 (2.1)	9.5 (1.5)
<i>Word context</i>						
Consecutively Correct	4* (4.1)	3** (2.3)	2.3** (1.2)	14 <sup>a</sup>	n.a.	7.8 (2.2)
<i>Tower</i>						
Achievement Score	5.5* (1.5)	5.4* (1.9)	5.6 (0.6)	n.a.	9 (3.6)	6.8* (1.2)
Rule Violations/Item	5.2* (1.2)	5* (1.4)	5.6 (0.6)		6.3* (1.5)	5.3* (1.5)
<i>Proverb</i>						
Achievement Score	6* (4.9)	5.4* (5.7)	3.5** (3.5)	9.3 (2)	10.3 (1.5)	7.3 (1.6)

\* Indicates scores < 2 SD and ≥ 1 SD below the general mean

\*\* Indicates scores > 2 SDs below the general mean

<sup>a</sup> Only patient DO was assessed

The scores of the groups were compared using non-parametric Kruskal-Wallis tests for between-subjects comparisons and Mann-Whitney tests for planned contrasts between groups. The overall performance of the confabulating patients on the D-KEFS was slightly worse than that of the frontal control patients, who in turn performed worse than the amnesic patients on most subtests of the battery. The latter group showed mild to no impairment on most subtests, while the former groups performed more than one or two SDs below the general mean on several subtests. However, not all of the differences between the groups reached significant levels and great variability was observed between the subtests of the battery. Confabulating patients and frontal controls performed worse than amnesic patients on the Trial Making, Tower and Proverb subtests but there was no significant difference between the scores of these three groups on any of the corresponding performance or error measures,  $ps > .3$ . By contrast, there was a significant difference between the confabulation, frontal and amnesic groups on both measures of the 20 Questions subtest,  $\chi^2(2) = 12.3, p < .005$  and  $\chi^2(2) = 6.3, p < .05$  respectively, with confabulating patients performing worse than the frontal control,  $Z = 3.1, p < .005$ , and the amnesic control group,  $Z = 2.5, p < .05$  on the number of questions asked. In addition, there was a significant difference between the confabulation and the frontal control group on the Word Context subtest,  $Z = 2.4, p < .05$ , with confabulating patients performed worse than the frontal group.

While confabulating patients performed worse than amnesic and frontal controls on all tasks of fluency there was no significant difference between the performance of the three main groups (confabulation, amnesic and frontal groups) on verbal (phonemic) fluency scores,  $ps > .7$ , although the confabulating patients performed significantly more set-loss errors than the frontal control patients,  $Z = 2.2, p < .05$ . The former group also produced more repetition errors than frontal controls but this difference was not significant,  $Z = 1.8, p = .08$ . The latter finding could be related to the better performance of the C3 group than the C1 and C2 groups in this condition (see below).

By contrast differences in category (semantic) fluency scores and on design fluency scores between the three main groups were significant,  $\chi^2(2) = 9.9, p < .01$  and  $\chi^2(2) = 8.4, p < .05$  respectively, with the confabulating patients

performing worse than both control groups on both measures. Post hoc comparisons revealed that the performance of the confabulating patients differed significantly from that of the frontal group,  $Z = 2.7, p < .01$ , but not from that of the amnesic control group,  $Z = 1.5, p = .1$ . Interestingly the difference in design fluency between confabulating and frontal control patients ceased to be significant when primary scores of design fluency were contrasted with the scores of the more basic sequencing components of the task (empty and filled dots non-switching conditions),  $Z = 1.1, p = .3$ , while the difference between confabulating patients and the amnesic control group remained significant,  $Z = 1.9, p < .05$ . Finally, although unilateral confabulation patients (C3) performed better than C1 and C2 bilateral subgroups on all measures of verbal and semantic fluency there were no significant differences between the performances of the three confabulation subgroups in these measures,  $ps > .2$ .

During the Sorting subtest confabulating and frontal patients performed less sorts than amnesic control participants but this difference was not significant,  $\chi^2(2) = 3.9, p = .1$ . By contrast the tendency of the confabulating patients to produce repeated sorts during the task was significantly greater than those of the two control groups,  $\chi^2(2) = 12.7, p < .005$ . Post hoc comparisons revealed that the performance of the confabulating patients differed significantly from that of both the amnesic group,  $Z = 2.6, p < .01$  and the frontal group,  $Z = 3.2, p < .001$ .

Confabulating patients and frontal controls were impaired on the critical Inhibition conditions (primary and error conditions) of Colour-Word Interference subtest (a 'Stroop' variation), while amnesic patients performed within the normal range (scores  $\geq 1$  SD below the general mean). However, this difference was not significant,  $\chi^2(2) = 3.1, p = .2$ , and neither was the difference in performance between the confabulation, frontal and amnesic groups on the more demanding Inhibition-Switching condition of this subtest,  $\chi^2(2) = 3.7, p = .2$ . Although, confabulating, frontal control patients and, to a lesser degree, amnesic control patients showed low primary measures' scores on this test, it is important to note that patients, and particularly the Korsakoff patients, performed poorly also on the fundamental components of this task, namely the naming and reading conditions of the test. Thus, their impaired performance on the primary inhibition and switching conditions of the test is at least partly attributable to impairments in

more fundamental cognitive impairments, as also suggested by their much higher scores on the contrast measure of the test. Indeed, no difference was found between the three main groups on this measure,  $\chi^2(2) = .7, p = .7$ . However, the confabulation group produced more errors in the inhibition and in the inhibition/switching conditions than both control groups. In the latter condition this difference was significant,  $\chi^2(2) = 7.4, p < .05$ , and confabulating patients produced more errors than frontal control patients,  $Z = 2.6, p < .01$  and amnesic control patients,  $Z = 2.1, p < .05$ .

The performance of the groups on the Cognitive Estimates test revealed that both confabulating and frontal control patients performed significantly worse than the amnesic group,  $\chi^2(2) = 62, p < .05$ . Bilateral confabulating patients (subgroups C1 and C2) performed worse on average than the frontal control group,  $Z = 2.1, p < .05$ , and the unilateral confabulating patients, but there no significant differences between the performance of the confabulation subgroups,  $\chi^2(2) = .7, p = .7$ .

The performance of groups on the Hayling Test showed that although all groups were impaired (scores falling below cut-off levels) the confabulation subgroups and the frontal control group performed worse on this task and they showed the highest suppression error scores in the second part of the test. Indeed, there were significant differences between the performance of the three main groups on the overall Hayling test score,  $\chi^2(2) = 7.2, p < .05$  and the corresponding error score,  $\chi^2(2) = 9.6, p < .01$ , with the confabulation group performing worse than the amnesic,  $Z = 2.5, p < .05$  and  $Z = 2.7, p < .01$  respectively, but not worse than the frontal controls,  $Z = .8, p = .4$  and  $Z = 1.7, p = .8$  respectively. Also there were no significant differences between the total and error scores of the confabulation subgroups,  $\chi^2(2) = 2.8, p = .2$  and  $\chi^2(2) = 1.6, p = .4$  respectively.

Although the patients forming the C3 subgroup were generally cooperative during assessment, several difficulties occurred during assessment of executive functions. Patient JO was particularly sensitive to poor performance during testing and discontinued most attempts to assess his executive functions, including several subtests of the D-KEFS and the BADS battery. He was also experiencing non-neurological visual difficulties at the time of his assessment and he was



awaiting an ophthalmologist's appointment. Although patients AO and DO also experienced visual problems these were partially corrected by spectacles. Their performance on the remaining subtests of the BADS was also defective (Profile Scores ranging from 0 to 2 on all subtests except the Temporal Judgement subtest on which AO's Profile score was 3; see also DO's brief case report below and Chapter 7).

In summary, although all groups showed some degree of impairment in the D-KEFS subtests and other frontal tests, confabulating patients and frontal control patients were severely impaired on a variety of executive functions, while the three amnesic patients showed mild impairment and this was present only in few tests (see also Kopelman et al., 1997). The performance of the confabulating patients differed significantly from that of the amnesic patients on the Switching Errors measure of the Trail Making Test, the 20 Questions and the Design Fluency subtests, the perseveration score of the Sorting subtest, and the error score of the Inhibition/Switching condition of the Colour-Word Interference subtest. These two groups also differed significantly in their performances on the Cognitive Estimates and the Hayling test. The performance of the confabulation group differed significantly from that of the frontal control group only on the Word Context, the Category Fluency condition and the error scores of the Verbal Fluency subtest, the perseveration score of the Sorting subtest, and the error score of the Inhibition/Switching condition of the Colour-Word Interference subtest. The interpretation of these differences and their implications for the production of confabulation are discussed below.

#### *Other Assessments*

All patients underwent standard neurological examination and were administered selective tests of visuo-spatial neglect. Five patients had severe motor deficits following their neuropathology. These included the three patients of the C3 group, which all had contralesional motor deficits. JO and DO had paralysis of both lower and upper limbs, while AO's had left upper limb paralysis and hemiparesis of the lower limb. Tactile sensation of left limbs was impaired in all patients. Right-left identification, finger recognition and semantic abilities as assessed with bedside tests were intact in all three patients. AO and DO showed homonymous hemianopia and all three patients showed visuospatial neglect,

without extinction. As expected these right-hemisphere patients showed higher amount of neglect on average than the other groups. Two of the frontal control patients (F5 and F6) also showed left-sided hemiplegia for both upper and lower limbs and left-sided neglect on the tests administered. The patients of all other groups did not show visuospatial neglect on the tests administered and none of them had any motor deficits at the time of assessment, except patient FM who showed mild ataxia. The performance of the groups on tests of visual neglect are summarised in Table 2-10 below.

**Table 2-10. Groups' Performance on Tests of Visuo-spatial Neglect**

Test	Confabulation Group & Subgroups				Control Groups	
	Total	Bilateral – C1	Korsakoff – C2	Unilateral – C3	Amnesic	Frontal
	N = 13	N = 7	N = 3	N = 3	N = 3	N = 7
	Mean(SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
<b>Line Cancellation</b>						
Left	15.2 (5.1)	17.7 (0.5)	18	7.7 (5.6)*	18	16.3 (3.1)
Right	16.5 (3.2)	17.6 (0.8)	18	13 (5.6)	18	17.4 (1.5)
<b>Letter Cancellation</b>						
Left	17.4 (5.7)	19.9 (0.4)	20	6 (2.8)*	19.3 (1.2)	17.4 (4.4)
Right	19.1 (1.8)	19.9 (0.4)	20	15.5 (0.7)	19.7 (0.6)	19 (1.7)
<b>Line Bisection</b>	8.4 (1.1)	8.9 (0.4)	8.7 (0.6)	7 (1.7)	8.7 (0.6)	8.3 (1.2)

*Mood & Related Behavioural Observations*

Formal assessment of experienced depression and anxiety levels (HADS questionnaire) showed differences between the three experimental groups and also in the confabulation subgroups. The groups' performance on the HADS are summarised in Table 2-11 below.

**Table 2-11. Groups' Performance on the HADS**

Test	Confabulation Group & Subgroups				Control Groups	
	Total	Bilateral – C1	Korsakoff – C2	Unilateral – C3	Amnesic	Frontal
	N = 13	N = 7	N = 3	N = 3	N = 3	N = 7
	Mean(SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
<b>HADS</b>						
Depression	6.6 (5.1)	6.3 (5.2)	5.5 (6.4)	10 (4)*	4.3 (4.2)	7 (5.5)
Anxiety	9.8(4.8)*	8 (1.8)*	7 (9.9)	13 (3.6)*	0.6 (1.6)	9 (3.7)*

Non-parametric Kruskal-Wallis tests revealed that the differences in anxiety and depression between the main experimental groups, as well as between confabulation subgroups were not significant,  $ps > .1$ . However, the observed tendencies are noteworthy. Confabulating and non-confabulating groups scored



within normal limits on the depression scale, except from the C3 confabulation group that showed borderline scores. Two of the three patients of this group reported experiencing very negative emotions, although neither of them was diagnosed as clinically depressed when psychiatrically evaluated. All groups scored higher on the Anxiety scale with the exception of the amnesic group. All other average group scores showed borderline levels of anxiety (Borderline Normative Scores: 8-10), while the C3 confabulation subgroup scored clearly within the abnormal level. These patients reported experiencing intense feelings of fear and anxiety.

*Clinical Observations: Mood & Awareness*

These mood assessments were also consistent with the behavioural observations of patients' everyday mood and the corresponding reports of psychiatric or clinical psychology evaluation. Bilateral confabulating patients showed marked flattening of emotions and apathy, intermitted by emotional lability and particularly episodes of emotional outburst expressing mostly anger, anxiety or despair. Patients RM and FM were mostly euphoric and inappropriately jocular. Restlessness, distractability, disinhibition and stimulus-bound behaviour was common among these patients, particularly patients RM, LH, BA, MS, IR and WM. The latter was also true for patients OT, CM and PT but they were less hyperactive and less disinhibited in their verbal output and their actions. All patients of the C1 group were also generally unmotivated and unable to care for themselves or engage in everyday activities without constant external prompting and monitoring. In great contrast, these patients constantly and persistently mentioned 'intended', 'scheduled' or 'planned' actions, duties, and activities that they had to attend to next. For example, patient LH constantly believed he had to leave the ward to find his stolen car, or that he had to pick-up his car from the garage or that he had to drive a colleague somewhere etc. This tendency was also evident in one of the patients of the C2 group, patient WM. By contrast, the anticipations and plans of the chronic patients CM and FM appeared to include only their release from the hospital, which according to them they had been admitted to only because of 'false allegations' (see also case reports in Appendix A3).

All confabulating patients appeared as either totally unaware of their circumstances or as minimising their importance or medical relevance, e.g. patient WM claimed he was in perfect health and often treated his assessment sessions as interviews for a job, while patient CM claimed she was in hospital because doctors were against her religious beliefs and thus falsely 'thought she was not right in her head'. Occasionally, patients further 'dramatised' the circumstances of their injuries. For example, patient JO claimed he was in hospital due to an explosion to his head. He further repeatedly described how he saw blood and bones coming out of his head and falling to the ground. On one occasion he also mentioned his daughter was present and 'she pick-up his head bones with a pair of tweezers' (see Clinical examples in Chapter 1).

The emotional presentation of the patients of the C3 confabulation subgroup was generally different from that of the other confabulation subgroups, as also indicated by their different HADS results. These three patients appeared more aware of their general circumstances and whereabouts, yet they showed impaired awareness of selective deficits, e.g. their paralysis, their confabulations, and they ignored or misinterpreted their implications. Moreover, they constantly expressed negative emotions such as sadness, anxiety and mostly anger. They continuously stated that they were dissatisfied with the service provided by medical and nursing staff and demanded immediate satisfaction of their needs. Patient DO explicitly stated that she felt she was unable to tolerate the slightest delay in service, although she wished she could. All three patients described profound and constant feelings of loss and sudden feelings of panic and anxiety. Yet, none of these patients identified the source of such emotions being their medical condition. Instead, in an almost paranoid manner, they attributed the 'cause' of their profound everyday dissatisfaction to the behaviour or the intentions of others. For instance, DO felt that caring staff were verbally and physically abusing her, AO often claimed that her relatives, nursing and medical staff were deliberately trying to prevent her from living an independent life (see also Chapter 7) and JO, in a series of bizarre allegations, claimed that "Arabs were to blame" for his condition and that the stroke unit was responsible for his lack of improvement, as 'they are refusing to give [him] any exercise' (at the time he had physiotherapy sessions approximately four times a week).

The patients of the frontal group also showed apathy, distractability, disinhibition and lack of motivation but these were less extreme than in confabulating patients. Moreover, all patients were aware of the circumstances of their neuropathologies. Patients A1 and A3 of the amnesic control group were also aware of their circumstances and showed appropriate emotional reactions of sadness. However, patients A2 and A3 also showed episodes of uncontrolled tearfulness, of sudden onset and progressive disappearance. Patient A2 identified the origin of his unpleasant emotions to his stroke and to relevant sad experiences in his past. By contrast, patient A3 repeatedly stated she was unaware of the origin of her extreme feelings of sadness and described she had no control over them. When it was pointed out to her that tearfulness seemed to appear during conversations related to her stroke or her disabilities, she confirmed the observation but was unable to provide further information. Her awareness about her memory, language and vision problems fluctuated, but she was able to accept the information given to her by rehabilitation staff and progressively learned to compensate for her difficulties by using the suggested strategies.

*Confabulation*

The performance of the confabulation and control groups as assessed with the Confabulation Battery is summarised in Table 2-12 below. The battery was administered to all patients except patients MS (C1 group) and F7 (frontal group). The latter were not assessed due to time restrictions.

**Table 2-12. Groups' Performance on the Confabulation Battery.**

Sections	Confabulation Group & Subgroups				Control Groups	
	Total C N = 12 Mean (SD) %	Bilateral- C1 N = 6 Mean (SD) %	Korsakoff- C2 N = 3 Mean (SD) %	Unilateral- C3 N = 3 Mean (SD) %	Amnesic N = 3 Mean (SD) %	Frontal N = 6 Mean (SD) %
<i>Personal</i>	19.6 (10.1)	20 (10)	26.7 (10.4)	11.7 (5.8)	3.3 (2.9)	0
<i>Semantic</i>						
<i>Episodic</i>	37.2 (19.4)	51.17 (15)	22.3 (8.1)	24.3 (15)	15.3 (4)	2.3 (3.6)
<i>Orientation</i>	31.7 (15.9)	36.7 (18.7)	33.3 (11.5)	20 (10)	13.3 (5.8)	1.6 (4.1)
<i>General</i>	16 (9.2)	21 (6.5)	13.3 (11.5)	8.7 (7.5)	4.7 (4)	5.6 (7.8)
<i>Semantic</i>						
<i>DK Semantic</i>	30 (15.3)	38.3 (16)	20 (10)	23 (11.5)	0	15 (15.2)
<i>DK Episodic</i>	26.7 (19.2)	31 (25.6)	20 (0)	23.3 (15.3)	3.3 (5.8)	18.3 (26.3)
<i>Total</i>	27.2 (8.2)	33 (11.7)	22.6 (6.8)	18.5 (6.6)	7.3 (6.8)	7.1 (7.6)

Note. 'DK' = 'Don't Know' Sections

Non-parametric tests were used to compare the performances of the experimental groups across the battery. The confabulation group confabulated across all sections of the battery and more often than the non-confabulating groups. A non-parametric Kruskal-Wallis test revealed significant overall differences between the groups,  $\chi^2(2) = 14.1, p < .005$ . Planned contrasts revealed that the performance of the confabulation group significantly differed from that of the amnesic,  $Z = 2.6, p < .005$  and the frontal control group,  $Z = 3, p < .005$ . Among the confabulation subgroups, the highest amount of confabulation overall, was observed in the bilateral subgroup (C1), while Korsakoff patients confabulated less across all sections of the battery except Personal Semantic Memory. In addition, right-hemisphere patients confabulated overall less than both bilateral confabulation groups. Although, the overall differences between the three confabulation subgroups did not reach significant levels,  $\chi^2(2) = 5.1, p = .08$ , the difference between the amount of confabulation produced by bilateral and unilateral patients was significant,  $Z = 2, p < .05$ .

The amount of confabulation produced by patients varied across battery sections. Confabulation patients showed the highest amount of confabulation in the Episodic Memory, Orientation and the two 'Don't Know' sections of the battery, although the C1 and C2 groups also showed high confabulation scores in the Personal Semantic Memory section. A within-subject Friedman test revealed that these differences between sections were significant in the confabulation group,  $\chi^2(5) = 13.1, p < .05$ . Although the two control groups confabulated less than the confabulation groups they also showed variability in the degree of confabulation between the different sections of the battery. Amnesic patients confabulated mainly about episodic memories and orientation information, while the frontal controls confabulated mainly during the two DK sections of the battery. These differences were significant as analysed by a within-subject Friedman test,  $\chi^2(5) = 12.1, p < .05$  and  $\chi^2(5) = 11.2, p < .05$  respectively.

In summary, confabulating patients confabulated across all the sections of the battery. Overall, they also produced more confabulations than both amnesic and frontal control groups. More generally, the amount of confabulation produced by patients varied significantly across the section of the battery. Confabulating

and amnesic patients showed a tendency to mostly confabulate in response to Episodic memory questions, while frontal controls confabulated mostly in response to 'Don't know' questions. Finally, bilateral confabulating patients confabulated on average significantly more than unilateral confabulating patients.

*Summary of Neuropsychological Findings*

The bilateral confabulation groups showed, similarly to the amnesic control group, only mild deterioration of general intellectual abilities, marked anterograde and autobiographical memory deterioration. However, the former also showed severe executive dysfunction in certain tasks and high amount of confabulation during formal testing, which were less severe in the amnesic control group. The unilateral confabulation group showed only mild deterioration in verbal intellectual, anterograde and autobiographical memory abilities but presented with marked impairments in perceptual organisation, visual memory and deficits in specific executive functions. Frontal control patients showed better performance in tests of memory and less confabulation but severe impairment in certain executive functions.

One typical patient of each confabulation subgroup is briefly presented in Appendix A3 to illustrate the neuropathological, neuropsychological and behavioural characteristics of each group. Two additional, full case descriptions of one bilateral and one unilateral confabulating patient are presented in Chapters 6 and 7 below.

## **2.8 Discussion**

The investigations of the present chapter aimed at presenting the confabulating and control patients recruited for the study and at examining their neuropathological and neuropsychological characteristics. The first major step towards these aims was the classification of confabulation according to multidimensional qualitative behavioural criteria. Subsequently, confabulating patients were classified in distinct confabulation subgroups according to neuropathological and neuroradiological data. Furthermore, the demographic and neuropsychological characteristics of each of these subgroups were examined in detail and direct statistical comparisons were performed in order to contrast these

confabulating patients ('target' groups) with non-confabulating patients (control groups). Finally, a quantifiable investigation of the verbal confabulatory behaviour of these groups was undertaken using an established Confabulation Battery (Dalla Barba, 1993b). The findings of these investigations, as well as the three specific hypotheses they addressed (see also Chapter 1), are discussed in turn below.

### 2.8.1 The Qualitative Features of Confabulation

In the present study confabulation was observed following both amnesia-related disorders (e.g. ACoA syndrome, Korsakoff syndrome) and neuropathologies typically associated with 'right-hemisphere symptoms', such as neglect and anosognosia for hemiplegia. These observations are consistent with previous studies on confabulation, which associate the symptom with neuropathologies causing amnesia, e.g. alcoholic Korsakoff syndrome, ACoA aneurysms, as well as with a wide variety of other syndromes, some involving no or minor memory deficit (Deluca, 2000; Hirstein, 2004; Johnson et al., 2000; see also Chapter 1).

The present study applied multidimensional criteria to classify confabulating patients. These criteria, based on a combination of various dichotomous distinctions of confabulatory features described in previous studies (e.g. see Berlyne, 1972; Kopelman, 1987; Kraepelin, 1904; Schnider et al., 1996), included ratings of confabulation frequency, plausibility, novelty, conviction level and production mode. It is noteworthy that these ratings corresponded to information collected from professionals and carers, as well as the subsequent quantitative investigation of confabulation (see below). In addition, this classification permitted the study of correlations between the ratings of the confabulating patients on these behavioural measures. In particular, it was found that only confabulation novelty positively correlated with production mode, suggesting that patients that produced false information spontaneously, i.e. without explicit probing, were also the ones more likely to confabulate about novel information, i.e. information unrelated to their life or the experimental conditions and *visa versa*. These two dimensions have been associated before, albeit under different terms (Berlyne, 1972; Bonhoeffer, 1901 in Berlyne, 1972), but their association was not systematically studied (see Kopelman, 1987). The

fact that no other correlation was significant suggests that the various forms of severe confabulation may be dissociable and simple dichotomous distinctions may not be sufficient to adequately classify confabulating patients.

Furthermore, significant differences in certain confabulatory features were observed between the confabulation subgroups of the study, as these were formed based on neuropathological data (see below). The confabulations of Korsakoff patients seemed to be spontaneously produced less often than in the other groups and their content involved less novel information, although it is unclear how the chronic state and the prolonged hospitalisation of these patients had influenced the quality of their confabulations. The unilateral confabulating patients produced confabulations less frequently than the other groups. Finally, bilateral confabulating patients showed high ratings of confabulation across all measures, except from Conviction, in which they showed a non-significant difference from the other groups in being prone to easily abandon, modify or even forget their false claims. These qualitative differences between the confabulation subgroups were accompanied by underlying neuroanatomical and neuropsychological differences (see below).

### 2.8.2 Quantitative Differences in Confabulation

The formal assessment of the memory domains affected by confabulation and the frequency of its presence among patients were consistent with the behavioural ratings of confabulation applied in the study, as described above. More specifically, confabulating patients confabulated in response to episodic, semantic memory and orientation questions, and although control participants also showed some confabulation during the battery, this tendency was significantly lower than that of the confabulating patients. The small number of control patients assessed in this study does not allow definite conclusions, yet some tentative observations can be made based on the performance of these groups.

More specifically, there was a tendency within amnesic patients to produce more confabulations in response to Episodic Memory and Orientation questions, while frontal subjects tended to produce more confabulations in the 'Don't know' sections. In the former case, one may assume that confabulations in episodic memory and orientation represented severe memory errors due to

amnesia. In the latter case, one may speculate that the poor executive control of frontal control patients did not assist them in evaluating the difficulty of the 'Don't know' questions and compelled them to try to answer them (see also below). In both instances the outcome was similar. Patients were unable to access the appropriate information to answer the questions (or not answer them).

Based on the above, one may further speculate that confabulation represents the exaggerated and combined effect of the above two tendencies, as both cognitive difficulties, i.e. amnesia and executive dysfunction are present in confabulating patients (see below). Indeed, confabulating patients produced the highest amount of confabulation in these four sections and showed less confabulation in general and personal semantic questions (see also Dalla Barba, 1993a; Dalla Barba et al., 1998; Fotopoulou et al., 2004; Kopelman et al., 1997). In addition, one could assume, as Kopelman and colleagues have (1997), that these two impairments have related, yet distinct roles in the formation of confabulatory tendencies, i.e. amnesia affects the availability of memories and executive dysfunction affects the selection and thus accessibility of appropriate memories and the monitoring of inappropriate responses.

However, others have claimed that such differences in confabulation frequency are explained by a single impairment. More specifically, Moscovitch and Melo (1997) argued that confabulating patients perform better in response to semantic than episodic questions because the former include specific probes and require less narrative description (e.g. 'When did the 1<sup>st</sup> World War start?' versus 'What did you do yesterday?'). Thus, they make fewer demands for effortful and goal-directed retrieval. According to these authors and others (Burgess & Shallice, 1996; Conway & Tacchi, 1996) it is precisely this type of 'strategic' or 'generative' retrieval which is impaired in confabulating patients and thus leads them to confabulate predominately in response to episodic questions. More generally, the exact relation of confabulation to the interaction of memory and executive dysfunction is a complex issue which will be further addressed in the following sections. However, it should be noted here that the utilisation of both amnesic and frontal control patients (see also Kopelman et al., 1997) appears to be an informative practice in the study of confabulation.



The confabulation battery also showed that bilateral confabulating patients confabulated more than Korsakoff patients who in turn confabulated more than right-hemisphere patients. This finding is also consistent with the behavioural ratings of confabulation frequency described above, which had differentiated the amount of confabulation produced by these three groups. Moreover, the results of the battery revealed that bilateral confabulating patients differed significantly from unilateral patients on the amount of confabulation they produced. The difference between groups C1 and C2 are not explicable by differential cognitive deficits as these groups performed similarly on most neuropsychological tests (see below), but the possibility remains that it relates to their different underlying neuropathologies, as well as to the chronic state of the C2 patients' disease. The difference between unilateral and bilateral patients was supported by several differences in tests of intelligence, memory and executive functions, and mostly by the relatively preserved verbal memory and the impaired visuo-spatial abilities of the C3 group (see below). Furthermore, the patients of the unilateral confabulation subgroup showed lower mood than the other groups and described intense negative feelings of anxiety. Given these observations, the following chapters will investigate the role of laterality in confabulation and the relation of the two syndromes will be further addressed by two respective case studies (see Chapters 6 and 7). The following sections examine the neuroanatomical and neuropsychological differences between confabulating and control patients, as well as between the confabulation subgroups with the aim of addressing three main hypotheses (see also Chapter 1).

2.8.3 Hypothesis 1: Direct damage or functional disconnection, involving the ventromedial and orbitofrontal cortices, is implicated in confabulation.

This hypothesis was partly confirmed by the present study, in that confabulating patients had lesions involving mostly the orbital and medial prefrontal cortex and associated areas (see also Johnson et al., 2000; Moscovith & Melo, 1997; Schnider et al., 1996). However, the lesion localisation was not precise enough to allow meaningful conclusions about the precise role of this area in the production of confabulation, over and above the role of other adjusted or functionally connected areas, such as the basal forebrain and other 'anterior limbic

areas'. This issue is discussed below in the context of each the specific neuropathologies observed in the recruited confabulating patients.

The orbital prefrontal cortex, including its medial and lateral portions, has received increased neuroscientific attention in the last decades. In humans, this region includes parts of Brodmann areas BA11, BA12, and BA47. Some regions of the orbitofrontal cortex (posterior parts of BA11-13) also form part of what is frequently referred to as 'the medial frontal lobes' (Mesulam, 2000). This is a heterogeneous cortical region and may be functionally segregated (Elliot et al., 2000; Knight & Stuss, 2002; Ongur & Price, 2000). The region represents a confluence of the orbitofrontal cortex, the cingulate complex (BA32 and BA35), and the dorsolateral heteromodal prefrontal cortex (BA9-10) (Mesulam, 2000). Previous studies have used a number of different terms to describe these regions. In the following discussion, the term 'orbital and medial prefrontal cortex' (OMPFC) will be used to emphasise the overall function and organisation of the ventral surface of the frontal lobes and the ventral regions of the medial prefrontal cortex, and its difference from other regions, such as the lateral prefrontal cortex (see also Bechara et al., 2000; Rule et al., 2002).

Various types of brain pathology were associated with confabulation in the present study. These included TBI, SAH haemorrhage caused by surgical treatment of ACoA aneurysms, or other causes such as TBI, alcoholic Korsakoff syndrome and anterior circulation strokes leading to isolated right-hemisphere lesions. Although these findings do not exhaust the list of neuropathologies associated with confabulation, they are consistent by previous studies which identify them as among the most frequent causes of the symptom (for reviews see Feinberg & Roane, 1997; Gilboa & Moscovitch, 2002; Hirstein, 2004; Johnson et al., 2000).

ACoA patients are known to have lesions in basal forebrain and the prefrontal cortex, with possible associated damage to the striatum (e.g. Alexander & Freedman, 1984; Beekman, et al., 1998; Damasio et al., 1985; Diamond et al., 1997; Irle et al., 1992; Phillips et al., 1987). However, the affected regions may vary significantly across patients (see Chapter 1). In the present study, the lesion localisation appeared similar to previous studies on confabulation in that the affected areas included mostly the OMPFC and associated areas (Johnson et al.,

2000; Moscovith & Melo, 1997; Schnider et al., 1996). However, the lesion localisation was not precise enough to allow meaningful contrasts between the confabulating ACoA patients and the ACoA patients without confabulation or amnesic and frontal controls of other aetiologies. The same applied for the Korsakoff patients of the study, whose scans revealed mostly generalised changes. Thus, the lesion localisation was not precise enough to allow meaningful contrasts between the three amnesic confabulating Korsakoff patients and the amnesic patients of different aetiologies, which seemed to have lesions involving medial temporal lobe and diencephalic areas.

One of the confabulating patients of the study had suffered severe hypoxia following cardiac arrest (patient BA). Hypoxia, caused by cardiac or respiratory arrest, as well as by various forms of poisoning, can give rise to a chronic and severe amnesic syndrome, recently thought of as caused by associated hippocampal and thalamic lesions (e.g. Aggleton & Saunders, 1997; Kopelman et al., 2001; Press, 1989; Kesler et al., 2001; Zola-Morgan et al., 1986). However, as a recent review highlights the sequelae of hypoxia includes variable and often widespread neuropathological and cognitive consequences (Caine & Wilson, 2000; See also Kapur, 1994) and further detailed study is required before concluding which are the most likely circuits responsible for the occurring memory disorder and which is the exact nature of the latter (see also Kopelman, 2002). In the present study the patient's extreme confabulation tendency was accompanied with indications of widespread atrophy and a focal lesion in the left frontal lobe.

Two confabulating patients of the present study had suffered severe closed head injuries following road traffic accidents and continued to floridly confabulate following the acute stage of their recovery and a period of PTA (two and six months post-injury). The neuropathology caused by severe close head injury frequently entails a significant degree of generalised cerebral damage, but focal lesions may also occur (see Chapter 1). TBI appears to be one of the most frequent aetiologies of transient confabulation (Johnson et al., 2000). In the present study, both patients showed extreme and persistent confabulation beyond an initial period of more generalised confusion and despite their neuropathological differences (e.g. RM showed a secondary SAH and underwent craniotomy for

increased intracranial pressure). Neuroimaging investigations revealed generalised changes but also focalised lesions in the medial aspects of the prefrontal cortex bilaterally (patient RM), as well as in the temporal lobes (both patients).

Thus, although most of the patients of the bilateral confabulation group showed lesions involving the OMPFC, the additional presence of generalised damage or focal lesions in the temporal lobes and the inconclusive evidence of basal forebrain lesions did not allow meaningful conclusions regarding the specialised involvement of these areas (e.g. OMPFC versus basal forebrain or temporal lobe lesions) in confabulation. Informative differences in the neuropsychological performance of these groups will be discussed below.

However, before discussing the neuropsychological performance of these bilateral patients, it is important to note that the third confabulation subgroup of the study presented a distinct underlying neuropathology. The three patients forming the unilateral confabulation group had isolated lesions in the right-hemisphere, mostly involving the frontal and parietal lobes as well as basal ganglia structures. They showed the corresponding typical motor and cognitive symptoms: self-sided hemiplegia, left-sided visuo-spatial neglect and anosognosia of such deficits (see below). Transient anosognosia for hemiplegia is quite common following acute RH lesions but the chronic type described in two of the three right-hemisphere patients of the present study is less frequent (Berti et al., 1996; Berti et al., 1998; Cocchini et al., 2002; Gold et al., 1994; Rode et al., 1998). Confabulation has been linked with the right-hemisphere syndrome in previous studies (e.g. Critchley, 1953; Feinberg et al., 1994; Ramachandran, 1995). Yet, no clear distinction exists between the two types of confabulatory behaviour (see Chapter 1). Crucially, it is not understood whether the presence of confabulation in these two distinct syndromes is attributable to common neuroanatomical and neuropsychological factors, or whether it represents a common outcome caused by a combination of different lesions and deficits. Some authors propose a differentiation of these confabulatory syndromes (Deluca, 2000; Feinberg & Giacino, 1997; Johnson et al., 2000) while other studies group together such patients (Schnider et al., 1996; Stuss et al., 1978).

For example, Schnider and colleagues (1996) grouped together amnesic confabulating patients with right-hemisphere lesions, left-sided hemiplegia, hemi-

neglect and corresponding AHP and confabulating patients of various other neuropathologies and bilateral lesions. They distinguished between patients based solely on their potential tendency to act upon their confabulations. Interestingly, they presented a spontaneously confabulating patient with a similar discrete right-hemisphere lesion in the internal capsule. They claimed confabulation in the latter case was the result of a disconnection of the dorsomedial thalamic nucleus from the orbitofrontal cortex (see also Chapter 7). However, AO and the rest of the patients of the C3 group were not severely amnesic (see below), as Schnider's patients. In addition, as discussed above, the confabulatory behaviour of this group presented with different qualitative characteristics. It is possible that these behavioural differences relate to the different underlying neuropathology (see also Chapter 7), but given the small number of patients assessed in this study further investigation is required. The section below examines the neuropsychological basis of these differences.

2.8.4 Hypothesis 2: Severe memory impairment commonly, but not necessarily accompanies confabulation and it is not sufficient for its occurrence.

This hypothesis was confirmed. More specifically, bilateral confabulation subgroups showed severe deficits in memory. These deficits were not sufficient to cause confabulation, as the patients of the amnesic control group showed similar degree of impairment, but they did not confabulate. Moreover, these severe memory deficits were not necessary for the production of motor-related confabulation, as unilateral confabulating patients showed only selective memory problems. These results are discussed below.

Bilateral confabulation subgroups showed severe deficits in memory, including orientation, learning of new information and autobiographical memory. Although the degree of their memory impairment was similar to that of the amnesic group, the nature of this deficit presented some differences from that of the latter control group. These results are consistent with previous studies on ACoA and Korsakoff patients, which have found memory impairments following such pathologies, yet they have shown that amnesia following these pathologies may differ in nature from classical descriptions of 'temporal lobe or diencephalic amnesia' (for reviews see Aggleton & Brown, 1999; Kopelman, 2002; O'Connor & Verfaillie, 2002; Parkin & Leng, 1983; Victor et al., 1971).

Specifically, the C1 and C2 groups were worse in orientation than the amnesic group and their answers were contaminated by confabulation. Their poor performance may be linked to their tendency to produce responses in a fast and automatic way, without apparently taking the time and effort to initiate appropriate retrieval searches, to place their answers into the right temporal context or to monitor and inhibit inappropriate responses. These observations would be consistent with the performance of these groups on tests of executive function (see below), and their neuropathologies which typically include lesions to the frontal lobes. However, confabulating patients performed worse than frontal control patients in orientation tasks suggesting that, in general terms, 'dysexecutive' behaviour is not sufficient to explain their poor performance in orientation. The possibility of their defective performance on orientation tests being caused by specific temporal and spatial contextualisation difficulties (e.g. Korsakoff, 1889; Van der Horst, 1932; Talland, 1961; 1965; Dalla Barba et al., 1997) versus more severe or more specific executive dysfunction (than those of frontal non-confabulating patients, see below) remains an open question which cannot be addressed by the simple WMS-III measure and instead requires specific experimentation (see Dab et al., 1999; Dalla Barba et al., 1997; Johnson et al., 1997; Moscovitch & Melo, 1997; Schnider et al., 1996; see also Chapter 4 below).

The C1 and C2 groups, as well as amnesic patients, also showed severe impairment in autobiographical memory. All three groups showed minimal recall of autobiographical events, with only the amnesic group showing some indications of a temporal gradient. This was more marked in the recollection of personal semantic information for all three groups. Interestingly bilateral confabulating patients appeared to recall personal semantic information slightly worse than amnesic patients. This finding could relate to their observed tendency to answer such questions with the wrong life-time period in mind and without the necessary abilities to monitor and correct such errors. However, the above differences between the groups should be interpreted with caution as the Autobiographical Memory Test could be sensitive to groups' age differences and the varying times of assessment following onset. For example, the marked difficulties of the Korsakoff group to remember events and information from their recent life could be associated with their anterograde amnesia given the fact that

these patients were assessed on average 10 years following the onset of their disease.

Interestingly, bilateral confabulating patients showed significantly greater impairment than the frontal control group across all orientation, anterograde and autobiographical memory measures. This was particularly evident in the WMS-III orientation, auditory delayed recall and recognition measures, as well as all measures of personal semantic and autobiographical memory recall. By contrast, the frontal control group showed impaired performance on the immediate and delayed recall conditions of the Rey Complex Figure, but this could at least partly attributed to the perceptual organisation difficulties these patients showed during the copying condition. Such difficulties have been shown to be attributable to organisational problems, secondary to executive dysfunction (Diamond et al., 1997).

In summary, both bilateral confabulating patients and frontal controls showed some degree of new learning and remote memory impairment. However, this was more marked in the confabulating than the frontal control patients and in the former it appeared similar in degree to that of the amnesic group. These results indicate that confabulation in these patients was linked with severe retrograde and anterograde amnesia and hence are consistent with previous studies which indicate that amnesia is necessary for confabulation of this type to occur (Talland, 1965; Talland et al., 1967; Vilkki et al., 1985; Deluca, 2000 for review). However, the present results also indicate that the presence of amnesia is not a sufficient condition for memory-related confabulation to occur. Instead, some specific memory dysfunction (e.g. temporality or strategic retrieval deficit) or the combination of additional deficits (e.g. see discussion on the Confabulation Battery above) may be causative of memory-related confabulation.

By contrast, amnesia did not appear as a necessary condition for the occurrence of motor-related confabulation. The C3 group showed only selective memory deficits, including problems in orientation and new learning of visual information. Their defective performance in visual memory could be caused or at least exaggerated by their confirmed visual difficulties of non-neurological origin, as well as by their impaired perceptual organisation and visuo-constructional abilities. The latter is supported by their defective performance on the copying

component of the Rey Complex Figure and their low scores on the corresponding WAIS-III subtests. Thus, it appears that right-hemisphere patients did not show a generalised memory deficit, and thus their confabulation could not be explained in the same way as the one of the bilateral groups. However, one could argue that their impairment in perception and construction, and its resulting deficit in visual memory, may have led to the emergence of confabulation. This would also be consistent with the finding that in two out of three of the right-hemisphere patients assessed confabulation was accompanied by delusional misidentifications (See DO's case report in Appendix A3 and AO's case-study in Chapter 7). However, the findings of the present study do not fully confirm such hypothesis. First, these patients also showed problems in orientation comparable to the ones of bilateral amnesic patients. More crucially, the confabulations of these patients were not limited to their motor (hemiplegia) or perceptual (neglect) deficits (see also Confabulation Battery section below). Although impairment in visual memory could have contributed to the development of delusional misidentifications, further neurocognitive mechanisms need to be postulated in order to explain the recall of false autobiographical events in everyday life and during formal testing.

#### 2.8.5 Hypothesis 3: Executive dysfunction is a common, but variable component of confabulatory syndromes.

Bilateral confabulation groups showed a wide-ranging executive functions impairment as compared to normative data and amnesic controls. This was true for both the C1 and C2 groups. Despite some demographic differences between these two groups they showed comparable degree of impairment in executive functions, although the pattern of impairment varied across tests. These findings imply that the neuropathologies of both groups caused structural or functional damage to frontal circuits, even though this was not detectable by neuroimaging investigations in every case. Similar impairments in executive functions have been noted in previous studies of confabulation (e.g. Beeckmans et al., 1998; Burgess & McNeil, 1999; Cunningham et al., 1997; Dab et al., 1999; Damasio et al., 1985; Fisher et al., 1995; Johnson et al., 2000; Kapur & Coughlan, 1980; Kern et al., 1992; Kopelman, 1987; Luria, 1976; Mercer et al., 1977; Moscovitch & Melo, 1997; Shapiro et al., 1981; Stuss et al., 1978). However the issue of whether confabulating patients can be distinguished from other frontal or amnesic non-



confabulating patients on the basis of their performance in 'frontal' tests is less clear in the literature (see Dalla Barba et al., 1997; 1998; Kopelman et al., 1997; Moscovitch, 1995; Schnider, 2003; for discussions), as is the question of which aspects of the 'dysexecutive syndrome' are critical for confabulation to occur (see Burgess & Shallice, 1996; Burgess & McNeil, 1999; Kopelman et al., 1997; Moscovitch, 1995 for discussions; see also Chapter 1).

In the present study, confabulating patients performed worse than frontal control patients on a variety of tests of executive functions but these differences were significant only on certain tests and conditions. These included measures of cognitive flexibility, such as verbal fluency (semantic fluency measure and error measures) and set-shifting errors (sorting perseveration measure), certain aspects of inductive and deductive reasoning, concept formation and abstract thinking (Word Context, 20 Questions D-KEFS subtests and the Cognitive Estimates Test, but not the Proverbs subtest or the description condition of the Sorting subtests) and a demanding test of simultaneous application of inhibition and switching abilities. This complex pattern of impairment does not allow precise behavioural-anatomical conclusions, as the above deficits have been linked with lesions to distinct prefrontal cortex areas. However, according to the proposal of Stuss and colleagues (2002), the striking difference in the performance of confabulating patients between the semantic and letter fluency tasks, not shown by the frontal controls, suggests that the confabulating patients had lesions in the 'anterior medial' (OMPFC) and not the superior medial or the dorsolateral prefrontal cortex. These observations are consistent with both the neuropathological data of this study (see above), as well as previous studies on confabulation (Damasio et al., 1985; Moscovitch & Melo, 1997; Schnider et al., 1996). Crucially, these findings are consistent with the clinical observations about the poor emotional inhibition and self-regulation of these patients, their lack of insight into their postmorbidity condition and their poor social conduct. These impairments are less understood than other prefrontal cortex symptoms and very few assessment tools have been developed for their investigation (see Bechara et al., 2000; Knight & Stuss, 2002, for discussion). Nevertheless, recent studies have linked such behavioural problems with the orbitofrontal and ventromedial regions of the prefrontal cortex (see Bechara et al., 2000; Berlin et al., 2004; Rolls et al., 2000; Shimamura et al., 2000; Tranel et al., 2002). The following experimental chapters

of this thesis will address the potential functional role of these regions in confabulation (see Chapters 3, 4, and 5).

Finally, although the assessment of executive functions in the three unilateral confabulating patients was complicated by their visual, visuo-constructive and emotional problems, the main executive functions impairment of the patients of this group appeared to be their difficulty to inhibit and monitor automatic responses and their ability to systematically search and repeatedly retrieve information from a given semantic category. These deficits were also observed in bilateral confabulating patients. Most crucially, this group also showed difficulties in insight, social conduct and emotional regulation. While bilateral patients showed generalised indifference and lack of motivation, with spells of euphoria or irritability, unilateral patients were constantly overwhelmed by anxiety and negative feelings, and were extensively preoccupied with their surroundings and their treatment (despite denying their disabilities). Both groups showed socially inappropriate behaviour.

In conclusion, executive dysfunction as measured by standardised 'frontal tests' was associated with both memory- and motor-related confabulation, but the pattern of impairment across tests and across patients was too varied to allow reliable differentiation of confabulating patients from other non-confabulating frontal patients and it was not sufficient to explain its occurrence (Hypothesis 2). Instead, confabulation may relate to a more specific impairment in affective regulation, linked with lesions to the OMPFC. Finally, it is important to note, that given the small number of amnesic and frontal patients addressed in the present study and the varied results of the tests administered, these findings should be treated as indications for further study rather than reliable conclusions.

#### 2.8.6 Summary & Conclusions

The study assessed thirteen patients with indications of confabulation. All patients showed severe forms of confabulation, as rated on a number of qualitative dimensions, including frequency, novelty, plausibility, conviction and production mode and were differentiated from a number of frontal and amnesic controls based on these behavioural criteria. These qualitative distinctions were confirmed by quantitative investigations, which also revealed that confabulating patients

confabulated mostly about autobiographical information and facts, but also in response to semantic memory questions. Among the confabulating patients confabulation tendencies were more pronounced in patients with bilateral lesions, although these patients showed less conviction in their confabulations. The symptom disappeared or was substantially reduced in most of these patients following a few months. Confabulation was less frequent in Korsakoff patients and produced more often by questioning. However, these patients were tested while in the chronic state of their disease. Finally, in patients with isolated right-hemisphere lesions confabulation was mostly motor-related and it extended to autobiographical memory less frequently. It also showed a number of other qualitative differences, it was accompanied by delusional false beliefs and in two out of the three recruited cases the symptom was persistent several months following its onset.

The neuroanatomical region most commonly identified by neuroimaging investigations as damaged in confabulating patients was the OMPFC and associated areas of the anterior limbic system. However, lesion localisation in some patients was not precise enough to allow definite conclusions regarding the neuroanatomical basis of confabulation. Thus, these findings provide only partial support for the first hypothesis of the study. However, this hypothesis received additional support from the clinical observations and the neuropsychological assessment of the confabulating patients, which revealed deficits in emotional regulation and 'frontal functions' associated with the OMPFC. More general executive dysfunction was present in all confabulating patients, but great variability was observed across tests and between patients. In addition, no clear pattern of executive functions deficit differentiated confabulating patient from non-confabulating frontal controls, although some interesting differences were observed. Thus, executive dysfunction as measured by 'frontal tests' might be a necessary, but not a sufficient component of confabulation. Finally, some degree of memory impairment was observed in all confabulating patients, but clinical amnesia was not sufficient to explain confabulation and it was not even necessary for the production of motor-related confabulation.

## Chapter 3 : Positive Emotional Bias in Confabulation

### *Wishful Reality Distortions in Confabulation*

*"Since the syndrome occurs in relation to an exogenous cause, and since definite neuropathology is present, it is easy to "see" that the mental symptoms are strictly related to the organic findings of the brain; consequently, one loses sight of the possible emotional aspects of the disorder. Indeed, the voluminous literature on the subject carries only scattered references to the role of affectivity in the problem. However, having observed patients with Korsakoff syndrome daily in hospital over a period of many years, I became first conscious – and later – convinced of the role of affectivity in the release of the syndrome."*

G. M. Davidson, M.D., 1948 *Psychiatry Quarterly*

### 3.1 Introduction

Classic neurological and psychiatric descriptions of confabulation include several indications of wishful, grandiose or self-serving content (e.g. Berlyne, 1972; Betlheim & Hartman, 1924; Clarke, Wyke, & Zangwill, 1958 in Talland, 1961; Flament, 1957, in Berlyne, 1972; Moll, 1915; Weinstein, Kahn, & Malitz, 1956; see also Chapter 1: Introduction). However, most recent models of confabulation do not directly address this issue (Fotopoulou et al., 2004 for review). Evidence from recent single-case studies (e.g. Conway & Tacchi, 1996; Fotopoulou et al., 2004) suggest that confabulation may be motivated and subject to emotional biases. In addition, these studies emphasise the significance of considering the relation between impaired cognitive functions and emotional or 'self' biases in confabulation (Burgess & McNeil, 1999; Conway & Tacchi, 1996; Downes & Mayes, 1995; Fotopoulou et al., 2004; Solms, 2000; Turnbull et al., 2004a).

The following experiment, based on a methodology developed by Fotopoulou and colleagues (2004), aims to address one crucial aspect of confabulatory content, namely its emotional valence. Although different laboratories have observed positive self-bias in single-case studies (Conway & Tacchi, 1996; Fotopoulou et al., 2004; Kaplan-Solms & Solms, 2000) and in a metaanalysis (Turnbull et al., 2004a), the valence of confabulation has never been directly investigated in a group study. In addition, potential differences in valence

between different confabulatory syndromes (e.g. memory-related versus motor-related confabulation) have not been examined.

The method developed below also addresses the complex issue of ‘control’ investigations in confabulation: confabulation in neurologically healthy subjects or neurological non-confabulating subjects, e.g. amnesic non-confabulating controls, can only be studied in experimental conditions which guide the production of false memories. However, existing experimental paradigms that elicit false memories in controls (Barclay & DeCooke, 1988; Loftus, 1993; Loftus, Miller, & Burns, 1978; Loftus & Pickrell, 1995; Suengas & Johnson, 1988) do not require the controls to generate material from their own autobiography. Typically, all (Heaps & Nash, 2001; Hyman & Billings, 1998; Hyman & Pentland, 1996; Johnson, Foley, Suengas & Raye, 1988; Kopelman, 1987; Suengas & Johnson, 1988) or only some 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 that allows them to spontaneously choose the theme, temporal reference, importance, amount of detail and emotional valence of each memory produced.

In summary, this experiment will address the fourth main hypothesis of the study, namely *the content of spontaneous confabulation is wishful, i.e. it shows a positive emotional bias* (see Chapter 1). With this aim, the study will compare the valence of confabulations in three experimental groups (confabulating patients, non-confabulating amnesic controls and healthy controls).

## 3.2 Materials and Methods

### 3.2.1 Participants

Ten confabulating patients of the thirteen forming the Confabulation Group (see Chapter 2) were tested (it was not possible to test patients MS, IR and PT due to time restrictions). This group was also subdivided into three subgroups based on neuropathological data, confabulation criteria and neuropsychological performance (see Chapter 2): The Bilateral Group (N = 7), consisting of the three

Korsakoff patients of the confabulation group (C2 subgroup) and the rest of the bilateral patients (C1 subgroup) and the C3, Unilateral Confabulation subgroup (N = 3). The amnesic (N =3) control groups (see Chapter 2) were tested as control subjects. The frontal control group was not included in this experiment as the control task was judged as cognitively too demanding for the patients in this group. Ten healthy subjects, individually matched to the confabulating patients for sex, age and educational level, were also recruited as control subjects. They were 3 females and 7 males, with mean age 58.4 years (SD 18.3) and mean years of education 10.8 (SD 1.8). All subjects, including raters (see below), gave written informed consent.

### 3.2.2 Materials

Confabulations were elicited and measured in both confabulating patients and controls using and adapting the method developed by Fotopoulou and colleagues (2004):

**Confabulating Patients:** Each patient underwent one 45- to 90-minute interview. These interviews were unstructured and minimally guided. The examiner's role was restricted to introducing her interest in the patient's life and memory and setting initial everyday conversational questions. The patients were allowed to choose the theme, temporal reference, amount of detail and emotional valence of each topic discussed. During the interview the examiner reflected patients' statements and asked for clarifications when necessary but did not confirm or contradict their claims, and maintained a neutral reaction to all statements. The interviews aimed at obtaining representative samples of the patients' confabulations, as these spontaneously occurred in their everyday interactions. The interviews were digitally recorded on a mini-disk recorder and fully transcribed.

An unselected, consecutive list of the first 20 confabulations, as these occurred in the transcripts of each patient, was selected with the aid of relatives, staff and medical files. Inclusion criteria were false memories or beliefs stated by the patient regarding any past, present or future object (event or fact), as determined by the verified information provided by relatives, caring staff and medical notes. Exclusion criteria included correct information (non-confabulatory

valid memories or thoughts) or information impossible to check by available corroboration sources and contradicting the corresponding 'true' information. However, 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' (see below). The sequence of the confabulatory material was preserved for each patient as the natural unfolding of the conversations often revealed the bizarreness of a memory, or helped establish its implausibility.

Ten different lists of 20 confabulations were formed, one for each patient. The confabulated statements were set in bold letters, for purposes of identification. Each confabulation was accompanied by information about the context in which it arose, e.g. the more general topic of discussion at the moment, as well as (verified) 'real' information, set in parentheses. Relatives, staff or medical files provided the 'real' information distorted or replaced by the corresponding confabulation. For example, when patient BA claimed that he has only one child, his wife and his medical notes indicated that he in fact has two. Similarly, when RM claimed he was 'player of the year' for three consecutive years at school his mother confirmed that this was true, but only for one year (see Appendix B1 for more examples).

**Controls:** Amnesic control patients and healthy controls were asked to 'simulate' confabulations in the following way: Initially, they were instructed to recall 20 self-referential memories of their choice. Participants were told that their memories could involve any topic of their lives, could be recent or remote, short or long, important or trivial, emotional or neutral. After each subject had completed this task their statements were read out back to them and they were asked to alter each statement consecutively in a way that led to the creation of false memories. These were defined as self-referential events or facts, which distorted the past experience in some way or which were completely incongruent with the original memory statement. Participants were told that the 'falsification' of their memories could be performed by distorting the existing facts, inventing, adding or subtracting information, mixing different events or thoughts between them, or by placing events in a wrong temporal or spatial context. Thus, the resulting false memories could have varying degrees of consistency with the

participants' previous statements, depending on their choice. The essential requirement was that their second statements altered the first ones in at least one aspect. The goal of this procedure was to 'teach' control subjects how to produce self-referential false memories that were similar in nature to spontaneous confabulations (as produced by patients) and yet had content that was chosen at will.

To assist controls further in understanding and appropriately carrying out the task, confabulation examples were randomly selected from the transcripts and read out to them. These included one confabulation from each patient's transcripts and were presented to controls accompanied by 'verification' information. The latter true statements about each patient were first read out to controls followed by the corresponding confabulation each patient had produced (see Appendix B2). These showed great variability in content and other memory characteristics e.g. emotional valence, temporal reference and degree of reality distortion. These differences were pointed out to the subjects, and it was explained that they could construct false memory statements in any, some or all of these possible ways depending on their preferences. The goal of this procedure was to provide control participants with a random and rich repertory of confabulation types.

Controls' statements were recorded verbatim and for each of the 13 control participants (3 amnesic and 10 healthy participants), a list of 20 false statements, each followed by corresponding reality information, was constructed. The overall questionnaire format was identical to that of confabulating patients (see Appendices B3 and B4).

### 3.2.3 Scoring

The 23 'confabulation' lists, here referring also to false statements generated by controls, were assembled together in random order and presented to two naïve raters (judges) as 'false memories that different neurological patients have produced'. The judges were two postgraduate students at the University of Durham (non-psychology students), one male and one female, ages 33 and 29 years respectively. They were volunteers, blind to the hypotheses of the experiment and were paid for participating in the study.



The judges were asked to rate whether the 'self' (in this context defined as self-representation, i.e. the representation of one's own identity, character, social image and position, psychological and physical state etc) in the confabulated events described by patients and controls, in comparison with the 'self' in the corresponding reality (i.e., the events and facts distorted or replaced by confabulations), was described as positive (enhanced self-representation) or negative (diminished self-representation). Self-enhancement and diminution were defined based on a long tradition of measuring self-representations in autobiographical memory (e.g. McAdams, 2001; Nelson, 2003; Wilson & Ross, 2003). More specifically, self-enhancement was defined as a self-representation that included a positive outcome for the self or a decidedly positive-affect state. Examples included: pleasure, growth, efficacy, confidence, understanding, recovery, gain, praise, recognition, learning, improvement, gratification, and strengthening of desired interpersonal relations or ultimate concerns (e.g. religious beliefs). By contrast, self-diminution was defined as a self-representation that included a negative outcome for the self or a decidedly negative-affect state. Examples included: displeasure, reduction, decrease, incompetence, fear, anger, sadness, fall, loss, deterioration, insult, offence, abuse, annoyance, and weakening of desired interpersonal relations or ultimate concerns. Ratings were given on a 7-point Likert-type scale, anchored at 1 = Extremely Negative to 7 = Extremely Positive. 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.

The following example illustrates the format and rating procedure of the confabulation questionnaire. Thus, in the following instance the judges had to decide, using the 7-point scale, whether WM's false statement regarding his reason for hospital attendance that morning was more positive or more negative for his self-representation than the corresponding reality, which in this case was the fact that he was in the hospital for a neurological examination:

**Example: WM, Confabulation 4**

The patient believes his deceased parents are alive but lost. While talking to the examiner about them he suddenly asks:  
 “Would you be able to help me find them? This is what I am here for, isn’t it”  
 [No, I am afraid I wouldn’t be able to help you. Is that why you are here today?]  
**“I’ve come for my sister, bringing er, the child. To help her, you know. She is ill”.**  
 [In reality, the patient had an out-patient appointment with the neurologist that morning and a subsequent session arranged with the examiner. His sister and her 5-year old daughter were accompanying him. They were not present during this examination and neither of them was ill.]

Is the patient’s self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1----2----3----4----5----6----7 Extremely Positive*
- (b) *Impossible to judge*

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

This particular confabulation received a mean rating of 5 (see Appendix B1 for more examples).

In summary, this experiment used the above method of collecting and rating confabulation material, in order to compare the valence of confabulations (dependent variable) in three experimental groups (confabulating patients, non-confabulating amnesic controls and healthy controls) (independent variable).

### 3.3 Results

#### 3.3.1 Inter-rated Reliability

Inter-rated reliability, calculated using Pearson’s correlation, resulted in a satisfactory reliability coefficient for self-representation rating of + .84. In order to avoid confounding the data analysis with confabulations that raters had evaluated as “Impossible to judge”, if a confabulation was scored as such by both raters this was excluded from the analysis. In the case that only one of the raters could not judge a confabulation they discussed their different perspectives. More generally, in cases of disagreement the following rules were followed: If the two

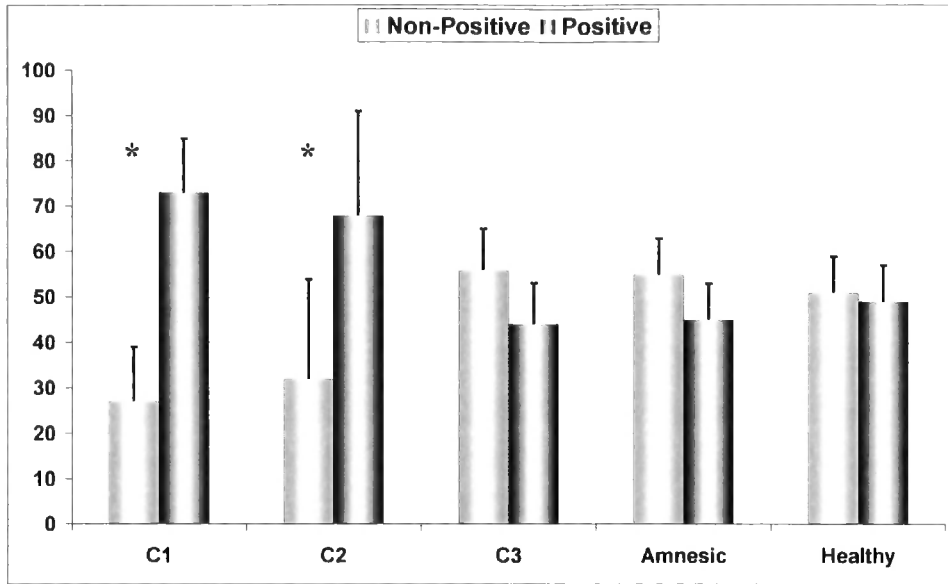
raters had judged a particular confabulation as positive or as negative, but their ratings differed in degree (e.g. rater A = 5 and rater B = 6, or rater A = 1 and rater B = 2) then the mean was calculated. The same applied to the cases where one of the raters had judged a given confabulation as neutral and the other had rated it as positive or as negative (e.g. rater A = 4 and rater B = 5). When, however, the two raters had rated a confabulation on opposite sides of the scale (e.g. one as positive and the other as negative) then they were asked to discuss their differences. The same applied to cases when only one rater had found a confabulation impossible to judge.

Kruskal-Wallis, non-parametric tests were used to analyse the differences in valence ratings for the three experimental groups (Confabulation, Amnesic and Healthy Controls). Planned contrasts between the bilateral confabulation subgroups and the controls groups and between the unilateral confabulation subgroup and the control groups were also performed to locate the origin of the overall differences between the groups. These were based on the differences in quality of confabulation and neuropsychological performance observed between the bilateral and unilateral confabulation subgroups (see Chapter 2). The critical level was corrected for multiple comparisons using Bonferroni adjustments.

Frequencies were calculated based on the 7-point scale. Mean ratings equal or below 4.5 (approximating the 4/7 Likert mid-point) were considered non-positive, while mean ratings above 4.5 were considered positive. Chi-square goodness-of-fit tests were performed for the ratings of each group to assess whether the groups showed valence preferences.

### 3.3.2 Amount of Positive Versus Non-positive Confabulations

The frequencies and corresponding percentages of positive versus non-positive confabulatory self-representations for each group were calculated. Figure 3-1 below depicts the percentages of positive and non-positive self-representations in each of the experimental groups.



Note. \* Indicates significant differences between the percentages of positive and non-positive self-representations.

**Figure 3-1. Percentages of positive and non-positive self-representation ratings across groups**

Confabulating patients produced in total 113 positive confabulations and only 65 non-positive confabulations; 22 of their statements were judged as impossible to rate (see Appendix B5 for patients' individual scores). Binomial goodness-of-fit tests for each group revealed significant differences in valence for the confabulation group,  $p < .05$ , but not for the amnesic,  $p = .3$ , or the healthy controls,  $p = .9$ . Frequencies of positive versus non-positive self-representations were also calculated for the confabulation subgroups. Binomial goodness-of-fit tests revealed significant differences in valence for the C1 subgroup,  $p < .0001$ , and the C2 subgroup,  $p < .005$ , but not the C3 subgroup,  $p = .3$ . These results indicate that the statistically significant difference in the number of positive versus non-positive confabulatory self-representations found in the confabulation group was mainly attributable to the behaviour of bilateral confabulation subgroups. Interestingly, while unilateral confabulating patients produced more positive self-representations in their confabulations these were accompanied by an almost equal number of negative confabulations and very few neutral confabulations.

3.3.3 The Degree of Emotional Bias

The mean valence ratings of each of the confabulating patients with bilateral lesions (subgroups C1 and C2) was greater than 5, except patient CM whose mean was 4.5. By contrast the three unilateral patients had means that ranged between 3 and 5, while amnesic patients had means ranging between 4 and 5, as did most of the healthy participants (see Appendix B6 for individual scores). The mean valence ratings of each group are shown on Table 3-1 below.

**Table 3-1. Mean valence ratings by group.**

Group	Valence		
	<i>N</i>	<i>Mean</i>	<i>SD</i>
<b>Confabulation Group &amp; Subgroups</b>			
Total	10	4.8	0.8
C1- Bilateral lesions	4	5.4	0.4
C2- Korsakoff	3	5.1	0.7
C3- Unilateral lesions	3	3.8	0.5
<b>Control Groups</b>			
Amnesic Controls	3	4.4	0.1
Healthy Controls	10	4.6	0.3

The confabulation group showed on average higher valence ratings than amnesic and healthy control participants. However, a non-parametric, Kruskal-Wallis, test with Group (Confabulation, Amnesic and Healthy Control groups) as the between-subjects factor, revealed these differences were not significant,  $\chi^2(2) = 1.9, p = .4$ . The bilateral confabulation groups showed on average higher positive ratings than unilateral confabulating patients and a Kruskal-Wallis test with Subgroup as the between-subjects factor (C1, C2 and C3) showed that these differences were significant,  $\chi^2(2) = 9, p < .05$ . Thus, the three subgroups were compared with control groups in a subsequent different analysis. A Kruskal-Wallis test with group as the between-subjects factor (C1, C2, C3, amnesic patients and healthy controls) revealed significant differences in valence between the groups,  $\chi^2(4) = 14.2, p < .01$ . Planned contrasts, using corrected critical alpha level  $\alpha = .025$ , further revealed that the bilateral confabulation subgroups (C1 and C2) showed significantly higher valence than the control groups,  $\chi^2(3) = 9.8, p < .025$ , while the valence ratings for the unilateral confabulation subgroup (C3)

were not significantly lower than those for the control groups,  $\chi^2(2) = 14.2$ ,  $p = .06$ .

### 3.3.4 Valence & Mood

In order to assess whether the above valence ratings of spontaneously produced confabulations related to patients' mood, as measured by the HADS, (see Chapter 2 and also see Appendix B7 for individual scores) Pearson correlational analysis were performed. There was no significant statistical association between the valence ratings and the depression HADS scores in the confabulation,  $r = -.1$ ,  $n = 10$ ,  $p = .7$  or in the amnesic group,  $r = .6$ ,  $n = 10$ ,  $p = .6$ . There was also no significant statistical association between the valence ratings and the depression HADS scores in the confabulation,  $r = -.2$ ,  $n = 10$ ,  $p = .7$  or in the amnesic group,  $r = .9$ ,  $n = 10$ ,  $p = .4$ .

In summary, the above results indicate that whilst most groups showed a bias in including more positive self-representations in their false memories than in their real memories, there was a statistically significant difference in the number of positive representations that confabulating patients included in their false statements. This was mainly attributable to the bilateral confabulation subgroups (C1 and C2), which produced more positive rather than negative or neutral self-representations in their confabulations than any other group. In addition, the confabulations of these subgroups were more positive in degree than those of the control groups. Amnesic non-confabulating patients and healthy controls did not show emotional biases of such magnitude in their results, although similarly to the bilateral confabulating patients they did show a tendency to represent themselves in more positive terms during false memory construction. By contrast, unilateral confabulating patients produced more negative confabulations than any other group and the overall valence mean of their confabulations was more negative than that of the control groups, although not significantly so. These differences in confabulation valence were not associated with differences in mood.

### 3.4 Discussion

The findings of the above study confirm the hypothesis that confabulating amnesic patients show a positive emotional bias in their confabulations (Hypothesis 4, Chapter 1). In particular, in their false memories patients show the tendency to present themselves in more positive (self-enhancing) terms. This tendency was also observed in the false memories constructed by healthy control participants and amnesic non-confabulating patients but to a significantly lesser degree. This investigation represents the first group study, known to the author, to demonstrate experimentally a positive emotional bias in confabulation. In addition, these results supplement the similar findings of a previous single-case study of wishful confabulation (Fotopoulou, et al., 2004) and a retrospective study of published cases (see Turnbull et al., 2004a). Finally, these findings provide the grounds for meaningful comparisons between emotional bias in neurological confabulation and normal memory distortion. These issues will be briefly discussed in turn below and further addressed in the final Discussion chapter of the thesis (Chapter 8).

#### 3.4.1 Wishful Content: Positive Emotional Bias in Confabulation

The hypothesis that confabulation is motivated is almost as old as the description of the symptom itself and has taken various, but not always equivalent forms (See Chapter 1: Introduction). For example, Bonhoeffer already in 1901 (in Berlyne, 1972) stated that confabulation represents a motivated *ad hoc* attempt to cover up memory gaps and escape the embarrassment introduced by amnesia. Williams and Rupp (1938) argued in favour of premorbid personality influences in confabulation and Weinstein and colleagues (1955; 1956) saw the symptom as a purely psychopathological mechanism serving to deny the devastating facts of injury. A series of other authors ascribed motivation a primary, or at least secondary, role in the production of confabulation (e.g. Betlheim & Hartmann, 1924; Conway & Tacchi, 1996; Davidson, 1948; Gainotti, 1975; Linz, 1942 in Berlyne, 1972; Moll, 1915; Van der Horst, 1932).

More importantly for the present chapter, whether the above studies consider confabulation motivated or not (i.e. they consider motivation as causative of confabulation or not), several studies have presented clinical observations of

emotionally biased confabulations (i.e. they have documented the phenomenon). These descriptions emphasise that the produced falsifications involve mostly issues of great affective stamp (Mercer et al, 1977) or marked personal significance (Burgess & McNeil, 1999; Conway & Tacchi, 1996; Clarke, Wyke, & Zangwill, 1958; Downes & Mayes, 1995). Confabulations also include personal grandiose references (Berlyne, 1972; Clarke, Wyke, & Zangwill, 1958, in Talland, 1961), metaphorical representations of current problems (Betlheim & Hartman, 1924; Jorn & Rybarczyk, 1995; Sabhesan & Natarajan, 1988; Weinstein, 1996; Weinstein et al, 1956), “autobiographic information more appropriate to the patient’s ideal than actual self” (Talland, 1961) or, aspects of past experience that have been important sources of self or social identity and that have provided significant channels of social relatedness (Conway & Tacchi, 1996; Gainotti, 1975; Moscovitch, 1989; Moll, 1915).

Nevertheless, until recently no direct experimental evidence supported such clinical descriptions. The findings of the present group-study, building upon recent case-reports (Conway & Tacchi, 1996; Fotopoulou et al., 2004; Solms, 2000; Turnbull et al., 2004a), show that the content of confabulation is indeed, as some clinicians have reported, largely pleasant and self-enhancing. Furthermore, this emotional bias appeared to be independent of patients’ mood. This finding further suggests that the role of emotions in confabulation requires further investigation. Moreover, as psychological and neuroscientific knowledge of both emotions and of memory has progressed significantly, the issue of motivation in confabulation could be updated, re-defined and re-addressed in the context of current perspectives on the relation between memory and emotion. This perspective will be further elaborated in Chapter 8.

#### 3.4.2 Valence & Confabulation Subgroups

Before proceeding to the following chapter it is important to highlight and discuss that despite the overall valence effects, not all confabulation subgroups showed positive emotional bias in their false memories. Confabulating patients with bilateral lesions with (C1 subgroup) and without (C2 subgroup) Korsakoff syndrome showed marked positive emotional biases in their confabulatory self-representations, despite their demographic and neuropathological differences and consistently with their similar performance in relevant neuropsychological tests.



This bias was positive on average across patients but also across each patient's confabulations. Instead, the above findings indicate that there was a difference in confabulatory content between confabulating patients with amnesia and bilateral prefrontal cortex damage and confabulating patients with unilateral lesions and without generalised amnesia. The latter showed on average, as well as individually a negative emotional bias in their confabulations, albeit not significant in comparison with controls. Despite the small number of unilateral confabulating patients assessed in this study this finding calls for attention and it will be further investigated in Chapters 5 and 7.

#### 3.4.3 Valence & Mood

Turnbull and colleagues (2004b) have suggested that the production of wishful confabulations is most frequently associated with instances of decreased mood. However, in the present study there was no association between confabulation valence and negative mood (anxiety and depression levels). Nevertheless, the assessment of mood in the present study was limited to the HADS results. Further study with wider assessment of mood states, including positive dimensions, is required in order to investigate the relationship between mood and valence in confabulation. This issue is further addressed in Chapter 5.

#### 3.4.4 Summary

The findings of this experiment confirmed the hypothesis that confabulating patients show a positive emotional bias in their spontaneous confabulations. In particular, in their false memories bilateral prefrontal patients show the tendency to present themselves in more positive (self-enhancing) terms. This tendency was also observed in the false memories constructed by healthy control participants and amnesic non-confabulating patients but to a significantly lesser degree. There was a valence difference in confabulatory content between confabulating patients with amnesia and bilateral prefrontal cortex damage and confabulating patients with unilateral lesions and without generalised amnesia. These issues are further investigated in the following two experimental group-studies (Chapters 4 and 5) and are further discussed in the final chapter of the thesis (Chapter 8).

## Chapter 4 : The Role of Emotions in Temporal Confusion

### *'The stuff that confabulations are made of'*

*"I have done that" says my memory. "I cannot have done that" says my pride, and remains inexorable.*

*Eventually-memory yields".*

*Nietzsche (Beyond Good & Evil, 1986/1966, p. 80)*

*"Who controls the past", ran the Party Slogan, "controls the future: who controls the present controls the past".*

*Orwell ('1984', 1949 p. 32)*

### 4.1 Introduction

One of the earlier explanations of confabulation stresses the inability of confabulating patients to retrieve events in their appropriate temporal context (Korsakoff, 1889/1996; Van der Horst, 1932; see also Talland, 1961). More specifically, it suggests that confabulating patients may have lost the 'temporal signposts' that normally allow individuals to retrieve events in their proper temporal order and context. Instead, confabulating patients tend to retrieve experiences of irrelevant chronological frames and falsely combine events and information relating to separate experiences or even lifetime periods. This hypothesis has been recently revived and further developed in two different versions (see Chapter 1 for detailed description of these theories). In a series of studies Dalla Barba and colleagues (see Dalla Barba, 2001 for review) have suggested that it is not chronology itself that is impaired in confabulating patients. Instead, the critical impairment in confabulation is the experience of time flow in consciousness, i.e. subjective temporality. In a compromised state, patients' consciousness cannot complete the adequate tasks required to utilise normally a-temporal information and memory traces to set up a personal temporal framework. Relying on a well-replicated experimental design, Schnider and colleagues (see Schnider, 2003 for review) proposed a similar view of confabulation. In a series of experimental studies they showed that confabulating patients could not distinguish between memories that pertained to ongoing reality and memories that did not. More specifically, confabulators appeared unable to inactivate evoked

memories that did not pertain to current reality and therefore they continuously retained in consciousness presently irrelevant memories.

Despite their potential differences the above models share three underlying assumptions, which will be addressed by the present study:

1. Confabulations always derive from actual past experiences misplaced in time or erroneously assorted with events from different periods.
2. Severely confabulating patients do not differ from amnesic, non-confabulating controls on executive functions tests (Schnider et al., 1996; Schnider, 2003) and 'frontal lobe' pathology is not necessary for confabulation to occur (e.g. Dalla Barba et al., 1993b; 1999)
3. The cognitive impairment that restrains confabulating patients from retrieving temporally appropriate information should lead to a *random* selection and retrieval of currently irrelevant and thus false events (or at least to a random selection within the limits of habitual and personal semantic information; Dalla Barba et al., 1997).

The first assumption, which lies at the heart of distinctions between confabulation and fabrication (Talland, 1961), or between simple versus fantastic confabulation (Berlyne, 1971), is not supported by a number of studies which documented confabulations unrelated to patients' previous experiences (Damasio et al., 1985; Fotopoulou et al., 2004; Kopelman et al., 1997; Moll, 1915; Villieus et al., 1996; see Chapter 1 for discussion). By contrast, the similar yet less restrictive theory put forward by Johnson and colleagues (Johnson et al., 1997; 2000) maybe more appropriate for describing confabulation in both forms, i.e. as true memories misplaced in context and as false memories erroneous in themselves (Kopelman, et al., 1997). This theory postulates that is not only temporal context or conscious temporality that is erroneously attributed to confabulated memories. Instead, confabulations could derive from a variety of source or context misattributions, including the misattribution of 'reality' to events never experienced, such as those included in dreams or fantasies (see also Chapter 1).

The second assumption is countered by a number of studies which have shown distinctive frontal lobe lesions and corresponding impairments in

confabulating patients (see Chapter 1). However, several of these authors have also emphasised that executive impairment is a conceptualisation too varied to be reliably measured by corresponding tests and applied to explanations of complicated syndromes such as confabulation (Burgess & McNeil, 1999; Gilboa & Moscovitch, 2002; Kopelman et al., 1997; Deluca, 2000; see also Chapter 2).

The third assumption is contradicted by clinical (e.g. Conway & Tacchi, 1996; Berlyne, 1972; Kaplan-Solms & Solms, 2000; Weinstein, 1996) and experimental (Fotopoulou et al., 2004; Turnbull et al., 2004) studies, as well as results of the present investigations (see Chapter 3) which show that confabulatory content may be highly specific, constant and emotionally biased (see also Burgess & McNeil, 1999; Downes & Mayes, 1995). Thus, it appears that although the retrieval of information from memory may no longer be constrained by current reality and temporality criteria as these models postulate, it may not be randomly retrieved. Instead, other mechanisms may determine which memories are selected for retrieval and which are attributed to reality. Burgess & McNeil (1996) and Dalla Barba and colleagues (1997) have shown how personal habits, personal semantic information or personally significant themes may guide confabulatory recollection. More specifically, Conway and Tacchi (1996) suggested that personal goals and emotions may have a particularly salient role in confabulatory retrieval. Johnson (2001) has argued that personal and social goals, as well as beliefs may influence which memories qualify as real and which not. Kopelman (1999) emphasised the role of social context is shaping or even causing confabulation. Solms (2000) suggested that in the absence of appropriate reality criteria, desires and inner needs may have auxiliary capacity to override other representations in the competition for recollection. Finally, in a critical review Myslobodsky and Hicks (1994) have heuristically summarised this argument as follows; confabulations are “memories that want to get themselves recalled” (p. 225).

However, despite these proposals and clinical observations, the direct relation between motivational influences and impaired reality monitoring in confabulation has never been addressed in an experimental study. With this aim, an experiment was designed which manipulated the effects of emotional valence (positive versus negative), temporal source (past, present, future) and selection

agent (self versus other) on memory recognition. The experimental material was based on patients' own memories to increase the ecological validity of the study. Given the unique personal relevance of autobiographical memories, various recent experimental and neuroimaging studies have used patients' own autobiographical memories as experimental material (e.g. Fink et al., 1996; Heaps & Nash, 2001; Levine et al., 2002; Loftus, 1993; Markowitch et al., 2000; Piefke et al., 2003). In brief, the following experiment was designed to test the specific hypothesis *that confabulations are constructed according to motivational self-serving biases that influence confabulatory content, over and above the cognitive impairments of reality monitoring and temporality.*

## 4.2 Materials & Methods

### 4.2.1 Participants

The experimental participants were seven severely amnesic patients. These were four confabulating amnesic patients, from the Bilateral Confabulation Subgroup and the three non-confabulating amnesic patients of the Amnesic Control Group (see Chapter 2). Relatives' participation in this experimental procedure was essential. Thus, these patients were the only patients, whose relatives were also available at the time of the assessment for the lengthy interviewing required by this experiment. Frontal non-amnesic controls (see Chapter 2) were not tested in this experiment, in which amnesia was a prerequisite. The amnesia classification criteria were based on participants' performance on the WMS-III Auditory and Visual Delayed Memory Index Scores and the confabulation classification was based on the developed qualitative criteria of confabulation frequency, conviction, novelty, plausibility, and production mode. These classifications are fully defined in Chapter 2. Although the demographic characteristics and neuropsychological scores of the Confabulation Group and the Amnesic Control Group were presented in detail in Chapter 2, only a subgroup of the Confabulation Group participated in this experiment. Thus, the performance of the present subgroups (Confabulation versus Amnesic) on these measures was compared in a preliminary analysis. In summary, the following experimental design contrasted the performance of amnesic confabulating patients (N = 4) and amnesic control patients (N = 3).

#### 4.2.2. Materials

The study used autobiographical memory materials. The selection of these materials was based on a preliminary interview with each patient (self-selected memories) and a subsequent interview with at least one relative of each patient (other-selected memories). In this way, the factor Selection Agent was manipulated. The factor Time Reference was manipulated as follows: Each patient was asked to generate 42 self-referential autobiographical statements, 14 from each of the following three temporal categories (life-time periods): (1) 'recent past' (two to five years before), (2) 'present' or 'very recent past' (last two months) and (3) 'future' (any hypothetical time in the future). The Valence of these statements was also manipulated, in that each temporal category was divided into two valence categories: seven pleasant and seven unpleasant memories.

##### *Preliminary Interviews: Self-Selected Items*

In order not to fatigue patients with repeated questioning and to conduct the selection interview in a flexible way the various temporal and valence categories were mixed and the corresponding questions were asked in random order. Most importantly, these categories were mutually exclusive. Thus, it was explained and stressed to participants that the memory statements they produced in each temporal category should be unique in time and thus incongruent with the rest of the categories. For example, when a participant was asked to generate a memory statement about a pleasant past event that was no longer true and he did not anticipate it to be true again in the future he gave this statement: "I won a dancing competition some years ago", adding that this was no longer true as he had not taken part in such a competition ever since and he could never participate again given his age. In a different example, when he was asked to generate a statement about an autobiographical experience that was never true in the past, was not true currently but he anticipated might be true in the future the patient said: "Although he has been being lucky so far, my grandson might break his legs the way he rides the bicycle". Finally, the patient gave this statement when he was asked to produce a pleasant memory about his current (very recent) experiences that was never true in the past and he did not anticipate to be true in the future: "My daughter bought her first car last week".

Although the task did not require patients to retrieve details of the remembered events, it was anticipated that given their amnesia patients might show some difficulty in retrieving information from their past (see also AMI scores above). Thus a number of measures were taken to assist them further to complete the task. The interview was conducted in an informal, conversational tone and the patients' efforts were explicitly acknowledged throughout the task. To ensure further that patients could freely retrieve gist information about true events and facts from these periods there were no time constraints in this phase and patients were allowed to think about the various experiences they would recollect at their own pace. They were given explanations repeatedly when necessary and each of them received a fixed list of general prompts during the experiment (see Appendix C1). The goal of this procedure was to aid patients to recollect autobiographical events of their choice under experimental control.

In addition, to ensure that the events retrieved by patients were accurate and correctly placed in time, at least one relative or carer of each patient was present during the interview. Following each memory generated by patients their relatives signalled silently to the examiner whether the memory was correct or not within each condition. The patient was not informed of this feedback and his statements were not contradicted. Moreover, the patient was not informed, initially or during the interview, regarding the number of statements he would have to generate within each category. Instead, the patient was asked to generate one memory statement at a time until the appropriate number of statements was recorded. This procedure aimed at allowing the patient to generate appropriate memories without confrontation or emotional distress. If relatives could not attend the initial interview, they were asked to corroborate doubtful statements in a subsequent interview. Due to time limitations and to avoid patients' fatigue, the interview with three of the confabulating patients and one of the amnesic control patients had to take place in two successive sessions scheduled in successive days.

In order to ensure that the remembered events were balanced in valence, arousal and rehearsal frequency, and to eliminate potential outliers, following their initial recollection, the selected memories were read back to each patient. Each patient was asked to rate their valence (pleasantness rating), their emotional intensity (arousal rating) and their rehearsal frequency (thought or discussion

frequency). These ratings were given in 7-point Likert-type scales. The final questionnaire of each patient included 36 of the initial 42 memory statements (6 events in each condition) balanced for valence, arousal and rehearsal frequency (see Appendices C2 and C3 for analysis and results).

#### *Other-Selected Items*

Subsequently the examiner, based on information collected directly from relatives, staff, medical files and her observations, constructed another 36 memory statements of matched temporal, arousal and valence characteristics. These included (i) 12 (six pleasant and six unpleasant) true statements about very recent events (in the last two months) in each patient's life that had never occurred earlier in the patients' past (e.g. 'My sister came to see me in hospital yesterday'), (ii) 12 (six pleasant and six unpleasant) true events about the patients' recent past (between two and five years ago) that were not mentioned by the patient and that had occurred only once in the patients' past and were no longer true, (iii) 12 statements were constructed (six pleasant and six unpleasant) which referred to plausible yet untrue events in the patients' lives, i.e. events that could have taken place in the past, but never did and it was feasible that they could take place in the future (e.g. 'I had an argument with Bill'). Thus, these statements were matched with the future, plausible but untrue, events that the patients themselves had generated (see above). Although information provided by relatives could not fully correspond with patients' self-ratings, every possible effort was made to ensure that each of the 'implanted' events was matched in valence, arousal and rehearsal frequency to one of the events remembered by the patients themselves.

#### *Overall Questionnaire*

The overall questionnaire for each patient included 72 self-referential events, expressed in first person and in present tense. Thus, for example, if a patient had produced this following future pleasant event "I wish my girlfriend would come to see me" (Patient RM) this was altered to "My girlfriend came to see me recently". Similarly, the following event referring to the patient's past "My car was stolen some years ago" (Patient A2) was transformed to "My car was recently stolen". The various characteristics of the memory statements collected are illustrated in Table 4-1 below and accompanied by corresponding examples.



**Table 4-1. Schematic Representation of Experimental Conditions**

Currently Relevant	Selection Agent	Time Reference	Valence	No	Examples of Memory Statements ( <i>Changed to present tense</i> )
Yes	Self	Present	+	6	"My sister visited me for the first time this week"
			-	6	"Yesterday, my parents had to take my cat away"
	Other	Present	+	6	"I performed my first internet search last week"
			-	6	"I broke a glass this morning"
No	Self	Past	+	6	"I attended my brother's wedding recently"
			-	6	"I was recently hired as a waitress in Newcastle"
	Other	Past	+	6	"I went to a rock concert in London last week"
			-	6	"I lost my leather wallet last week"
			+	6	"I bought a catering business"
			-	6	"My mother was admitted to the hospital"
	Other	Future	+	6	"It is my parents' silver anniversary this week"
			-	6	"I burned our dinner last week"
Total				72	

4.2.3 Procedure

A second interview with each patient was scheduled two weeks after the first one. Patients were informed that a number of statements about currently true and false autobiographical events would be read out to them. In addition, they were told that these statements were based on true or false information collected during previous sessions and during interviews with their relatives. Their task was to judge the veridicality of each statement in their current life. All 72 items were read out to each patient in random order. It was particularly stressed to them that they had to judge whether each statement was true or not in their current life, defined as the last two months, irrespective of whether they had been true in the past or not. Thus, for every memory statement patients had to respond using one of the following answer choices:

1. This event is true in my current life (last two months)
2. This event is not true in my current life (last two months)
3. I do not know whether this event is true or not in my current life (last two months)

#### 4.2.4 Experimental Design

The experimental investigations of the study assessed patients' ability to distinguish between currently relevant and currently irrelevant 'memories' in a recognition task. The main design measured the effects of three main independent variables on memory recognition scores (two dependent variables; false positive and don't know responses). This design included one between-subjects factor, Group (confabulating versus amnesic patients) and three within-subjects factors, Valence (pleasant versus unpleasant memories), Time Reference (memories originally deriving from the 'past' versus an imaginary 'future') and Selection Agent (memories selected by the 'self' versus the 'other'). This design allowed for 2 x 2 x 2 x 2 comparisons. The effects of these factors on false positives (false recognition of past or future events as currently relevant) and 'Don't know' responses to past or future, i.e. irrelevant, events were analysed separately.

A separate design applied to the effects of the factors Group, Valence and Selection Agent on correct responses (recognition of currently relevant events), as in this analysis, the variable Time Reference was by definition constant and therefore not manipulated. Thus, 2 x 2 x 2 comparisons were allowed.

### **4.3 Results**

Given the small number of patients assessed, data were analysed using non-parametric Mann-Whitney tests for the between-subject differences and Wilcoxon Signed Ranks tests for the within-subject interactions

#### 4.3.1 Patients Characteristics

##### *Demographic Characteristics*

Confabulating patients were all male while the amnesic control participants were two males and one female. Although the groups showed great variability in age (range in years 19-64) the age of individual participants was matched as closely as possible. Thus, both groups included one participant of 19-20 years old, one of 60-64 years old and the remaining three participants were in their early forties. Non-parametric Mann-Whitney U tests revealed the two groups did not differ in age,  $Z = .4$ ,  $p = .9$ , education,  $Z = 0$ ,  $p = 1$ , or post-onset

assessment time,  $Z = .4$ ,  $p = .9$ . The groups' demographic characteristics are summarised in Table 4-2 below.

**Table 4-2. Demographic Characteristics and Memory Performance of the Experimental Groups.**

	Confabulating Amnesics	Non-Confabulating Amnesics
<b>Patients</b>	LH, RM, OT, BA	A1, A2, A3
<b>N</b>	4	3
<b>Age in Years</b>	M = 41.5, SD = 17	M = 44.3, SD = 19
<b>Education in Years</b>	M = 11, SD = 2.8	M = 10.7, SD = 2
<b>Months from Onset</b>	M = 6.7, SD = 2.2	M = 6.3, SD = 2
<b>Male: Female Ratio</b>	4 : 0	2 : 1
<b>Pathology</b>	ACoA/ SAH; TBI/ SAH; ACoA/ SAH; MI/ Hypoxia respectively	TBI; CVA; Meningitis respectively
<b>Lesion Sites</b>	F; FT; F; gen atrophy/L. F respectively	F,O; Hipp,Th; Th,cer respectively
<b>WMS-III Index Scores</b>	M (SD)	M (SD)
<i>Auditory Immediate</i>	53.8 (3.8)	58 (7.5)
<i>Visual Immediate</i>	71.8 (15)	59.7 (4.6)
<i>Immediate Memory</i>	54 (10.9)	50.3 (4.6)
<i>Auditory Delayed</i>	55.8 (1.5)	55.3 (4.6)
<i>Visual Delayed</i>	66 (9.3)	54 (4.5)
<i>Auditory Recognition Delayed</i>	57.6 (5)	62.5 (10.6)
<i>General Memory</i>	52.5 (5.4)	48.7 (4.7)
<i>Working Memory</i>	88.5 (14.5)	79 (22.9)
<b>AMI</b>		
<i>Personal Semantic</i>		
<i>Childhood</i>	14.3 (3.3)	17.5 (1.3)
<i>Adult life</i>	9.4 (1.9)*	16.2 (1.3)
<i>Recent life</i>	7.1 (5.8)	9.2 (3.3)
<i>Total</i>	30.8 (8.7)*	42.8 (3.7)
<i>Autobiographical</i>		
<i>Childhood</i>	1.8 (2.2)	3 (3.6)
<i>Adult life</i>	2 (1.4)	2 (1)
<i>Recent life</i>	1 (1.4)	1.7 (1.5)
<i>Total</i>	5 (4.2)	6.7 (4.7)

Note. Pathology: ACoA = Aneurysm of the Anterior Communicating Artery, TBI = Traumatic Brain Injury, MI = Myocardial infarction, CVA = Cerebrovascular Accident, TBI = Traumatic Brain Injury, SAH = Subarachnoid Haemorrhage; Locus: F = Frontal, P = Parietal, T = Temporal, O = Occipital Lobe, Hipp = Hippocampal region, Th = Thalamus, R = Right, L = Left, N on CT = no lesion visible on CT scan; All patients were right handed except patient RM. \* = Significant difference between Confabulating Patients and Amnesic Control Patients.

### Memory

The performance of the groups on standardised neuropsychological tests of memory are summarised in Table 4.2 above (see Chapter 2 for further details).

As expected, both groups performed on average below cut-off scores on most sections of the WMS-III and the AMI, with the marked exception of the WMS-III Working Memory Index Score, which was within normal limits in both groups. In addition, the confabulating patients performed better than the amnesic patients in the Visual Immediate Memory sections of the WMS-III but this difference was not significant,  $Z = 1.1$ ,  $p = .3$ . Mann-Whitney U tests revealed that the two groups did not differ significantly in any other WMS-III Index scores,  $ps > .1$ . In the AMI both groups remembered personal semantic information of their childhood relatively well, but their scores dropped significantly when they had to recall such information from their recent life. The confabulating patients showed an additional difficulty in recalling personal semantic information from their adult life, i.e. they showed a steeper temporal gradient in the recall of personal semantic facts. Non-parametric Mann-Whitney U tests revealed that there was a significant difference between the groups in the Adult life and Total Personal Semantic Information Scores of the AMI,  $Z = 2.1$ ,  $p < .05$  and  $Z = 2.1$ ,  $p < .05$ , respectively. There were no other significant differences between the two groups on the AMI measures,  $ps > .1$ . These results imply that despite some partial differences the two groups had overall significant and comparable memory loss for both recent and remote information and events. Most importantly, given that the present experiment used experiences and facts from the patients' recent lives, it should be emphasised that both groups showed severe impairment in the recall of recent events and facts from their autobiography.

#### *Executive Functions*

Confabulating patients were impaired on most 'frontal' tests administered (see Chapter 2 for tests' details), while the amnesic control patients performed within normal limits on most tests. Thus, overall the confabulating patients performed worse than the amnesic control participants in most but not all of the assessed frontal tests. Non-parametric Mann-Whitney U tests revealed that the performance of the two groups differed significantly on the Hayling test's Total and Error scores,  $Z = 1.9$ ,  $p < .05$  and  $Z = 2.2$ ,  $p < .05$  respectively, the Proverb test,  $Z = 2.1$ ,  $p < .05$ , the Category Fluency measure of the Verbal fluency subtest,  $Z = 2.2$ ,  $p < .05$ , the Perserivation Errors measure of the Sorting Test,  $Z = 2.3$ ,  $p < .05$ , the Errors measure of the Trail subtest,  $Z = 2.1$ ,  $p < .05$ , and the

Primary and Achievement scores of the 20 Questions subtest,  $Z = 2.1$ ,  $p < .05$  and  $Z = 1.9$ ,  $p < .05$  respectively. The performance of the two experimental groups on tests of 'executive functions' is summarised in the Table 4.3 below.

**Table 4-3. Groups' Performance on Tests of Executive Functions.**

Test	Confabulating Patients	Amnesic Patients
<b>Hayling Test</b>	2.8 (1.3)*	5.7 (1.5)
<b>Hayling Errors Score</b>	1.5 (1)*	6.3 (.6)
<b>Cognitive Estimates</b>	10.8 (4.2)	4.7 (1.2)
<b>D-KEFS</b>		
<u>Trail Making</u>		
Trail Making	1.3 (.5)	6 (5)
Switching	5 (3.6)*	13.3 (4.2)
Errors in Switching		
Switching Vs Number & Letter Reading	6.8 (3.9)	11 (2.6)
<u>Verbal Fluency</u>		
Letter	6.3 (3.4)	8 (3)
Category	1.3 (.5)*	6 (1.7)
Set-Loss Errors	6.3 (2.6)	10.6 (2.5)
Repetition Errors	4.5 (4.4)	7.3 (5.7)
<u>Design Fluency</u>		
Switching	4.5 (3.1)	7.3 (1.2)
Switching Vs Filled & Empty Dots	8.3 (3.4)	12 (1.7)
Repetition Designs	9.5 (3)	9
<u>Color-Word Interference</u>		
Naming & Reading	6.5 (4.4)	4.7 (3.2)
Inhibition	7.5 (4.3)	9 (2)
Inhibition/Switching	5.5 (6.1)	7.7 (5.7)
Inhibition Vs Naming	10.5 (3.3)	11 (3.6)
Inhibition Errors	3.3 (4.5)	6.7 (4.9)
Switching Errors	1	6 (4.4)
<u>Sorting</u>		
Correct Sorts	7.3 (1.5)	13 (5.7)
Description Score	6.5 (1.9)	5.7 (2.5)
Repeated Sorts	1*	7.3 (4.1)
<u>20 Questions</u>		
Questions Asked	3.5 (3)*	11 (1)
Achievement Score	4 (3.6)*	10.3 (2.1)
<u>Word Content</u>		
Consecutively Correct	4 (2.5)	n.a.
<u>Tower</u>		
Achievement Score	5 (2)	9 (3.6)
Rule Violations/Item	5.3 (1.5)	6.3 (1.5)
<u>Proverb</u>		
Achievement Score	2.5 (1.7)*	10.3 (1.5)

Significant differences between confabulating and amnesic patients,  $p < .05$ .

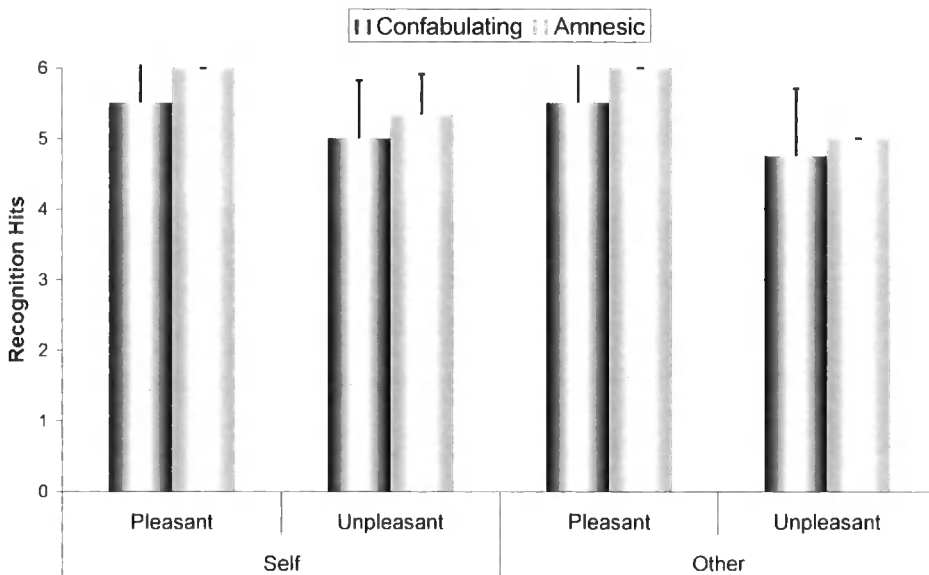
In summary, the two experimental groups did not differ in terms of their demographic characteristics and showed comparable difficulties in recent and

remote memory. However, confabulating patients appear more impaired than amnesic control patients on tests of executive functions. These comparisons will be further addressed in the Discussion section below.

#### 4.3.2 Experimental Analyses

##### *Recognition of Currently Relevant Events*

Both groups, confabulating and amnesic control patients, showed high levels of correct recognition of currently relevant and pleasant events, irrespective of whether events were self-selected ( $M = 5.5$ ,  $SD = 1$  and  $M = 6$ ,  $SD = 0$ , respectively) or experimentally chosen ( $M = 5.5$ ,  $SD = 1$  and  $M = 6$ ,  $SD = 0$ , respectively). Patients also correctly recognised most of the currently relevant unpleasant events but their scores were lower. These results are depicted in Figure 4-1 below.



**Figure 4-1. Correct Recognition Scores of Currently Relevant Events Across Groups.**

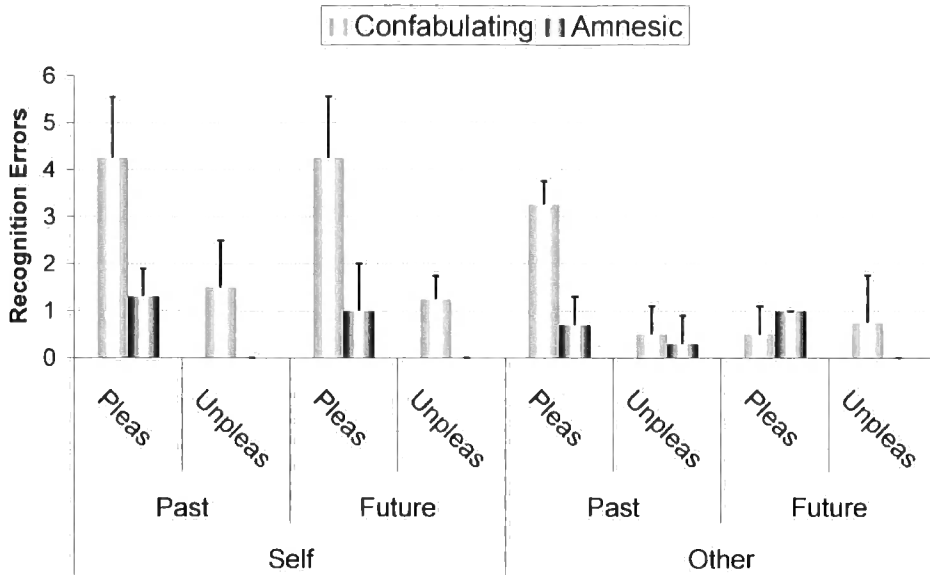
Note. Significant difference between pleasant and unpleasant events, with both groups showing higher recognition of pleasant rather than unpleasant events ( $p < .05$ ). No significant difference was found between groups.

A non-parametric Mann-Whitney test revealed there was no main effect of group (confabulating versus amnesic patients) on the number of statements correctly recognised,  $Z = 1, p = .3$ . Within-subject, non-parametric Wilcoxon Signed Ranks Tests were used to analyse the main effects of Valence (pleasant versus unpleasant statements) and Selection Agent (self versus other-generated statements). These revealed that Selection Agent had no significant effect on correct recognition,  $Z = 1, p = .3$ , while there was a main effect of Valence,  $Z = 2.9, p < .005$ , with patients recognising overall more pleasant than unpleasant memory statements. The two-way interactions of Group x Valence and Group x Selection Agent were analysed by calculating the differences between mean recognition scores of pleasant and unpleasant statements and of self-selected and other-selected memory statements, respectively. The Group factor had no effect on these differences,  $Z = 0.8, p = .4$  and  $Z = 0.1, p = .9$ , respectively. The interaction Valence x Selection Agent was analysed by calculating the difference of recognition scores for self-selected pleasant versus unpleasant items and other-selected pleasant versus unpleasant items. This interaction was not significant,  $Z = 1, p = .3$ . The three-way interaction, Group x Valence x Agent was analysed by calculating the difference between self-generated valence differences (pleasant minus unpleasant) and other-generated valence differences (pleasant minus unpleasant). The factor group had no effect on this difference,  $Z = 0, p = 1$ .

The above results indicate that while both confabulating and non-confabulating amnesic patients were more likely to correctly recognise pleasant than unpleasant events as currently relevant, there were no other differences between or within the groups in recognition of very recent autobiographical events. The latter was relatively high for both groups. Thus, it appears that confabulating patients are able to correctly recognise true personal events of their recent past, despite their more general difficulties in learning and recalling new information.

#### *False Recognition of Currently Irrelevant Events*

The critical results of the experiment relate to the false positives, i.e. the number of misrecognitions patients made in response to items that were not in fact relevant to their current reality. These findings are summarised in Figure 4-2 below.



**Figure 4-2. False Positives in the Recognition of Currently Non-Relevant Events**

A non-parametric Mann-Whitney test revealed an overall effect of Group (confabulating versus amnesic patients),  $Z = 3.5$ ,  $p < .001$ , with confabulating patients making more errors than amnesic control subjects. Wilcoxon Signed Ranks tests were used to analyse the overall within-subject effects of Valence (pleasant versus unpleasant), Time Reference (past versus future) and Selection Agent (self versus other). These revealed an overall effect of Valence,  $Z = 4$ ,  $p < .001$ , with more errors produced by patients in response to pleasant than unpleasant memory statements and an overall effect of Selection Agent,  $Z = 2.8$ ,  $p < .01$ , with more mistakes produced by patients in response to self-selected than other-selected items. There was no overall effect of time,  $Z = 1.5$ ,  $p = .1$ .

The interactions of the between-subjects factor group with the three within-subjects factors, i.e. Valence, Time Reference and Selection Agent, were analysed by calculating the difference between error scores of pleasant and unpleasant items, past and future items, and self-selected and other-selected items, respectively. Non-parametric Mann-Whitney tests were used to analyse the effects of Group on these differences. These revealed that Group had a significant effect on Valence,  $Z = 2.5$ ,  $p < .05$ , and on Selection Agent,  $Z = 2.3$ ,  $p < .05$ . The interaction Time Reference x Group was not significant,  $Z = .7$ ,  $p = .4$ . The

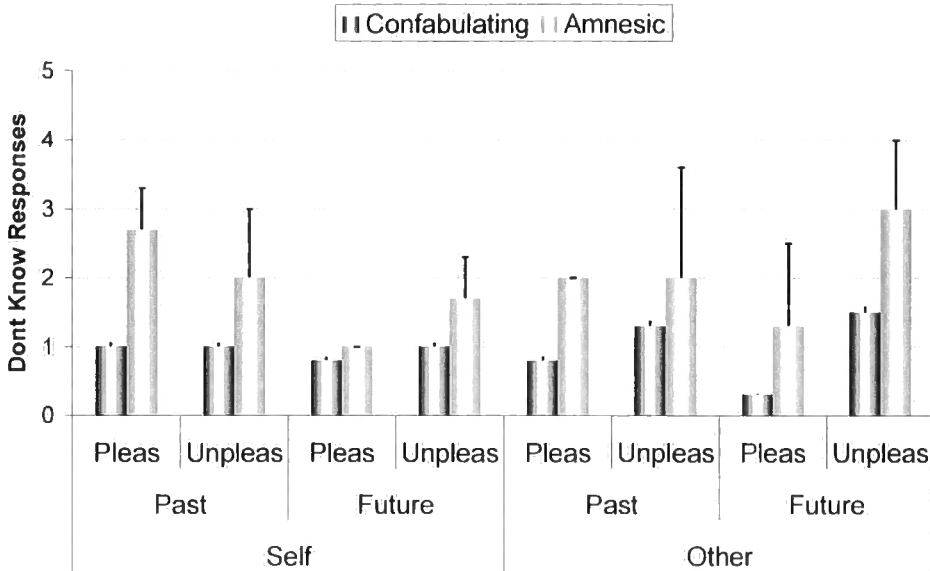


remaining 2-way interactions between the three within-subject factors, i.e. Valence, Time Reference and Selection Agent, were analysed by calculating the difference between error scores in pleasant and unpleasant items. Thus, the interaction between the within-subject factors Valence and Time Reference was analysed by calculating the difference between error scores in pleasant and unpleasant items and comparing this difference across past and future items. A Wilcoxon Signed Ranks test revealed the interaction was not significant,  $Z = 1.2$ ,  $p = .2$ . The interaction between the within-subject factors Valence and Selection Agent was analysed by calculating the difference between error scores in pleasant and unpleasant items and comparing this difference across self- and other-selected items. A Wilcoxon Signed Ranks test revealed this interaction was significant,  $Z = 2.5$ ,  $p < .05$ . Finally, the interaction between the within-subject factors Time Reference and Section Agent was analysed by calculating the difference between error scores in past and future items and comparing this difference across self- and other-selected items. A Wilcoxon Signed Ranks test revealed no significant interaction,  $Z = .8$ ,  $p = .4$ .

The three way interactions, Group x Valence x Selection Agent, Group x Valence x Time Reference and Group x Time Reference x Selection Agent were analysed by calculating the difference between self-generated valence differences (pleasant minus unpleasant) and other-generated valence differences (pleasant minus unpleasant), the difference between past valence differences (pleasant minus unpleasant) and future valence differences (pleasant minus unpleasant) and the difference between self-generated time differences (past minus future) and other-generated past differences (past – future), respectively. The factor Group had no effect on these differences,  $Z = 0$ ,  $p = 1$ ,  $Z = 0$ ,  $p = 1$  and  $Z = 1.1$ ,  $p = 0.3$ , respectively. The three way interaction Valence x Time Reference x Selection Agent was analysed by calculating the difference of the difference of the error scores of past and future memory statements between self- and other-generated statements. The factor valence (pleasant versus unpleasant) had no effect on this difference,  $Z = .7$ ,  $p = .5$ . Finally, the difference between groups of the latter difference, i.e. the four-way interaction, was not significant,  $Z = .5$ ,  $p = .6$ .

*Don't know' Responses*

The number of 'Don't Know' responses patients produced in response to the various categories of false (i.e. currently irrelevant) memory statements was also separately analysed. These findings are summarised in Figure 4-3 below.



**Figure 4-3. Groups' 'Don't know' Responses across Time and Agent Conditions**

A non-parametric Mann-Whitney test revealed an overall effect of group (confabulating versus amnesic patients),  $Z = 3.8, p < .001$ , with confabulating patients making fewer 'don't know' responses than amnesic control subjects. Wilcoxon Signed Ranks tests were used to analyse the overall within-subject effects of Valence (pleasant versus unpleasant), Time Reference (past versus future) and Selection Agent (self versus other). These effects were not significant,  $Z = 1.8, p = .06, Z = 1.2, p = .8$  and  $Z = .3, p = .8$ , respectively. However it should be noted that the overall effect of Valence approached significant levels, with patients showing a tendency to produce more 'don't know' responses in unpleasant than pleasant memory statements.

The interactions of the between-subject factor group with the three within-subject factors, i.e. valence, Time Reference and Selection Agent, were analysed by calculating the difference between errors scores of pleasant and unpleasant

items, past and future items, and self-selected and other-selected items, respectively. Non-parametric Mann-Whitney tests were used to analyse the effects of Group on these differences. These revealed that group did not have a significant effect on Valence,  $Z = 0.2, p = .8$ , Selection Agent,  $Z = 0.4, p = .5$ , or Time Reference,  $Z = 1.3, p = .1$ . The remaining 2-way interactions between the three within-subject factors, i.e. Valence, Time Reference and Selection Agent, were analysed by calculating the difference between error scores on pleasant and unpleasant items. Thus, the interaction between the within-subject factors Valence and Time Reference was analysed by calculating the difference between error scores for pleasant and unpleasant items and comparing this difference across past and future items. A Wilcoxon Signed Ranks test revealed a significant interaction,  $Z = 2.4, p < .05$ , with patients producing more 'don't know' responses to unpleasant than to pleasant items in the future rather than in the past conditions. The interaction between the within-subject factors Valence and Selection Agent was analysed by calculating the difference between error scores for pleasant and unpleasant items and comparing this difference across self- and other-selected items. A Wilcoxon Signed Ranks test revealed that this interaction was not significant,  $Z = 1.7, p = .09$ , although patients showed a tendency to produce more 'don't know' responses to the unpleasant than to the pleasant items in the self- rather than other-selected condition. Finally, the interaction between the within-subject factors Time Reference and Selection Agent was analysed by calculating the difference between error scores for past and future items and comparing this difference across self- and other-selected items. A Wilcoxon Signed Ranks test revealed no significant interaction,  $Z = .9, p = .3$ . The three way interactions, Group x Valence x Selection Agent, Group x Valence x Time Reference, Group x Time Reference x Selection Agent and Valence x Selection Agent x Time Reference were not significant,  $Z = .1, p = .9$ ;  $Z = .6, p = .6$ ;  $Z = .9, p = .4$  and  $Z = 1.1, p = .3$  respectively. Finally, the four-way interaction Group x Valence x Time Reference x Selection Agent was not significant,  $Z = .5, p = .6$ .

#### *Summary of Findings*

The above results indicate that the two experimental groups, confabulating and non-confabulating amnesics did not differ in terms of their demographic characteristics or their performance on standardised tests of new learning and

autobiographical memory. However, confabulating patients appeared more impaired than amnesic control patients on tests of executive functions. In the experimental investigations both groups showed high levels of correct recognition of currently relevant events and both groups were more likely to correctly recognise pleasant rather than unpleasant events as currently relevant, irrespective of whether these events were previously self-selected or experimentally chosen. Confabulating patients produced significantly more false positives than amnesic controls, i.e. they erroneously accepted past events or thoughts about potential future events as currently relevant events more often than controls did. Overall, more errors were produced in response to pleasant than unpleasant statements in the self rather than the other condition. Although both groups produced more errors in response to pleasant than unpleasant memory statements, this tendency was significantly more frequent in confabulating patients. In addition, both groups produced more errors in the self-generated than in the other-generated conditions but this was more prominent in the confabulation group than in the amnesic control group. Amnesic control patients produced significantly more 'don't know' responses than confabulating patients. In addition, there was a non-significant tendency in both groups to produce more 'don't know' responses to unpleasant than pleasant memory statements and a significant tendency to produce more 'don't know' responses to unpleasant than pleasant memory statements in the future than in the past conditions. These results are discussed below.

#### **4.4 Discussion**

This study explored three assumptions related to the hypothesis that the critical impairment in confabulation is the failure of temporality, or temporal context (Dalla Barba, 2001; Schnider, 2003).

##### 4.4.1 Do confabulations always derive from actual past experiences misplaced in time?

The present investigations provide only partial support for the role of temporal confusion in memory. More specifically, although confabulating and non-confabulating amnesic patients showed comparable degrees of memory impairment for recent and current life time periods, confabulating patients showed

a significantly greater tendency than amnesic controls to misrecognise past events as currently relevant (Schnider et al., 1996), particularly if they were self-selected. However, the findings of the present experiment contradict the assumption that confabulations always derive from actual past experiences misplaced in time or erroneously assorted with events of different temporal reference. More specifically, the investigations showed that confabulating patients were significantly more likely than controls to misrecognise as currently relevant self-referential events that had actually never taken place, i.e. their fears or wishes for the future. Although such statements had been thought of and expressed by the patients before (e.g. during the first phase of the experiment), they were never experienced as real life events, i.e. they were merely 'mental events', thoughts or fantasies. Thus, the material upon which confabulations are built may go beyond experienced memories and personal facts to thoughts, fantasies and potentially other mental constructs and representations, e.g. dreams. This view is consistent with previous descriptions of confabulatory confusions of dreams and reality in confabulation (e.g. Moll, 1915; Berlyne, 1972). This view is also consistent with the theoretical framework put forward by Johnson and colleagues (1997; 2000), which conceptualises confabulation as the result of deficits in the complex retrieval and attribution processes that determine whether a mental representation is internally generated (e.g. imagined) or deriving from external reality (i.e. perceived). However, a deficit in reality monitoring alone, cannot account for the emotional bias observed in this study (see below).

#### 4.4.2 Does executive dysfunction differentiate confabulating from amnesic non-confabulating controls?

In this study the performance of confabulating patients was significantly worse than that of matched amnesic patients in a number of executive functions. These included tests of inhibition, perseveration, set-shifting, abstract thinking and reasoning. However, it should be noted that the performance of the confabulating patients showed some variability across tests. For example, although these patients performed significantly worse than amnesic controls on the Hayling test, particularly during the second part of the test (assessing inhibition of automated responses), they performed similarly to control patients on the Colour-Word D-KEFS subtest which also taps inhibition of automated

responses. Similarly, while they showed impairment on reasoning and abstract thinking on the proverbs and the 20 Questions D-KEFS subtests their performance was mixed and overall better on the Cognitive Estimation test, also assessing these abilities. These mixed results suggest that although executive dysfunction may be causative of confabulation, 'frontal tests' are not sufficient to reliably identify the specific cognitive deficits underpinning confabulation (see also Kopelman et al., 1997; Schnider et al., 1996; see also Chapter 2). Moreover, these data cannot determine if temporal confusion is a primary cause of confabulation, or whether it is secondary to executive dysfunction, i.e. one of the outcomes of executive dysfunction. This issue will be further discussed in Chapter 8.

4.4.3 Does temporal confusion, or a more general confusion between reality and fantasy lead to a random selection and retrieval of confabulatory memories?

In the present experiment confabulating patients mis-recognised as currently relevant more pleasant than unpleasant past events, and more self-selected 'events' than other-selected events. Amnesic non-confabulating patients showed a similar tendency but at a significantly lower rate. These results suggest that although confabulating patients were prone to temporal and reality confusion errors, this tendency was more applicable to pleasant self-referential events and less influential over negative events. Characteristically, in response to several of these positive memory statements patients responded with additional confabulatory descriptions, which they insisted they must narrate before the test could continue. For example, patient RM gave a positive response to a statement about winning the lottery in his current life (a previous future self-selected statement). He then added that it was the second time in a year. Immediately, he went on to describe a long narrative with impressive amount of detail regarding the amounts he won and how he spent the money, how grateful his friends and family were for his presents, and what other acts of charity he did. These findings confirm that confabulation is subject to emotional influences, over and above temporality and reality monitoring deficits.

Interestingly, confabulating patients did not show this strong effect in experimentally selected events. More specifically, although they were prone in confusing personally-generated past events and wishes as current relevant events, they showed less confusion and no pleasantness effect in 'future' other-selected

events. An interpretation of this finding may be that these patients were not as likely to accept never experienced and externally generated information as part of their autobiography, no matter how plausible and self-related the latter might have been. This interpretation goes against a 'suggestibility' explanation of confabulation, which postulates that such patients should be prone to external suggestion (Mercer et al., 1977; Schnider et al., 1996; see also Chapter 1). The issue of self-relevance and motivation will be addressed in the next chapter. The issue of suggestibility will be further addressed on chapters 6 and 7.

It is also of interest that amnesic patients showed more 'don't know' responses than confabulating patients. This difference could relate to confabulating patients executive dysfunction (see above), leading to impulsivity in responding. It could also be linked to tendency to fill-in memory gaps (in this case with a 'no' or 'yes' answer) due to embarrassment. However, it should be highlighted that these patients were anosognosic of their memory impairments and did not appear embarrassed or uncomfortable during the interview. By contrast, amnesic patients appeared more distressed with their occasional inability to relate events to their current life with certainty. Thus, although the 'gap-filling' hypothesis could not be excluded with certainty, it appears unlikely.

In conclusion, the results of the above experimental investigations suggest that confabulations include both the confusion of events in time as well as the confusion of never experienced events for memories. The cognitive deficits associated with memory-related confabulation include both amnesia and executive dysfunction, although the exact aetiological role of the latter and its relation to temporal confusion and reality monitoring remains to be specified. Crucially, this experiment confirmed the fifth hypothesis of the study. Namely, confabulations are constructed according to motivated biases that influence confabulatory content, over and above the cognitive impairments of reality monitoring and temporality. In other words, these deficits are not sufficient to account for the emotional biases observed in the misrecognition of currently irrelevant memories. By implication, they are not sufficient to explain confabulatory content (see also Chapter 3).

## Chapter 5 : Is Confabulation Self-Serving?

### *An Emotional Prose Recall Experiment*

*"Alike with the individual and the group, the past is continually being re-made, reconstructed in the interests of the present" (Bartlett, 1932, p. 309)*

#### 5.1 Introduction

The wishful and purposeful character of confabulation has been repeatedly portrayed in clinical descriptions (e.g. Berlyne, 1972; Feinberg, 2001; Kaplan-Solms & Solms, 2000; Weinstein & Kahn, 1955). More recently it has been experimentally documented in single-case reports (Conway & Tacchi, 1996; Fotopoulou et al., 2004). The previous group studies of the thesis also documented such bias in the content of spontaneous confabulation and showed that pleasant rather than unpleasant memories and representations were more likely to be confused as currently relevant memories and thus influence confabulatory content. This experiment aims at addressing the mechanisms which underlie such emotional bias and its relation to memory and frontal dysfunction.

More specifically, the present study aimed at developing an experimental paradigm for addressing directly and under controlled conditions the potential self-serving biases in confabulation. To this extent, the study employed an emotional prose recall task to investigate the manner in which confabulating patients recall emotional narrative material. The cognitive ability to comprehend, memorize and recall narrative stories has been the subject of extensive research since the beginning of the last century (Bartlett, 1932; Propp, 1928). Research has shown that prose recall requires the priming, maintenance, and integration of a number of representations in long-term memory, as well as the capacity to retrieve them from long-term memory (see Baddeley & Wilson, 2002; Mar, 2004). Furthermore, some recent models of narrative comprehension and recall suggest that readers of narratives often comprehend the depicted events by assuming the perspective of a character, mentally representing his or her emotional states (for review see Mar, 2004). Furthermore, experiments on memory encoding and retrieval have shown that relating information to oneself may enhance recall (self-



referent effect, Rogers, Kuiper, & Kirker, 1977). The self-reference effect has also been demonstrated in children as young as 10 years of age (Halpin et al., 1984), as well as in elderly adults (see Symons & Johnson, 1997 for an extensive review). This effect implies that the use of stories as recall material is ecologically valid and highly appropriate for the investigation of emotional memory biases and even more specifically for the investigation of self-related emotional biases.

In the present study, confabulating patients were asked to reproduce a series of short stories. In order to investigate potential self-related emotional biases the following manipulations were carried out. First, the study manipulated the emotional valence of the stories (positive, negative and neutral). Second, the study manipulated the self-reference of the material (self- versus other-referent encoding). Such manipulations have proven successful in revealing negative emotional biases in studies on depression (e.g. Zupan et al., 1987; Bishop, Dalgleish & Yule, 2004). The performance of confabulating patients was compared to that of frontal and amnesic patients on the same task. As amnesia and frontal lobe dysfunction have been identified as the two core components of the cognitive and neural mechanisms of confabulation (e.g. Deluca, 2000; Moscovitch, 1989; see Chapter 1) the study of these groups could provide insight on the specific contribution of these two factors into confabulatory behaviour (see also Kopelman et al., 1997 and Chapter 2). In brief, this experiment addressed the sixth hypothesis of the study. Namely, *the content of confabulation is self-serving, over and above the memory and executive deficits that might influence memory recall.*

## 5.2 Materials & Methods

### 5.2.1 Participants

The participants of the study consisted of 22 neurological patients and 10 healthy individuals. 12 of the 13 patients of the Total Confabulation Group (see Chapter 2) were classified as the Confabulation group (patient PT was not tested due to time constraints). The three patients of the Amnesic Group and the seven patients of the Frontal Group were also tested as control subjects (see Chapter 2). The ten healthy control participants tested were matched for age, gender and education to the confabulating patients. They were 4 females and 6 males, with

mean age 52.1 years (SD 17.8, range 26-79 years) and mean years of education 11 (SD 1.8). All subjects, including raters (see below), gave written informed consent.

### 5.2.2 Materials

A pilot study, with two phases, was conducted for selection of the appropriate set of six stories from an original pool of 18 different story plots, devised by the experimenter. The latter included story plots of similar length (85-92 words) but varying emotional valence, 6 stories  $\times$  3 valence options, positive, negative and neutral. All stories were also similar with respect to their main semantic and narrative characteristics (see Appendix D1 for full description). In addition, all stories had equal number of semantic 'idea units' for recall. The latter were defined following Bransford and Johnson (1972) as corresponding to "either individual sentences, basic semantic propositions or phrases" that conveyed a single theme (see also Maquire et al., 1999). All stories included (1) the presentation of an acting agent with an explicit description of intention for further action, as well the temporal and spatial information of the initial setting [8 semantic units]; (2) the presentation of an external obstacle to agent's intended action and the reaction by the main agent, including his emotional reaction [6 semantic units]; (3) the final outcome, including its rationale, temporal information, and explicit description of the main agent's emotional state [7 semantic units]. Finally, all stories included two acting agents. One was the protagonist of the story and one had a secondary role.

The stories were piloted using 20 healthy adults (10 younger adults, five male and five female, with age range 20-30 years and 10 older adults, five male and five female, with age range 50-70 years). They were asked to rate (i) their ability to understand each of the 18 stories (comprehension rating); (ii) the valence of each story (positive/negative); (iii) the emotional intensity of its story (arousal rating); (iv) their ability to 'visualise' each story in their minds' eye (visualisation rating); (v) their 'familiarity' with the agents' actions and reactions, i.e. their ability to 'relate' and 'understand' the actions and feelings of the main character of each story ('identification' with the agent rating). All five ratings were given on a 9-point scale.

In the first stage of the pilot study, the selection of the set of six stories was based on the coexistence of the following criteria: high comprehension, visualisation and agent identification, and balanced variability in valence and arousal. More specifically, the six selected stories had mean ratings of visualisation  $\geq 6$  and all of them received, by all 20 participants, ratings of  $\geq 7$  in the comprehension and 'identification with agent' scale (see Appendix D2 for detailed scores). In addition, four emotional stories were included (2 negative and 2 positive) which were rated by all 20 participants on the extreme low and high borders of the valence scale (i.e.  $\leq 3$  and  $\geq 7$  respectively) and were also rated by all participants as relatively high in arousal, ratings  $\geq 6$ . None of the 'neutral' stories were rated by all participants as totally neutral in valence (valence rating of 5), but the two stories finally selected were the ones which were rated by all participants as low in arousal (i.e. ratings  $\leq 2$ ) and had valence mean ratings most approximating the neutral point of the valence scale ( $M = 4.15$ ,  $SD = .93$  and  $M = 4.9$ ,  $SD = .79$  respectively).

In the second phase of the pilot study, differences in valence ratings were analysed using a repeated measures ANOVA with two between-subject factors, age (younger versus older adults), and gender (male versus female) and two within-subject factors, valence category (positive, negative, neutral) and story plot (plot a versus plot b). There was a significant main effect of valence category,  $F(2,32) = 291.7$ ,  $p < .001$  and there were no main effects of age, gender or story plot. Post-hoc tests using Bonferroni correction revealed that the positive stories were rated as significantly more positive than the neutral stories,  $t(39) = 13.1$ ,  $p < .001$ , which in turn were rated as significantly more positive than the negative stories,  $t(39) = 11.5$ ,  $p < .001$ . None of the interactions involving age, gender or story plot was significant,  $ps > .1$ .

Furthermore, potential differences in visualisation ratings were analysed using a repeated measures ANOVA with two between-subject factors, age (younger versus older adults), and gender (male versus female) and two within-subject factors, valence category (positive, negative, neutral) and story plot (plot a versus plot b). There was no significant effect of age, gender, valence category or story plot on visualisation ratings, nor significant interactions between these factors,  $ps > 1$ .

The above results provide indication of successful manipulation of valence in the selected stories and suggest that the effect of this manipulation was consistent across different stories and across participants of different age and gender.

Finally, the selected six story plots were analysed for readability using Microsoft Word 2000 readability statistics. All stories had similar Flesch Reading Ease levels ranging from 57.1 to 63.8 and similar Flesch-Kincaid Grade level ranging from 7.6 to 8.3.

### 5.2.3 Procedure

Patients and control participants were assessed individually during two sessions, on two consecutive weeks (three stories per session, one pleasant, one unpleasant and one neutral). The stories were read out to each participant in a neutral manner and at a regular pace. His/her answers were audio-recorded on digital mini-disk and fully transcribed. Prior to presentation of each story, participants were instructed that a fictional story about a person's life was going to be read out to them and that they should try to subsequently remember as much of it as possible. In the second session, the instructions of the test were identical except in that participants were also instructed to imagine that they were the protagonists of each story and that the events of each story were actually happening to them (self-encoding manipulation). In this second session the narration type of the stories was altered from a third-person narration (e.g. "John Wilson is a talented architect...") to a first-person narration ("Imagine that you are a talented architect..."). The latter were matched for gender to each participant (e.g. "Imagine you are a successful businessman/woman...").

Emotional valence was manipulated by alternating the emotional content of all stories in the final narrative unit of each story plot (unit of final outcome). Two of the stories ended in a favourable way for the main agent of the story (positive valence), two of them in a disadvantageous way for the protagonist (negative valence) and two in a neutral way (neutral valence). In each story this ending was accompanied by the explicit presentation of two of the agents' emotions, e.g. "She felt humiliated and scared". The manipulation of valence of narrative stories by alternation of a few key elements within the last sections of

each story was used successfully before in emotional prose recall studies (e.g. Bishop et al., 2004).

To maximise learning opportunity, each story was read out twice and participants had to remember as much information as possible following each presentation (two immediate recall conditions). Prior to the second presentation participants were reminded of the original instructions and were also told that they should try to remember as much as possible from each story including elements they had already mentioned. Following a 10- (for all amnesic patients) or 30- (for non-amnesic participants) minute delay in which participants were engaged in distracting activities of neutral emotional significance, e.g. digit span, matrix reasoning tests etc, they were asked to recollect each story again. When participants could not remember the stories, the agent's characteristics (e.g. profession of agent) of each story were given as a single cue. Prior to the presentation of each new story there was a 10-minute interval, in which participants were again engaged in distracting cognitive tasks of neutral emotional significance, e.g. block design tests.

In order to measure whether participants understood the stories in similar ways, participants had to answer a set of questions following the second immediate recall trial of each story. These included a rating of comprehensibility, a rating of 'familiarity' with the protagonist's actions and reactions (understanding of the protagonist's actions and emotions based on previous experience) and a rating of story visualisation (7-point scales, 1= low to 7 = high). These factors (e.g. low comprehension, inability to 'relate to the main agent etc) have been shown to influence recall in previous studies (Meyer 1984; Kintsch and van Dijk 1978; Gernsbacher, Hargraves, and Beeman 1989; Kintsch, Welsch, Schmalhofer, and Zimny 1990). Thus, these ratings were used to control for the potential influence of these confounding variables on participants' recall scores.

The selection of the three stories to be encoded in self-referent versus other-referent manner and the order of presentation by valence was counterbalanced across participants within each group. Where it was not possible to fully counterbalance these factors, due to group sizes, independent analysis were performed to assess their effects (see below).

#### 5.2.4 Coding

Participants' attempts at recalling the stories were scored for a number of primary measures. These included amount of recall (number of content units), emotional valence (pleasantness scale) and content errors (number of distortions, fabrications and perseverations).

##### *Amount of Recall*

Participants' recall protocols were scored for the presence of idea units, as defined above (following previous studies e.g. Bishop et al., 2004; Cowan et al., 2004; Van den Broek, Lorch, & Thurlow, 1996). For each unit a score of one was given when the participant recalled the elements of the unit or alternative elements with equivalent meaning, e.g. synonymous words or phrases of equivalent meaning, e.g. 'she stormed in' instead of she 'she burst in', 'they upgraded your status' instead of 'they offered you a better position'. Each story had 21 different idea units. Semantic recall scores of the two immediate recall conditions were added up to form the Total Immediate Semantic Recall score (maximum score = 42), which in turn was added to the Delayed Semantic Recall score to form the Total Semantic Recall Score (maximum score = 63).

##### *Amount of Confabulation Errors*

Participants' protocols were scored for the number of confabulations. These included (i) 'fabrications' of information completely unrelated to the semantic or phonemic elements of each story (Fabrication score), and (ii) 'distortions' of the semantic information or narrative relations of each story (Distortion score). The total Confabulation Score was calculated by adding the respective errors (distortions and fabrications) in both immediate and delayed recall conditions. In addition, protocols were scored for the number of perseverations they included. These referred to the repetition of information both within each story, as well as across the stories of each session.

##### *Valence Rating*

The recall protocols were scored for emotional valence using a 7-point scale (1 = Extremely Unpleasant, 7 = Extremely Pleasant). Scoring of valence emerged out of each protocol as a whole, as opposed to primarily being a function

of the use of explicitly emotional words or phrases. In this way the ability of the participants to comprehend and reproduce the emotional content of each story in their recall protocols could be scored irrespective of their ability to remember accurately specific words or phrases. For the same reasons, potential recall errors (e.g. confabulations) were considered at face-value in the valence rating. Total Valence Scores were calculated by averaging the valence rating of the two immediate and the delayed recall conditions.

Two 'naïve' raters practised following this coding system. Coding was performed blind to the participants' group classification. Raters were paid for their participation to the study. Inter-rater reliability was calculated using Pearson's correlation. The two rates showed satisfactory reliability coefficients of + .78 for semantic recall rating, of + .82 for errors rating and of + .79 for valence rating. Differences were solved by discussion. For differences in valence ratings the following rules were followed: If the two raters had judged a particular story protocol as pleasant or unpleasant, but their ratings differed in degree (e.g. rater A = 5 and rater B = 6, or rater A = 1 and rater B = 2) then the mean was calculated. The same applied to the cases where one of the raters had judged a given protocol as neutral and other had rated it as pleasant or unpleasant (e.g. rater A = 4 and rater B = 5). When, however, the two raters had rated a story protocol on opposite sides of the scale then they were asked to discuss their differences.

#### 5.2.5 Design

The main experimental design included one between-subjects factor, Group (confabulating, amnesic, frontal patients and healthy controls) and two within-subjects factors, story Valence (positive, negative and neutral) and story Reference (self versus other). This design allowed for 4 x 3 x 2 comparisons on three main dependent variables: amount of recall, valence rating and amount of confabulation errors. Several factors, e.g. groups' demographical characteristics, story characteristics, stories' ratings etc, which could have influenced the participants performance on the prose recall task were analysed separately to avoid overloading the main analysis. In addition, the potential laterality effects within the confabulation group, i.e. bilateral (N = 9) versus unilateral (N = 3) subgroups, were separately analysed.

### 5.3 Results

Given the small number of patients assessed and the unequally sized groups, data were analysed using non-parametric statistics. The Kruskal-Wallis test was used for the between-subjects analyses. Subsequent pair-wise comparisons were performed using the Mann-Whitney U-Test. The Friedman test was used for related samples comparisons between the valence conditions, and subsequent pair-wise comparisons were performed using Wilcoxon Signed Ranks tests. The latter was also used to analyse the within-subjects effects of reference (self versus other). The significance threshold for all analyses was set at  $p < .05$ . Given the need for multiple analyses only significant results are reported in full. The p-value of non-significant findings is also reported.

#### 5.3.1 Preliminary Analysis: Controlling for Confounding Variables

##### *Participants' Characteristics*

Table 5-1 shows the age, education and gender characteristics of the four groups used in this study.

**Table 5-1. Means and SDs for Age, Education and Gender Ratio by Group.**

	<b>Confabulation Group</b> (N = 12)	<b>Frontal Group</b> (N = 7)	<b>Amnesic Group</b> (N = 3)	<b>Healthy Controls</b> (N = 10)
	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>	<i>Mean (SD)</i>
<b>Age</b>	57.6 (18.1)	52 (22.1)	44.3 (19.1)	52.1 (17.8)
<b>Education</b>	10.3 (3.2)	12 (2)	9.7 (2)	11 (1.8)
<b>Male:Female Ratio</b>	8:4	4:3	2:1	6:4

Non-parametric Kruskal-Wallis tests revealed that the age and educational differences between the groups of the study were not significant,  $ps > .2$ . Therefore, these factors were excluded from subsequent analyses. The ratio of males to females was not identical across groups and in order to examine whether gender had an effect on the participants recall, valence and confabulation scores, non-parametric Mann-Whitney tests were performed on each of the six total recall, valence and confabulation scores. There was no significant effect of gender on the recall ( $ps > .1$ ), confabulation ( $ps > .2$ ), or valence ( $ps > .1$ ) scores of any of



the story conditions. Therefore, the factor Gender was excluded from subsequent analyses.

#### *Story Characteristics*

The reference (self versus other) in which each content story was presented to each patient and the order of presentation by valence were not fully counterbalanced within each group, due to unequal sizes. In order to establish whether these factors were likely to confound results, non-parametric tests were conducted on each of the six total scores of recall, valence and confabulation with either (i) the story/reference combination or (ii) the order of presentation as the between-subject factor. There was no significant effect of story/reference combination on recall ( $ps > .3$ ), valence ( $ps > .2$ ) or on confabulation scores ( $ps > .1$ ), and there was no significant effect of presentation order on recall ( $ps > .6$ ), valence ( $ps > .2$ ), or confabulation scores ( $ps > .1$ ). These factors were excluded from subsequent analyses.

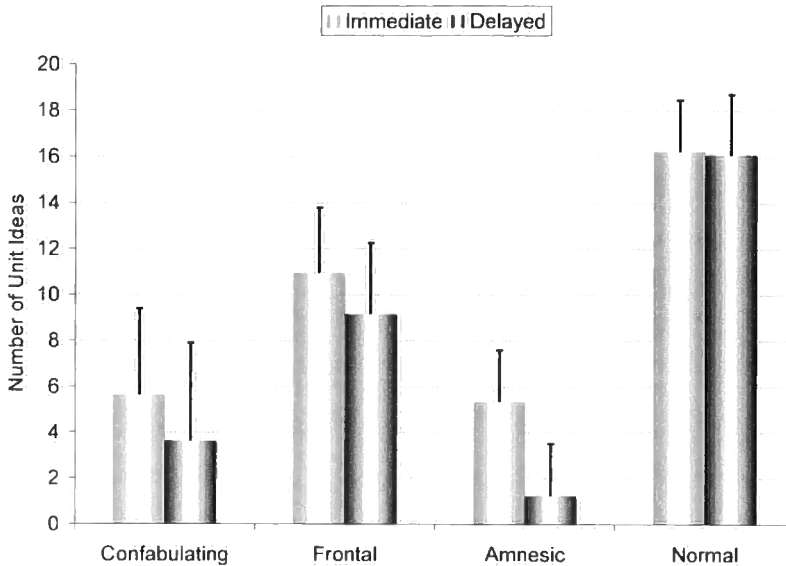
#### *Subjective Story Ratings*

Kruskall-Wallis and Mann-Whitney tests revealed that the four experimental groups did not differ in their ratings of comprehensibility, visualisation, or identification with agent,  $ps > .1$  (see Appendix D3 for mean ratings by group).

#### *Immediate Versus Delayed Recall*

The effects of immediate versus delayed recall conditions on amount of recall were examined separately to avoid overloading the main analysis, which was conducted based on total scores. As expected, the stories were generally better recalled on immediate (average of first and second immediate recall conditions) than on delayed recall,  $Z = 7.6$ ,  $p < .0001$ . However, this difference was not equal across groups. The performance of the confabulating and non-confabulating amnesic patients appeared to drop more than the other two groups, while the recall scores of healthy controls appeared less influenced by delayed recall (see Appendix D4 for detailed results). Indeed, there was a main effect of group on the difference between immediate and delayed recall,  $\chi^2(3) = 42.8$ ,  $p < .0001$ . Post hoc Mann-Whitney tests revealed that the confabulation group

differed from the amnesic,  $Z = 2.9, p < .003$ , and healthy control groups,  $Z = 5.1, p < .0001$ , but not the frontal control group,  $Z = 0.8, p = .4$ . These results are shown in **Figure 5-1** below.



**Figure 5-1. Performance of Immediate and Delayed Recall across Groups**

There was no effect of valence or agent on the difference between immediate and delayed recall,  $\chi^2(2) = 1.3, p = .5$  and  $Z = 1, p = .3$ , respectively. None of the other two-, three- and four-way interactions involving group, valence and agent were significant,  $ps > .1$ , except from the interaction of Valence (positive versus negative) x Agent (self versus other) x Recall (immediate versus delayed) which was significant,  $Z = 2.3, p < .05$ . As these differences were secondary to the hypotheses of the study they were not included in the main analysis. However, they were taken into consideration in the interpretation of the results (see below).

### 5.3.2 Main Analysis

#### *Amount of Recall.*

Mean total semantic recall scores, broke down by experimental factors and group, are depicted in **Figure 5-2**.

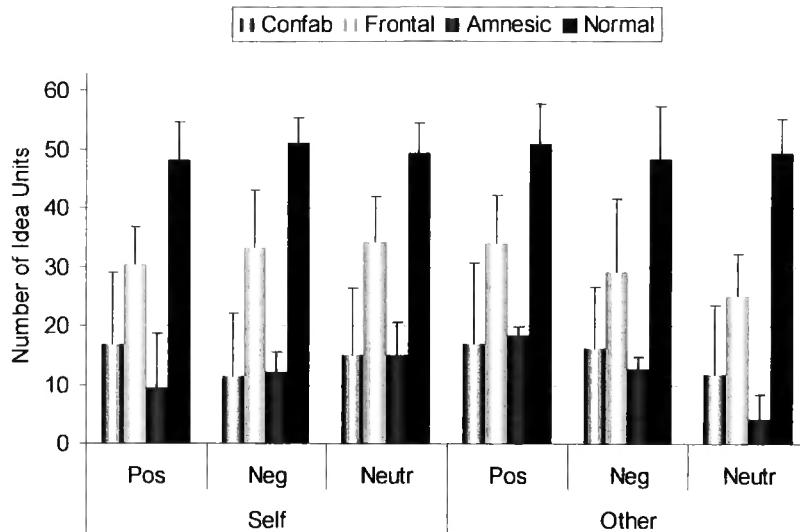


Figure 5-2. Mean Number of Idea Units Recalled by Groups across Conditions

Factors influencing participants' recall performance were examined by conducting non-parametric tests. Overall, confabulating and amnesic patients recalled less semantic information than frontal patients, who in turn recalled less information than healthy controls. An independent-sample, Kruskal-Wallis, test confirmed that there was a significant main effect of group,  $\chi^2(3) = 23.2, p < .001$ . Post hoc analysis, with Bonferroni correction, revealed that the confabulating group differed from the frontal control group,  $Z = 2.9, p < .005$ , and the healthy control group,  $Z = 3.8, p < .001$ , but not the amnesic group,  $p = .8$ . By contrast, a related-sample Wilcoxon Signed Ranks Test revealed that there was no main effect of reference (self versus other),  $p = .4$ , and a Friedman test revealed there was no main effect of valence,  $p = .2$ . Further between-subject non-parametric tests revealed that the difference between self-referent and other-referent recall did not vary between groups,  $p = .2$ . Similarly, the difference between the recall of stories with positive and negative valence did not significantly vary between groups,  $p = .9$ . A Group x Valence (positive versus negative) x Reference (self versus other) interaction was also studied by calculating the difference between positive and negative story recall in self-referent conditions and the difference between positive and negative story recall in other-referent conditions and

fabrication errors in immediate and delayed recall conditions of each story protocol).

The mean scores of Total Confabulation across groups are shown in Figure 5-3 below.

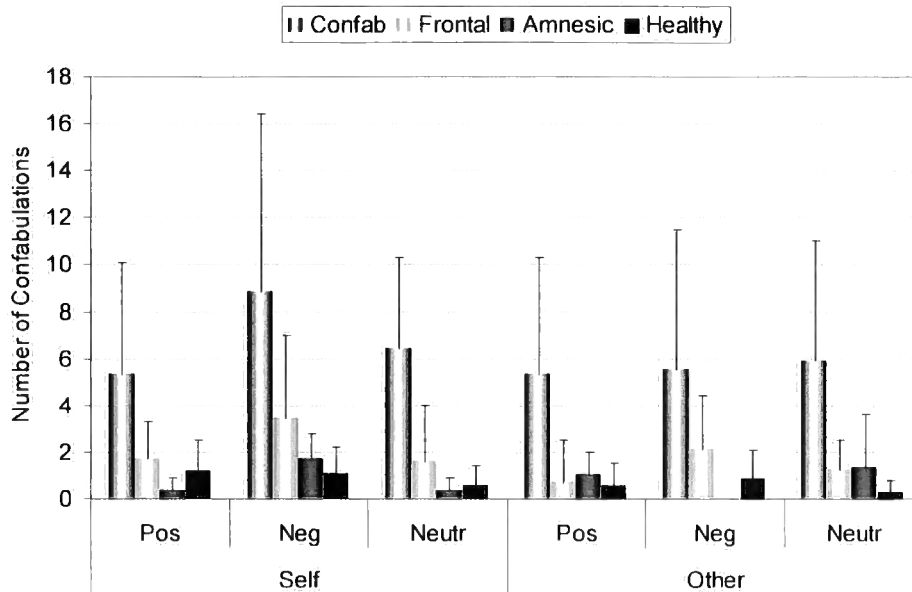


Figure 5-3. Mean Number of Confabulations across Groups and Conditions

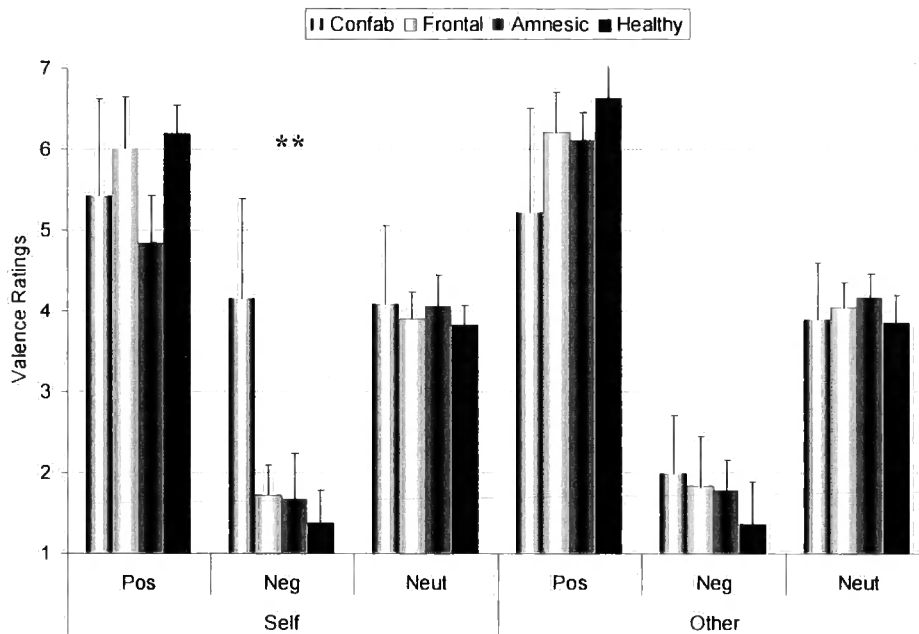
Non-parametric tests were used to analyse the factors that might have influenced participants' confabulatory errors. A within-subject, Friedman test revealed that there was a main effect of valence,  $\chi^2(2) = 8.9, p < .05$ , with participants confabulating more in the negative than the positive or neutral conditions. A Wilcoxon Signed Ranks test also revealed a main reference effect,  $Z = 1.9, p < .05$ , with participants producing more confabulations in the self-referent than the other-referent conditions. In addition, as expected, a between-subject Kruskal-Wallis test showed that there was an overall effect of group  $\chi^2(3) = 20.9, p < .001$ , with the confabulating patients confabulating significantly more than all the control groups. The control groups showed no significant difference in amount of confabulation, i.e. when the confabulation group was excluded from the analysis there was no significant difference between the amount of confabulation the control groups produced,  $\chi^2(2) = 3.9, p = .1$ . There was also no evidence that

the difference between self- and other- reference conditions, or the difference between positive and negative valence conditions varied significantly across group,  $ps > .3$ . Similarly, there was no significant interaction of Valence x Reference, or Group x Valence x Reference,  $ps > .2$ .

The above results suggest that although confabulating patients, and frontal patients at a lesser degree, showed a tendency to produce higher amount of confabulation in negative self-referent than in other conditions, this tendency was not statistically significant.

### Valence Ratings

The mean scores of valence ratings across groups are shown in **Figure 5-4** below.



**Figure 5-4. Mean Valence Ratings across Groups, Valence and Perspective Conditions.**

Note. \*\* signify statistically significant differences between the Confabulation Group and the control groups in the self-negative condition.

A number of differences between the groups were observed in the recalled valence (dependent variable: pleasantness rating) of the originally positive and

negative stories (independent variable: story Valence). The significance of these differences was statistically analysed using non-parametric tests. As expected, there was a main effect of story valence on valence rating,  $\chi^2(2) = 52.6, p < .001$ . There was no main effect of reference (self versus other) and there was no main effect of group,  $p = .08$ , although the latter difference approximated levels of significance. The difference in valence rating between positive and negative stories varied significantly between the groups,  $\chi^2(3) = 17.4, p < .005$ , with the confabulation group showing overall higher ratings of pleasantness than the control groups. Furthermore this interaction was significant in the self-referent conditions,  $\chi^2(3) = 15.4, p < .005$ , with the Confabulation group showing higher pleasantness ratings than controls in the self-negative condition. Post hoc analysis revealed that the difference in valence rating between positive and negative self-reference conditions varied significantly also across the three control groups, with the Amnesic group showing lower pleasantness ratings in the self-positive condition,  $\chi^2(2) = 17.8, p < .05$ . The latter finding should be interpreted with caution due to the small size of the amnesic control group. The difference in valence rating did not vary significantly across groups in the other-reference conditions,  $p = .06$ , although it approximated significant levels. No other interaction reached or approximated significant levels.

In conclusion, these findings revealed that the confabulation group showed a significant difference from other groups in recalling self-referent emotional information in more pleasant terms. This tendency was particularly evident in the negative self-referent stories, which the confabulating patients recalled in more pleasant terms on average.

#### *Laterality effects*

In order to assess whether the Bilateral and the Unilateral (right-hemisphere patients) Confabulation subgroups differed in their performance on the conditions of the prose recall test, non-parametric Mann-Whitney U tests were used with laterality (bilateral versus unilateral) as the between-subject factor. These revealed that although the unilateral patients remembered more idea units in all story-reference combinations, these differences did not reach significant levels,  $ps > .08$ , except in the self-referent positive stories, in which unilateral patients remembered more idea units than bilateral patients,  $Z = 2, p < .05$ . In addition, the

valence ratings of the protocols of the two sub-groups did not differ significantly across any valence-reference combination,  $ps > .2$ . Thus, although the unilateral patients produced more unpleasant stories than the bilateral group in the critical self-negative combination, this was not significant,  $p = .2$ . Similarly, there was no difference between the groups in the amount of confabulation they produced in any of the valence-reference combinations,  $ps > .1$ , except in the other-referent and negative stories. More specifically, in the other-negative condition there was a significant difference between the groups,  $Z = 2.1$ ,  $p < .05$ , with unilateral confabulating patients producing more confabulations than bilateral patients. By contrast, unilateral patients produced less confabulations than the bilateral subgroup in the self-negative condition but this difference was not significant,  $p = .1$ . The mean Recall, Confabulation and Valence scores of the Bilateral and Unilateral confabulation groups are presented in Appendix D5.

### 5.3.3 Summary of Main Findings

As expected, confabulating patients showed excess of confabulation errors and impaired recall of short affective and neutral stories compared with frontal and non- neurologically impaired controls. Their overall performance in the recall of these emotional stories was equally impaired to that of a small group of matched amnesic patients, although the latter showed a steeper decline from immediate to delayed recall. However, confabulating patients recalled significantly less information when presented with a negative than a positive self-referent story. This finding was accompanied by the fact that confabulating patients recalled the valence of the negative self-referent stories worse than all other groups, narrating the story plot in a more pleasant way than the original. In addition, they showed the highest amount of confabulation errors in this condition (a non-significant trend) and frontal control patients showed the same tendency. By contrast, confabulating patients, similarly to control groups, did not show such biases in the recall of third-person stories. Finally, these biases were shown by both bilateral and unilateral confabulating patients, although the unilateral subgroup showed overall better recall, less confabulation and the degree of emotional and self-serving bias was less extreme than in the case of the bilateral confabulating patients. These findings are discussed below.

## 5.4 Discussion

### 5.4.1 Self-Serving Bias in Confabulation

Overall, confabulating and amnesic patients recalled less prose information than frontal patients, who in turn recalled less information than healthy controls. These results were also consistent with the neuropsychological performance of the experimental groups in standard neuropsychological tests of memory (see Chapter 2). However, there was one crucial feature in the recall performance of confabulating patients that was significantly different than that of the other three groups. Namely, the confabulation group recalled self-referent emotional information in significantly more pleasant terms than the other groups. This bias was particularly evident in the negative self-referent stories, which the confabulating patients recalled on average in more pleasant terms than the other groups did. Moreover, the confabulation group recalled the negative self-referent stories in significantly less detail than the positive self-referent stories and they produced the highest amount of confabulatory errors, i.e. distortions and fabrications, in the recall of these stories (a non-significant trend). Table 5-3 below illustrates the performance of confabulating patients (patients LH, OT, IR) in this valence/reference combination and contrasts it with that of the other groups. As these examples illustrate, confabulating patients showed the tendency to produce self-enhancing fabrications and more generally to distort the meaning and emotional significance of negative self-referent stories in ways more pleasant for the 'self'. These tendencies were not observed in control participants.

**Table 5-3. Examples of Recall Protocols in Negative and Self-referent Conditions**

Story Version: Self-Referent & Negative Valence Combination
<b>Original Story Protocols</b>
<b>Plot 1</b>
[Imagine that] you are a hard working/ employee/. It is Sunday/ morning/ and you are preparing to go out/. You have planned a wonderful day-trip/ to the seaside/ in order to rest/. However, your best friend calls you saying/ he is ill, lonely and needs your help/. Feeling exhausted/ and not bearing to miss your trip/, you lie to him/ saying that you promised to see your sister/. Four days later/, you find out that/, due to inappropriate treatment/, your friend's health has severely deteriorated/ since Sunday/. You feel guilty/ and ashamed of yourself.
<b>Plot 2</b>
[Imagine that] you are a well - qualified/ assistant/. It is Thursday/ morning/ and you have completed a long report/. You burst/ into your boss's office/, wanting to announce the outcome/. However, your boss has asked you/ not to disturb him that morning/. With great embarrassment/, you suddenly remember his request/. You apologise/ for interrupting a board meeting/. The next day/, your boss tells you that you might lose your promotion/ and even be fired/, as you are so absentminded/ lately/. You feel very humiliated/ and scared/.



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**Story Version: Self-Referent & Negative Valence Combination**

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**Normal Control: N7**

Male. Age: 57y. Plot 1

Immediate Recall 1: "I'm a dedicated employee, it's Sunday morning, I have a day-trip planned to the sea-side...I'm about to meet, to go with my sister. A close friend calls, I make up an excuse not to see him or not to receive him. I get a call four days later to tell me that the friend's health has deteriorated... and that's it."

Immediate Recall 2: "I'm a dedicated employee, I'm sitting on a Sunday morning, looking forward to a day-trip to the seaside. My friend calls, to tell me they're feeling ill and lonely...I explain, no actually I don't explain how tired I am, I make up an excuse that I have to see my sister. And then four days later, my friend's health has deteriorated due to inappropriate treatment and I feel guilty and I can't remember what else it is".

Delayed Recall: "It's Sunday morning, I have a trip to the coast planned. My friend phones to say they're feeling ill, feeling down. I make up an excuse that I have to see my sister. I find out four days later, due to inappropriate treatment he's got worse...I feel guilty (?). And that's it".

**Frontal Control: F2**

Female. Age: 55y. Plot 1

Immediate Recall 1: "Your sitting around doing nothing much but you're a little tired, it's been a hard week, a hard days work and your friend phones you and says would you like to come out for dinner and you say I'm terribly sorry I have a friend, my sister is ill and unfortunately when the story came to it her sister really was ill and she felt very very guilty".

Immediate Recall 2: "Okay so ... I'm a middle-aged lady, am I? Who's had a hard days work and I'm looking forward to a trip to the sea and I'm very very tired. Ohh I've never been so tired in my life can you imagine and my friend phones me and he asks me to come out with him for tea. I say I'm terribly sorry my sister is ill, is it? And I won't be able to go there. My sister really became, no my friend, oh he, wait my friend was feeling ill and he asked me to come and see. He's sick and he's lonely and he needs my help and comfort. I said sorry but my sister's ill or is it my friend, my sister isn't it, oh no my friend is ill she didn't go. She felt really upset when she found out that he who had invited her out really was ill."

Delayed Recall: "Her boyfriend called ill, said I am ill and lonely. But I said my friend is ill, I have to go and see her. Then she felt guilty because her friend was indeed ill".

**Amnesic Control: A2**

Male Age 63y. Plot 1

Immediate Recall 1: He had arranged to go to the sea-side and he felt ashamed when his friend passed away. He felt ashamed that he lied.

Immediate Recall 2: "He made an excuse that he was on holiday and his friend died. And he felt ashamed".

Delayed Recall: "No, I can't remember"

**Confabulating Patient: LH**

Male. Age 60y. Plot 1

Immediate Recall 1: "You are going to see your sister at the coast, nice Sunday out, you've had a scadly time, looking forward to it for a day's rehab so to speak (laughs), you get this call from your mate he is feeling a bit under the weather, not very happy with how the world is treating him he needs to talk to someone, to get these things out of his chest, sort them out. Would you go down to help him? Being a good friend you do. You go down do your best. Next WK he pops his cods. The only feeling you should have, not happiness satisfaction but something along these lines, because you did your best to help him in his final days, even if you didn't know that these were his final days".

Immediate Recall 2: "You are going to see your sister at the coast, you felt you needed a rehab visit to get yourself totted up again, a friend rings, he feels ill, getting worse, he needs a bit of help, would you go and talk to him, to cheer him up, pulling straight whatever. You go down you do that, that is on a Monday or something like that, by the Friday the medical people realise that they have been giving him wrong treatment and his condition has deteriorated considerably, but you feel happy that you've been down to help on time".

Delayed Recall: "Was this the guy feeling under the weather? He rang his mate because he was feeling down at the month, sorry at himself, have had the worse problems, sitting on his shoulders, well he wasn't but he would have done, and (laughs) so he wanted somebody to give him a bit of boost, to help him a bit, so he rang his mate. His mate was on his way to the coast to see his sister, but because this guy was such a close friend he knocked the trip to see his sister on the head and went to see his mate who felt wonderfully chuffed about it".

**Confabulating Patient: OT**

Male. Age 40y. Plot 1

Immediate Recall 1: "My friend rang up to see how I was. I started asking him how he was and how he was keeping".

Immediate Recall 2: "A friend who rang and says he...well he asked... fancy on going on a trip with him. I told him yes".

Delayed Recall: "Sorry, pet, nothing comes to my mind. Why though, I don't know".

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Story Version: Self-Referent & Negative Valence Combination

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**Confabulating Patient: IR**

Female. Age 45y. Plot 2

Immediate Recall 1: "I... one morning, I went to work to pick up a check. They didn't give it. She can't leave the job. They want her to stay. She didn't leave it. Took the coffee and went back home".

Immediate Recall 2: "I wrote an exam. I went to my boss to show the school report. I had no more money. He said I must go. I took over the report and left. I can also lose the job. He didn't give me money any more. But I went. He said stay".

Delayed Recall: "Lady is in the garden. They made garden pretty and they eat happy in the house, in the garden and they put clothes on. I liked it there. And he said I could stay".

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#### 5.4.2 Self-serving Confabulation: The Role of Amnesia and Executive Dysfunction

These findings support previous indications of emotional biases in confabulation (Conway & Tacchi, 1996; Fotopoulou et al., 2004; see also Chapters 3 and 4). In this experiment, such bias was not observed in either amnesic or dysexecutive patients, at least not to the same degree. The three amnesic patients tested in this study showed, when compared to confabulating patients, equally poor recall performance in stories with negative valence, although their performance deteriorated more sharply from immediate to delayed conditions. However, unlike the confabulation group, the amnesic patients were able to recall the negative valence of the original stories appropriately. In addition, they made only few confabulatory errors in these conditions, which did not differ in number from their low error scores in all other conditions. Thus, although memory impairment may have contributed to confabulating patients' wishful distortions of the prose material it was not sufficient to cause such bias.

Previous studies have shown that frontal patients are impaired in the recall of narrative material, although at a different level and possibly for different reasons than amnesic patients without executive dysfunction (Baddeley & Wilson, 2002; Moscovitch & Winocour, 2002; Sirigu et al., 1995; Zalla et al., 2002). In particular, identified executive impairments specifically contributing to poor prose recall, involve the inability to establish inferential relations and sequential links among narrative events at early encoding stages (Zalla et al., 2002). Moreover, the capacity to monitor, integrate and manipulate the contents of working memory is impaired in such patients (Baddeley & Wilson, 2002; Moscovitch & Winocour, 2002). Finally, the capability to provide the optimal retrieval strategy for recall as, well as to select, verify and adjust the products of retrieval can be defective in frontal patients (Baddeley & Wilson, 2002; Burgess & Shallice, 1996; Hough,

1990; Moscovitch & Winocour, 2002; Wapner et al., 1981). By contrast, the impairments thought of as responsible for amnesic patients' poor performance in prose recall, include mainly transferring and maintaining semantic information in long-term memory (Baddeley & Wilson, 2002; Zalla et al., 2002).

Although the present study did not directly investigate these detailed differences, the general quantitative and qualitative differences in semantic recall between the story protocols of the frontal and amnesic patients suggest that different cognitive processes underlie their impaired performances. In particular, frontal patients tended to remember more idea units than amnesic patients but these were often misrepresented, or erroneously interpreted, distorted and even placed into different temporal order. Table 5-3 above illustrates the difference in recall quality between the two groups (see patients A2 and F2), as well as between the confabulation group and the group of healthy participants (see also Appendix D6 for recall protocols of positive story plots). However, it is important to note that despite the similarities in the recall patterns of confabulating and frontal control patients, the latter did not distort the emotional valence of the original stories as confabulating patients did and their semantic recall scores did not significantly vary across positive and negative stories. Thus, general executive impairment cannot explain the positive emotional bias shown by the confabulating patients.

More generally, it appears that the combination of executive dysfunction and memory impairment, as encountered in confabulating patients of this study (See Chapter 2) and in the literature (e.g. Cunningham et al., 1997; Kopelman, 1987; Moscovitch & Melo, 1997) causes the unique pattern of impaired recall presented by the confabulation group of the present study. More specifically, while the semantic recall scores of these patients were as poor as those of the amnesic group, their recall protocols also revealed an excess of fabrications, distortions and narrative inconsistencies which resembled the recall performance of the frontal group. Thus, both frontal lobe dysfunction and amnesia had an obstructing effect on the recall performance of confabulating patients and could be considered as contributing factors to confabulation. However, this study shows that neither was sufficient to cause the selective emotional biases observed in confabulatory content.

Moreover, it is also important to highlight that the emotional bias shown by the confabulating patients could not have been caused by general emotional processing or mood factors. The emotional bias observed in the confabulating patients was restricted to the self-referent conditions. Confabulating patients had no difficulty in representing the negative valence of the other-referent story. Their protocols revealed that they expressed highly negative emotions about narrative characters they did not identify with. Moreover, the average recall scores of the confabulation group in the other-referent stories with negative valence did not vary significantly from those of the other-referent stories with positive valence and finally the number of confabulations they made in the other-referent stories with negative valence did not vary significantly from those of the stories with positive valence. Thus, these results suggest that confabulating patients did not show an inability to encode, store and recall negative information *per se*. Instead, their positive emotional bias was linked to some other self-related mechanism and its influence on memory (see below). Table 5-4 below offers some examples of other-referent recall protocols with negative valence.

**Table 5-4. Examples of Recall Protocols in Negative and Other-referent Stories**

Other-Referent & Negative Valence Combination
<p><b>Original Story Protocols</b></p> <p><b>Plot 1</b>            Mary Taylor is a well - qualified/ assistant/. It is Thursday/ morning/ and she has completed a long report/. She bursts/ into her boss's office/, wanting to announce the outcome/. However, her boss has asked her/ not to disturb him that morning/. With great embarrassment/, she suddenly remembers his request/. She apologises/ for interrupting a board meeting/. The next day/, her boss tells her that she might lose her promotion/ and even be fired/, as she is so absentminded/ lately/. She feels very humiliated/ and scared/.</p> <p><b>Plot 2</b>            Patrick Welsh is a hard working employee. It is Sunday morning and he is preparing to go out. He has planned a wonderful day-trip to the seaside in order to rest. However, his best friend calls him saying she is ill, lonely and needs his help. Feeling exhausted and not bearing to miss his trip he lies to his friend, saying he promised to see his sister. Four days later he finds out that, due to inappropriate treatment, his friend's health has severely deteriorated since Sunday. He feels guilty and ashamed of himself.</p> <p><b>Confabulating Patient: LH</b>            Male. Age 60y. Plot 1  <u>Immediate Recall 1:</u> "This poor lass makes a big cock of her job because she is a woman so she will resign anyway (laughs!). Now, seriously, there'll be some very important business issue going on over a period of time, a good result is reached. Mary, whatever you call her, the assistant, so excited, she had overwhelming instinct, dives into his office to fire it out, he is in a meeting in which he definitely didn't want to be disturbed in, backs out.            Next day she is pulled in and told that if she ever does anything like this again she'll be in hot water and could possibly lose her job. In the meantime it could seriously affect any positions she's been short-listed for a rise".  <u>Immediate Recall 2:</u> "There'll be some long-term on-going business issue, came to a conclusion on Thursday. Mary, got very excited about this, so shot straight to her bosses office, the managing director to get him straight on this. As she shotted in she realised he was in an important board meeting and had given specific instructions</p>

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**Other-Referent & Negative Valence Combination**

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not to be disturbed. Friday boss calls Mary in says "Look little flower" oh didn't say little flower but I'd thought it will be nice. He said right you know what you did yesterday was totally out of bounds you are not supposed to do things like that, it could have affected your situation as you are standing for a rise or it could mean that you are fired for breaking regulations".

Delayed Recall: Was that the fish one? I thought she was doing pretty well and got a kick in the teeth? Why did she? I can't remember she was doing something. She was trying to do something with fish but she didn't manage to finish it.

**Confabulating Patient: OT**

Male. Age 40y. Plot 1

Immediate Recall 1: "Her boss was trying to get her to come to his office. Regarding a promotion that was in mind for her. And by the time the message came through for her...well by the time she got to his office she caused some kind of panic. Well, it sounds silly but how she caused it I don't know!"

Immediate Recall 2: "Well, there was a lady that worked in an office block. There was room for some kind of trouble toward... in her job".

Delayed Recall: "I don't remember this one, sorry".

**Confabulating Patient: WM**

Male. Age 56y. Plot 1

Immediate Recall 1: Mary was working. She had news for her boss, but when she...when she got to her bosses' office the boss was in a meeting... and she didn't know what to do with the news. He was upset because he wanted the news and Mary was upset because he was upset and because she couldn't remember the news anymore.

Immediate Recall: She had a phone call. Said she'd give the news to her boss immediately. And when she got to the bosses' office the boss was in a meeting... and the same night she went home, and the next day when she came back to work, she forgot to give a message to the boss and... it was, the boss, her boss had to attend a very important meeting. And next day, and her boss found out he had to be meeting, a very important meeting and he fired Mary Taylor. And when she got home she found that her dog was dead.

Delayed Recall: "... Mary Taylor, was also involved with another man...and John's father killed Mary... And John...John's father found out. He went, he found, so his son knew about the other man involved with his mother. He also wanted to kill John".

**Confabulating Patient: IR**

Female. Age 45y. Plot 2

Immediate Recall 1: "Patrick has a friend. The friend is not well. But Patrick is tired, very tired. And he has no more money. Patrick tells his friend he is going to go, but doesn't go. The friend is not happy, Patrick is not happy."

Immediate Recall 2: "Patrick has a friend. His sister says he has a friend and this friend is ill. Patrick must go and see his friend. But Patrick goes...Patrick is tired. He goes to his sister and says he is tired. His sister says you are lying again. When you were a child you use to lie to me too. But Patrick doesn't go to his friend and he is friend is not well and Patrick is not well".

Delayed Recall: "They are brother and sister and they should not having doing these things. God, will know. God will punish them. He can see".

**Confabulating Patient: DO**

Female. Age 71y. Plot 2

Immediate 1 ...Mm, I wouldn't do that. [Can you just tell me what you remember from the story?]

It's sad...Everybody would know that he didn't go to his sister.

It's very sad really. [So can you tell me the story?] ... He told his best friend he's going to his house to see his sister...I would have told him. That I had to go to the seaside. Because I nearly burned out.

Immediate 2: Well, he did know he was ill. He didn't know he was that ill, so it is very sad. He has hurt his friend. He was burned out. He wanted to rest. So, he lied to his friend. That was wrong.

Delayed Oh that was awful... Somebody hurts their best friend. You shouldn't have lied to them. And...he goes to the beach. It is an occasion where you're being awful...

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In conclusion, the positive emotional bias showed by confabulating patients was not explicable solely by amnesia and classically associated lesions in

medial temporal lobes and diencephalic regions. In addition, the performance of frontal control patients showed some similarity with that of confabulating patients but executive dysfunction alone was not sufficient to cause the phenomenon and particularly to explain its emotional and self-related biases. This selective bias could not either be explained as an effect of mood, as patients showed no difficulty in recalling other-related negative emotions. Thus, both amnesia and executive dysfunction seemed to have contributed to the formation of confabulations, but self-related processing seemed to have a salient role in the emotionally-biased performance of confabulating patients. The latter self-related mechanisms will be addressed below.

#### 5.4.3 Self-Referent Biases in True and False Memories

Several studies within cognitive psychology have showed that memory for self-relevant information is superior to memory for 'objective', i.e. not self-related information (see Czienskowski, 1997; Gillihan & Farah, 2005; Symons & Johnson, 1997 for reviews). This self-referent effect is explained with reference to the unique elaborative and organisational properties of self-representation and self-related knowledge (e.g. Rogers et al., 1997; Maki & Carlson, 1993). Alternative interpretations link the self-referent effect with increased elaboration or organisation demands included in process of self-attribution of memories, as well as its frequent use in information processing (Czienskowski, 1997; Ferguson et al., 1983; Klein & Kihlstrom, 1986; Symons & Johnson, 1997). Thus, while there is disagreement on whether the self is a unique structure that requires specialised processing or whether it is just one of the efficient ways of structuring, representing and elaborating information (see Gillihan & Farah, 2005 for discussion), there is almost universal agreement on the fact that the 'self' is a uniquely effective process of encoding information, maintaining it in memory and retrieving it. It results in spontaneous, efficient processing of material that is often well organised and exceptionally well elaborated (Symons & Johnson, 1997).

The above studies focused on the effects of self-processing on memory facilitation, i.e. *increase of memory accuracy and decrease of errors of omission*. By contrast, other studies have considered the organisational properties of the 'self' with respect to its capacity to cause *memory inaccuracy and increase errors of both omission and commission* (Greenwald, 1980; Johnson, Nolde, &

DeLeonardis, 1996; Schacter et al., 1998). Thus, relying on well-developed structuring framework, such as one's self-representation, may facilitate memory. However, it can also distort it in the process of shaping it according to the characteristics of one's self-representation. This is particularly true in the case of autobiographical memory which appears to have a reciprocal relation with one's social and self-identity, i.e. one's recollections influence one's self-view and one's self-representation filters one's memories (See Conway, 2001; McAdams, 2001 for reviews). Given such interdependence, a number of studies have been dedicated to the examination of the ways self-representation can influence memory and lead to memory inaccuracies, distortions, omissions and even fabrications (for reviews see Conway & Pleydell-Pearce, 2000; McAdams, 2001; Pillemer, 2001; Singer & Salovey, 1993; Stein, Wade & Liwag, 1999; Walker, Skowronski & Thompson, 2003; Woike, Gershkovich, Piorkowski & Polo, 1999). These studies also highlight the connection and interdependence of self-goals and autobiographical memory. More specifically, autobiographical memory grants functions of identity formation, self-coherence, and emotion-regulation (Barclay, 1996; Bluck & Habermas, 2001; Conway, 1996; Fivush, 1998; MacAdams, 2001; Neisser, 1988; Pasupathi, 2003; Pillemer, 1992). However, there seems to be a trade-off between these organisational functions and memory accuracy, which leads to memory errors and distortions. Crucially, distortions of event content, time reference or significance are employed in the service of positive self-appraisal (Greenwald, 1980; Wilson and Ross, 2003); and distortions of emotional intensity and valence serve the purpose of sustaining a pleasant representation of one's autobiography (for a review see Walker, Skowronski & Thompson, 2003).

The results of the present study can be interpreted in a similar way. It thus appeared that although confabulating patients did not show a generalised emotional abnormality in their recall of emotional and neutral stories, they did show a selective bias in recalling the emotional valence of self-referent negative information. They instead distorted this information in a way that portrayed positive image of themselves. It thus appeared that the confabulations employed to distort the emotional valence and the significance of the critical stories served to preserve a positive self-representation and were guided by the emotional values of the latter. As discussed above, these motivational processes can also be found in normal autobiographical distortion. Characteristically, Greenwald (1980) has

termed the determining influence of the self on autobiographical memory as ‘the totalitarian ego’. However, despite the pervasive nature of such self-related influences, in neurologically healthy individuals they are not sufficient to cause severe confabulation. Instead, confabulation seems to require the presence of some degree of both memory impairment and executive dysfunction. It seems that given such deficits the normal involvement of motivation in shaping memory is further unconstrained and leads to the construction of particularly wishful confabulations. In brief, these results provide support for the fifth hypothesis of the study. Namely, they show *that the emotional bias in the content of confabulation is self-serving, over and above the memory and executive functions deficits accompanying its presence*. The potential neural basis of such self-serving influences on memory will be further addressed on Chapter 8.

#### 5.4.4 Self-Serving biases in Motor-related Confabulation

It is also noteworthy that although the unilateral subgroup showed overall better semantic recall and less confabulatory errors, it showed a similar emotional and self-serving bias as the bilateral confabulating patients. Thus, although unilateral patients showed different emotional biases in spontaneous confabulations (see Chapter 3), under controlled experimental procedures they did show similar self-serving biases as the bilateral patients. It is also of interest that these three patients showed an increased number of confabulations in the negative other-referent condition, although they did not alter the emotional valence of these stories. These findings could be related to the increased tendency these patients showed in their confabulations to blame others for their illness, accuse them of abuse, stealing, abandonment, conspiracy and other paranoid themes (see also Berlyne, 1972). These confabulations appear negative to the naïve rater (see Chapter 3), yet they may serve similar motivational purposes of positive self-regard (Bental, 2003; Kaplan-Solms & Solms, 2000). This issue will be further addressed in Chapter 8.



## Chapter 6 : A Case Report of Wishful Confabulation

*“Just as the pleasure ego can do nothing but wish, work for a yield of pleasure, and avoid unpleasure, so the reality ego need do nothing but strive for what is useful and guard itself against damage”*

*S. Freud, Formulations on the Two Principles of Mental Functioning, 1911.*

### 6.1 Introduction

This chapter reports the cognitive profile and confabulatory behaviour of a patient who suffered a subarachnoid haemorrhage and underwent craniotomy and clipping of an anterior communicating artery (ACoA) aneurysm. His neuropathology resulted in dense anterograde and retrograde amnesia, executive dysfunction and marked confabulation, which persisted six months following his operation. The present study will focus on the content of the patient’s confabulations and anosognosic statements aiming at (1) investigating the cognitive deficits underpinning the patients’ confabulations; (2) providing further support, specification and explanatory power to the findings of the previous group studies on motivated confabulation (Chapters 3, 4 and 5). More specifically, this case report will focus on the role of awareness of deficit, suggestibility, premorbid personality traits and self-representation in memory-related confabulation.

### 6.2 Case Report

#### 6.2.1 Personal History

LH was a 60 year-old, right-handed, man. He was a mechanical equipment salesman and local manager. LH was married and had two children. His relatives described his premorbid personality as strong-willed, apparently self-confident and assertive. LH was highly sociable and involved in a variety of leisure activities. However, his family noted that LH was in reality very introverted regarding his own feelings and he found it particularly difficult to accept or reflect upon his own limitations. He tended to ‘work or joke his

problems away'. They also noted that in the last years he was becoming increasingly less motivated in his work and had increased his weekly, social-related, alcohol intake.

### 6.2.2 Medical History

LH had no significant previous medical or psychiatric history. He was travelling for business purposes when he was urgently admitted to hospital with a history of severe headache with nausea and vomiting. A CT angiographic investigation confirmed the presence of a small saccular aneurysm at the junction of A1 and A2 segments of the left anterior cerebral artery and also revealed subarachnoid haemorrhage in the adjacent subarachnoid space and in the medial right frontal lobe. He underwent craniotomy and clipping of the anterior communicating artery (ACoA) aneurysm the following day. His postoperative recovery was uneventful apart from delirium tremens five days post-admission, which was treated by chlordiazopoxide. Prior to being transferred to a regional neurosurgery department in the North East of England a postsurgical intracerebral angiogram was performed, which confirmed satisfactory clipping of the angiogram, although there was a very small residual bleb at the site of the previous aneurysm and the right A1 segment appeared hypoplastic. A final CT angiographic study 10 days post-surgery revealed evidence of the recent fronto-temporal craniotomy (see Figure 6-1 below). There was a sizeable extra cranial haematoma with evidence of the recent haemorrhage and the placement of an aneurysm clip in the left paraclinoid region. A small residual haematoma was present in the depth of the anterior interhemispheric fissure/septum pellucidum. Residual subarachnoid blood was noted within the mid line frontal sulci and over the convexity mainly on the left. There was also a small amount of blood in the occipital horns. Ventricles were mildly prominent.



**Figure 6-1. LH's Post-operative CT scan.** This cranial CT angiographic study, taken 10 days post-surgery, demonstrates evidence of left frontal craniotomy. There is a large acute infraction within the left frontal lobe, including both dorsolateral and ventromedial prefrontal cortex. In addition, there is a smaller haematoma within the posterior aspect of the right frontal lobe. There is a sizeable extra cranial haematoma with evidence of the recent haemorrhage and the placement of an aneurysm clip in the left paraclinoid region. A small residual haematoma is present in the depth of the anterior interhemispheric fissure/septum pellucidum. Residual subarachnoid blood is noted within the mid line frontal sulci and over the convexity mainly on the left.

When LH's neurological condition was stabilised, one month post-admission he was transferred to another unit for ongoing rehabilitation but made little significant progress with respect to orientation, memory and executive abilities. Following his operation, caring staff reported that LH presented with memory problems and was often confused and disoriented in time and place. Initially he was very talkative and verbally disinhibited and constantly developed

false ideas, often of a bizarre content, about the hospital staff and his whereabouts. He was also noted to be particularly unmotivated to participate in the activities of his rehabilitation programme, a behaviour which was embedded in a confabulatory belief system. For instance, he demanded that staff should leave him alone, or other times immediately serve his needs insisting that they were hotel staff in a holiday resort in Australia. Psychiatric examination at the time reported cognitive dysfunction, anosognosia and confabulation. LH had no physical impairments. He had a mild degree of hypertension which was treated pharmacologically.

The most striking aspect of LH's cognitive state, as well as a major issue of difficulty in his social interactions and management, was his persistent tendency to confabulate events and facts about himself and his surrounding environment. At the time of the assessment, i.e. four months following his admission to the rehabilitation unit, staff reported that LH appeared unaware of his hospitalisation, and confronted with the hospital surroundings he continuously fabricated reasons for being admitted or claimed he was simply visiting the hospital premises. He often refused to participate in the activities of the unit, was verbally disinhibited and occasionally became verbally abusive to staff, threatening to attack them physically.

In addition, he failed to remember and accept that he was not allowed to leave the hospital on his own free will and he persistently claimed that he lived at home with his wife. He also typically interpreted his everyday activities as part of his premorbid everyday work schedule. For example, during his occupational therapy session he behaved as though he was in hospital to sell medical equipment. LH's previous professional duties included such visits to the particular hospital and he did consult the unit's occupational therapists about the use of rehabilitation supplies. However, LH did not actually remember these therapists, nor did he show familiarity with the surroundings. Instead, every time he misinterpreted the caring activities as work-related circumstances he claimed this was the first time he actually dealt with this specific unit and its staff. Although LH's confabulations had some common themes, mostly relating to premorbid life circumstances and activities, his confabulations did not show apparent content constancy or specificity and could be triggered by questioning or produced

spontaneously. LH generally defended his confabulation but did not hesitate to give alternative versions of the same theme, even minutes apart. When his confabulations referred to the present and he intended to act upon them (e.g. leave the ward) providing him with conflicting evidence only enhanced his resistance and his adherence to his beliefs. At these times, distraction was the only possible solution, although at times this failed too and the patient became very agitated.

### **6.3 Neuropsychological Evaluation**

LH was assessed in his rehabilitation unit four months post-surgery. His close relatives and friends helped substantially in verifying his answers and providing details about his premorbid life and personality. In addition, a control group of five neurologically healthy adults were tested on the tests which lacked published norms. These controls were in-patients at Newcastle General Hospital suffering from non-neurological conditions, such as orthopaedic injuries. These were five males with mean age 57.8 (2.2), ranging from 56 to 61 years, and mean education 13.6 (2.3) years. Where possible their performance scores were compared to that of LH's using the methods developed by Crawford & Howell (1998) and Crawford & Garthwaite (2002) for obtaining point estimates and confidence limits of the abnormality of an individual patient's test score when the control sample is modest in size (e.g.  $N < 5$ ). Written consent was obtained for all participants.

#### 6.3.1 Pre- and Post-Morbid Intelligence

LH's performance on the WAIS-III is summarised in Table 6-1. Overall, LH's intelligence score appeared as moderately deteriorated in comparison with his WTAR predicted WAIS-III score of 92. His Verbal IQ Score of 105 appeared less affected, with the main difficulty shown on the Similarities subtest (SS score 7) which is known to require abstract thinking. Bedside and formal assessment (Pyramids and Palm Trees) further confirmed that LH's semantic abilities were intact (See Table 6-1). By contrast, LH showed some deterioration in his ability to perform tasks that required perceptual organisation and even more marked difficulties in tasks that assessed processing speed (Digit Symbol Coding Subtest SS = 8 and Symbol Search SS = 6).

**Table 6-1. Neuropsychological Evaluation of LH's Intellectual Abilities**

<b>Test</b>	<b>Score</b>	<b>Age-Adjusted Level</b>
<b><u>Intelligence</u></b>		
WAIS-III	Index Scores	
Verbal IQ Score	93	Average
Performance IQ Score	53	Extremely Low
Verbal Comprehension	105	Average
Perceptual Organization	54	Extremely Low Impaired
Working Memory	75	Borderline
Processing Speed	57	Extremely Low Impaired
Full Scale IQ Score	73	Borderline
WTAR Estimated IQ	92	
SCOLP Test		
Speed of Comprehension	5	10 <sup>th</sup> percentile
Spot-the-Word	11	75 <sup>th</sup> percentile
<b><u>Other Tests</u></b>		
<b>Mood</b>		
HADS		
Anxiety Score	10	Borderline (8-10)
Depression Score	10	Borderline (8-10)
<b>Semantic Abilities</b>		
Pyramids & Palm Trees Test	88.4% Correct Rate	98.5%
<b>Bedside Tests</b>		
Colour Pointing in Pictures	100 % Correct Rate	Normal
Word Semantic Categorisation	99 % Correct Rate	Normal
Word Semantic Naming	80 % Correct Rate	Normal
Symbolic Gestures on Request	100 % Correct Rate	Normal
<b>Orientation</b>		
WMS- III Orientation Sub-test	43 % Correct Rate	5 <sup>th</sup> percentile
RBMT-E Orientation Subtest	10.5/14	Profile Score 1

**6.3.2 Executive Functions**

LH's performance appeared impaired on most executive functions' tests administered (**Table 6-2**).

Table 6-2. LH's performance on tests of Executive Functions

Test	Score	Age-Adjusted Level
<b>Hayling Test</b>	SS 1	Impaired
<b>DEX Questionnaire</b>		
LH Self-Report Ratings	M 1.9 SD 1.4	Minimisation
Staff Ratings	M 2.7 SD 1.1	
Relative Ratings	M 2.7 SD 0.9	
<b>Cognitive Estimates</b>	Error Score: 5	Normal
<b>DK-EFS</b>	<b>SS (Age-Adjusted)</b>	Normal
<i>Trail Making</i>		
Condition 4: Switching	1	10(3)
Total Errors in Condition 4	3	10(3)
Contrasts 4 Vs: Motor Speed	1	10(3)
Contrasts 4 Vs: Visual Scanning	3	10(3)
Vs: Combined Measure of Reading	8	10(3)
<i>Verbal Fluency</i>		
Letter	9	10(3)
Category	1	10(3)
Switching	1	10(3)
Switching Accuracy	1	10(3)
Set-Loss Errors	4	10(3)
Repetition Errors	9	10(3)
<i>Design Fluency</i>		
Composite Score	8	10(3)
Switching	6	10(3)
Switching Vs Combined		
Repetition Designs	7	10(3)
Percent Design Accuracy	6	10(3)
<i>Color-Word Interference</i>		
Naming & Reading	12	10(3)
Inhibition	10	10(3)
Inhibition/Switching	14	10(3)
Inhibition Errors	1	10(3)
Inhibition/Switching Errors	1	10(3)
<i>Sorting</i>		
Free Sorting Correct Sorts	6	10(3)
Free Sorting Description Score	5	10(3)
Repeated Sorts	1	10(3)
<i>20 Questions</i>		
Initial Abstraction	7	10(3)
Total Questions Asked	7	10(3)
Weighted Achievement Score	8	10(3)
<i>Word Content</i>		
Total Consecutively Correct	2	10(3)
<i>Tower</i>		
Total Achievement Score	6	10(3)
Mean First-Move Time	12	10(3)
Total Rule Violations	9	(Percentile Rank)
Rule-Violations-Per-Item Ratio	7	10(3)
<i>Proverb Free Inquiry</i>	4	10(3)

n.a. = Not administered

Furthermore, LH clearly underestimated his executive difficulties in comparison with the perspective of his relatives and staff in the DEX Questionnaire (Dysexecutive Syndrome Questionnaire, BADS 1996). Somewhat surprisingly, his performance was normal on the Cognitive Estimates Test. However, his performance was defective on the more demanding DK-EFS battery. More specifically, LH showed marked impairment in sequencing and set shifting as measured by the Trail Making Test. Interestingly, he showed problems even in simple letter and number sequencing (low scores on conditions 1 & 2 of the test), over and above any visual or motor difficulties. His performance was not defective in a letter fluency task, but deteriorated steeply when he had to perform a category fluency task, as his few answers were mainly repeated words or non-words. Interestingly, LH did not show problems in tests of semantic knowledge (see Table 6-1) suggesting that his deficit was one of flexibility, rather than semantic categorisation. In the design fluency task, LH did not show problems in designing abstract figures. However when he had to shift between alternating designs he showed perseveration and his performance was defective.

In the color-word test, an equivalent of the Stroop procedure, he was able to complete the simple reading tasks without errors in relatively normal speed. However, in the critical inhibition condition he exhibited impulsivity in that he failed to follow the rules and inhibit the automatic response. Thus, although his processing speed scores appear normal, he made an abnormally high number of errors, for which he showed no monitoring. LH's performance was contaminated by impulsivity and lack of self-monitoring also during the Word Context test, where his answers did not meet the specified semantic criteria, were often inappropriate and generally did not portray the ability for deductive, abstract thinking. Inductive thinking was also impaired as shown by LH's poor performance on the Proverbs test where he produced inaccurate and concrete interpretations to both common and uncommon proverbs. LH performed slightly better and he showed clear evidence of motivation during the 20 questions test, which has a game-format. He showed clear interest in the examiner's feedback and was able to use it to his benefit. He did not exhibit perseveration tendencies during this task, but his abstraction and semantic categorisation abilities were poor.



6.3.3 Anterograde Memory

LH's anterograde memory abilities as assessed by the Wechsler Memory Scale-III Edition (WMS-III) are summarised in Table 6-3. His General Memory Index Score was extremely low, showing marked memory deterioration attributable to his poor performance on both visual and verbal memory tests. His scores were somewhat higher for visual than for auditory immediate and delayed recall subtests, while his performance on working memory subtests was average. LH made a few intrusions (including fabrications) during these tests, mainly in the delayed recall of the auditory tests (Logical Memory II & Verbal Paired Associates II). On the Rey Complex Figure Test (Table 6-3) he showed intact planning and construction abilities (normal Copy scores) but he was unable to retain sufficient information in memory even immediately after presentation of the figure. LH was not orientated to space and time and he performed poorly on two different orientation tasks assessed in different sessions (see Table 6-1 above).

**Table 6-3. LH's performance on neuropsychological tests of memory**

Memory Test	Score	Age-Adjusted Level
<b>WMS III</b>	<b>Index Scores</b>	
Auditory Immediate Memory	59	Extremely Low
Visual Immediate Memory	88	Low Average
Immediate Memory	67	Extremely Low
Auditory Delayed	58	Extremely Low
Visual Delayed	75	Borderline
Auditory Recognition Delayed	55	Extremely Low
General Memory	57	Extremely Low
Working Memory	105	Average
<b>Rey Complex Figure</b>	<b>Raw Scores</b>	
Copy	33/36	Normal
Immediate Recall	9	Impaired
Delayed Recall	7	Impaired
<b>AMI</b>	<b>Raw Scores</b>	
<i>Personal Semantic Memory</i>		
Childhood	14/21	Borderline
Early Adult Life	12/21	Definitely Abnormal
Recent Life	9/21	Definitely Abnormal
Total	35/63	Definitely Abnormal
<i>Autobiographical Incidents</i>		
Childhood	5/9	Borderline
Early Adult Life	4/9	Probably Abnormal
Recent Life	1/9	Definitely Abnormal
Total	10/27	Definitely Abnormal

**n.a. = Not administered**

#### 6.3.4 Autobiographical Memory

The Autobiographical Memory Interview (Kopelman et al, 1990) was used to assess LH's knowledge and memory of his personal past. His wife was interviewed following his assessment and was asked to verify his answers. LH's recollection of his own past appeared generally defective. He showed particular difficulty in recollecting personal semantic and autobiographical information of recent years, a difficulty indicative of retrograde amnesia. Although his scores for earlier periods were higher they did not reach cut-off levels (i.e. he showed a mild temporal gradient). Crucially, his performance in autobiographical memory recall was contaminated by confabulation and perseveration. Thus, LH answered some of the autobiographical events questions by narrating an event of similar thematic content as the one he had narrated in the previous life-time period. Or, he answered by fabricating events that had never taken place, and that could never have taken place in the context of LH's life circumstances (according to his wife). His recollections were also poor in specificity and often hard to follow. LH did not appear aware of these inconsistencies, nor of the lack of coherence in his memories.

#### 6.3.5 Language

LH's spontaneous speech was normal, showing normal flow, articulation and prosody. He did not appear to have difficulties in comprehending spoken or written speech and could follow complicated conversations. However, LH found it difficult to remain within the limits of given conversational topics and although he initially addressed such topics, often he quickly went on to speak of something totally unrelated. More generally, LH's speech appeared as abnormally abstract. For example, his answers to direct questions tended to address the given topic in a quasi-metaphorical way. More specifically, he tended to provide a relevant answer but this was set in an irrelevant context. E.g. when asked what he had done the previous day, LH replied that he had been to work but it was a terrible mess. The files had been all lost and the catalogue did not make sense anymore. The worse thing, he said, was that others could not really have helped him. The information was gone, he could not retrieve it. On another occasion, when asked if he remembered who the examiner was he replied as follows: "Yes, I had to do a promotion in Durham University but the material was complicated and they

brought in this Greek lass. I was showing her the catalogue, everybody else was laughing but to their surprise she understood. She is the one who introduced us, isn't she?"

#### 6.3.6 Mood & Cooperation

LH was generally cooperative during testing but he occasionally found it difficult to concentrate for long periods and often required prompting in order to complete certain tasks. His motivation in the ward was low. He was very talkative, hyperactive and often verbally disinhibited and inappropriately jocular. LH's mood fluctuated between apathy and occasional and sudden episodes of agitation. Despite his apparently apathetic answers in informal conversation, his scores on a self-report questionnaire were of borderline levels for both depression and anxiety (see HADS results).

#### 6.3.7 Confabulation

In order to formally assess LH's confabulations the "Dalla Barba Confabulation Battery" (1993a) was administered to both him and the control participants (see Chapter 2 for test's details and procedure). LH's and controls' performance across the sections of the battery is summarised in Figure 6-2. LH confabulated across all the sections of the battery; more often he confabulated when answering episodic questions, orientation questions and "I don't know" semantic questions. LH's confabulation scores on the General Semantic questions section were relatively low, in contrast to the relatively high rate of confabulations produced by controls in this same section. Dalla Barba and colleagues (1993a,b; Dalla Barba, et al., 1990) have observed similar patterns in their confabulating patients. These results are also similar to the findings collected from the bilateral confabulation group of the present study (see Chapter 2).

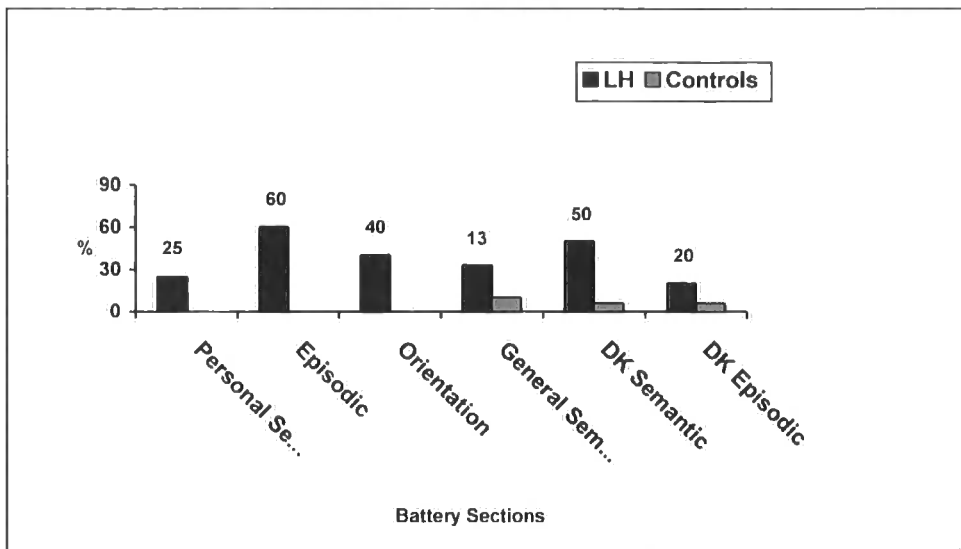


Figure 6-2. Percentage of Confabulations in the Confabulation Battery.

#### 6.4 Experimental Investigations: Confabulation and the Self

The above investigations examined potential cognitive deficits associated with the production of confabulation, as shown in the literature. The following section focuses on the positive aspects (Jackson, 1932) of LH's symptomatology. These included the subjective experience of his deficits (awareness of deficits), the potential role of suggestibility and personality traits in confabulation, as well as the potentially motivated self-representations elicited by confabulation.

##### 6.4.1 Study 1: Awareness of Deficit

The ability to be aware of one's deficits entails a number of cognitive, and potentially emotional, components and there is currently no generally acceptable theory of unawareness (e.g. see Burgess & Shallice, 1996; Bisiach & Geminiani, 1991; Frith, Blakemore, & Wolpert, 2000; Heilman et al., 1998; Vuilleumier, 2004). Moreover, its relation to confabulation has not been thoroughly investigated (e.g. see Feinberg et al., 1994; Lu et al., 1997; Schacter, 1991; Venneri & Shanks, 2004). Although a number of reliable measures have been proposed to quantify awareness of deficit (e.g. Anderson & Tranel, 1989;

Fleming, Strong & Ashton, 1996; Fordyce & Roueche, 1986; Giacino & Cicerone, 1998) few of them have been developed to assess confabulating patients and even more importantly some authors have argued that developing standard assessment tools for such highly complex and poorly understood abilities requires consideration of individual differences. For instance, writing about unawareness related to hemiplegia and hemianopia, Bisiach and Geminiani (1991) argued that “from what has been said about the clinical presentation of anosognosia, it follows that no satisfactory standard assessment of this condition can be suggested. Anosognosia deserves assessment tailored to each individual case, comprising faithful records of all spontaneous behaviour, as well as of that instigated by the examiner’s queries, the limits to which are set only by the examiner’s inventiveness and the patient’s mood and intelligence” (see also Clare, Wilson, Carter, Roth, & Hodges, 2002).

With this perspective in mind, and given the focus of the present study on confabulation only a clinical assessment of LH’s awareness abilities was undertaken. This relied on an exploratory semi-structured interview, the Levels of Awareness Test (see Appendix E1). The aim of this was not to provide quantifiable awareness scores but instead to clinically explore the nature of LH’s understanding of his own postmorbid condition. The interview included open ended questions, aimed at a variety of cognitive domains and also explored the patient’s reaction to a variety of question types. These included general direct questioning, questioning following specific tasks and demonstration of deficits, questioning about past examples of behaviour and questioning about anticipation of future difficulties (see Appendix E1 for description of questions). The patient’s answers were corroborated by equivalent interviews with relatives and professionals.

#### General Postmorbid Condition Awareness

LH appeared unaware of his general condition and medical history and answered the relevant questions mostly by confabulating. For example, he gave multiple and inaccurate accounts of why he was admitted to the hospital. For instance, he claimed he was in hospital due to a misunderstanding. He narrated that one day he was standing at a bus stop and two buses arrived. There was a nurse there who said one of the buses was for the healthy and one for the ill. She

asked him to get in the bus on the right and only after he had got in he discovered this was the wrong bus, the one for the ill. Afterwards, he said, they wouldn't let him go (see Study 4 for similar examples).

#### Awareness of Individual Deficits

LH's answers to questions about specific impairments showed that he was unaware of most of the individual deficits staff, relatives and the examiner had observed. His answers to such questions took two forms. He either appeared totally unaware of any change in his abilities and portrayed a self-confident image of himself, e.g. "Oh, yes. I have a very good memory. I've always relied on it", or he acknowledged some problem, but minimised its importance or its self-relevance by confabulating, e.g. "Yes, I do find that over the last three four weeks I am exhausted all the time. But everybody has it. It's a bug". In domains like memory and executive functions LH showed particular difficulties in acknowledging his impairments. Crucially, LH showed marked unawareness of the everyday consequences of his impairments such as his inability to live independently or manage his finances. In order to answer the corresponding questions he appeared to use information and self-values from his premorbid life. For example, he frequently referred to his duties and responsibilities as a local area manager in order to demonstrate what he thought were his current intact abilities. When his current performance on relevant tasks suggested otherwise he failed to acknowledge it and he further confabulated work-related excuses, e.g. "they keep changing the catalogue these days, how am I supposed to work like this?".

LH's answers to questions about his mood and emotional state were noteworthy. He generally appeared more aware of changes in his emotional than his cognitive state. Yet, he often gave confabulatory answers to these questions and he did not always describe the expected personality change. For example, he stated he felt more 'mellow', 'lazy', 'calm' and 'able to control his temper' lately, in vast contrast to his relatives' observations and staff's complains about his hyperactivity and irritability. Interestingly when asked to respond to specific examples of his behaviour, or give examples of his current goals and plans LH provided further insight into his condition. He described that he felt his personality was largely 'switched-off'. He sensed he had "created a dream-like

state for himself". One he felt safe in, but one that worried him too. He felt stuck and needed to unstuck himself. He felt like he is hiding. "Hiding from others and myself. Hiding my emotions most of all... in any way I can. In the only way that I know. With any words I can find. It doesn't really matter how".

When further prompted LH was momentarily able to gain insight into his confabulation. He described how he often said things to people just to "distract them until he could find the right answer". Other times he went away from "a professional meeting" and asked himself "Oh, my God what bollocks have I been saying? Why? I couldn't help it. These thoughts just come out and people must think I am out of it". When asked how he felt during these episodes he replied "Well you see, at the time I always feel I am right and they are all wrong and daft. I am better than them, I am full of myself, and there is no doubt in my mind". Despite these remarkable descriptions LH appeared unable to retain a stable awareness of his emotional and motivational state. His answers to identical subsequent questions fluctuated greatly and it appeared every effort he made to gain insight was soon followed by a confabulatory minimisation, or self-alienation of the conclusions he had just reached. Thus, for example, when he was asked again regarding the state of his current motivation he referred to the political situation in Britain and insisted that it was the government and its economical policies that had to be blamed for his lack of motivation.

#### Observation of his own impairments

From the above it appears that LH had impaired general knowledge of his deficits. Most of the time, demonstration of his deficits by specific tasks had no beneficial effect on his awareness. However, there were times that following demonstration he was able to explicitly recognise his inability to perform certain tasks. For example, after having replied that he does not confuse his memories with dreams "more than any other person would", he was reminded of a dream he had reported in a previous session, which he had experienced as "so real" he couldn't decide if it was a dream or not. He then commented that he felt his "dream pattern was massive". He had "the same dreams again and again repeating themselves in [his] mind that they came to bear on reality". Reality, he continued, "is twisted into dreams, which are not dreams". When however, minutes later he was asked about the same symptom he appeared unable to reflect on it again and

replied by saying he could easily tell the difference between the two. The only problem he faced, he now thought, was excessive dreaming which he attributed to specific current work circumstances. He expected the problem to be temporary.

#### Future Perspective

LH's perspective on the future was also characterised by unrealistic plans of returning to activities of his premorbid life and largely expressed in terms of his professional life. His goals for the future seemed to focus on improving external circumstances, e.g. working under a different boss, asking for a raise, and he couldn't identify any self-improvement needs or goals.

#### Awareness and Confabulation

LH's confabulated frequently throughout the interview and particularly in sections that he showed the highest unawareness of deficits. His confabulations included false excuses of failure to perform a task ("I've been out of work for a few weeks you see. I am a bit out of practice"), impossible future plans ("I just need to tell this people how to do their jobs properly and it will be fine") and spontaneous false memories (e.g. "Wasn't there something on TV the other day about Prince Charles having mixed up his memories? Yes, yes, we saw it together, don't you remember?").

Overall, the interview revealed that LH had impaired awareness of his deficits at multiple cognitive levels (See also Crosson et al., 1989; Langer & Padrone, 1992; Schacter, 1991). While he sometimes presented with intact ability to recognise his difficulties upon demonstration he had poor general knowledge of his deficits, and even greater difficulty in updating his self-representation, foreseeing his disabilities and planning his future in a realistic way. He was more aware of a few isolated deficits, such as minor language problems. He also showed considerable insight, albeit temporary and contaminated by frequent confabulations, into the changes of his emotional and motivational state. Importantly, there was an association between the deficits of which LH was most unaware of and the high amount of confabulation he produced in these domains, i.e. it appeared his confabulations supported the denial of his deficits.



6.4.2 Study 2: Confabulation and Suggestibility

*Materials and Procedures*

The hypothesis that suggestibility is wholly or partly responsible for confabulation has a long tradition in the literature (see Chapter 1) but few studies have addressed this hypothesis experimentally (Mercer et al., 1977; Moscovitch & Melo, 1997; Schnider et al., 1996). In the present study, the Gudjonsson Suggestibility Scale (GSS1) (1997) was used to directly assess LH's potential tendency to yield his answers according to external suggestion. The scale comprises a narrative paragraph containing a story of an event (read out to the subject) and 20 questions (15 suggestive and 5 non-suggestive) that are asked about the story, following immediate and delayed recall trials. The 20 questions are then asked a second time, following clear negative feedback, and provide the scoring for 'Yield 1' (giving in to suggestive questions prior to negative feedback), 'Yield 2' (giving in to suggestive questions following negative feedback), 'Shift' (number of times subjects change their answers following negative feedback) and 'Total Suggestibility' (Combined scores of Yield 1 and Shift). A secondary measure of 'Total Confabulation' is also estimated as the amount of distortions and fabrications produced on free recall. The suggestibility questions were asked following immediate recall, i.e. delayed recall of the story was not assessed. Gudjonsson's (1997) scoring criteria were followed as closely as possible. LH's responses to the GSS1 were audio-taped and transcribed fully.

*Results*

LH's immediate recall scores were abnormal in comparison with the means of the general population (Gudjonsson, 1997). These results were hardly unexpected given LH's memory impairment (see above). His distortion and fabrication scores were within normal range (2 in total). LH's scores on the Suggestibility measures indicate that his responses to memory questions did 'yield' to external suggestion but not as excessively as expected given his memory and intellectual deficit. His initial Yield scores were abnormally high (partly explicable by his poor memory), but his Shift score (5) indicates that negative feedback and repeated exposure to distracting information had a limited influence on his answers, comparable to other individuals with intellectual deficits. His

Total Suggestibility score (14) was not within normal range, but was certainly within the range of individuals with intellectual disabilities (IQ 57-75).

**Table 6-4. LH's performance on the Suggestibility Scale**

<b>Suggestibility Scale Percentile GSS1</b>	<b>LH</b>	<b>General Population Norms</b>	<b>Intellectual Disabilities Sample (IQ 57-75)</b>
Immediate Recall	8 (5 <sup>th</sup> )	21.3 (7.1)	7.3 (4.5)
Delayed Recall	-	19.5 (7.5)	5.9 (4.5)
Yield 1	9 (90 <sup>th</sup> )	4.6 (3)	7.1 (4)
Yield 2	12 (90 <sup>th</sup> )	5.6 (3.8)	8.5 (4.4)
Shift	5 (75 <sup>th</sup> )	2.9 (2.5)	5.0 (3.6)
Total Suggestibility	14 (90 <sup>th</sup> )	7.5 (4.6)	12.1 (6.2)
Distortions (immediate)	1	1.15 (1.2) (GSS2)	
Distortions (Delayed)	-	1.26 (1.8) (GSS2)	
Fabrication (immediate)	1	0.4 (0.7) (GSS2)	
Fabrication (Delayed)	-	0.5 (0.7) (GSS2)	

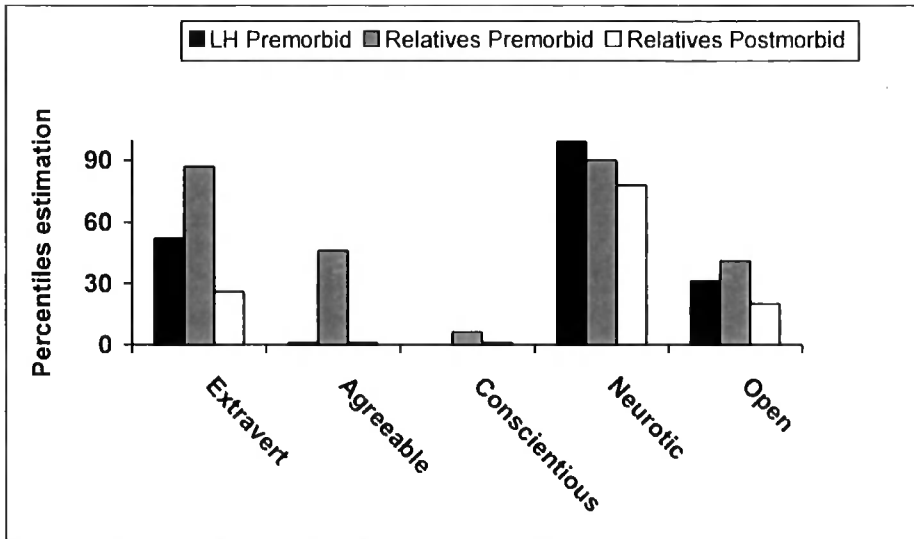
#### 6.4.3 Study 3: Pre- and Post-Morbid Personality

Several authors have stressed the potential role of premorbid personality characteristics in the production of confabulation (see Chapter 1) but very little experimental research has actually addressed this issue (Gainotti, 1975; Conway & Tacchi, 1996) and the hypothesis remains controversial (e.g. Burgess & Shallice, 1996; DeLuca, 2000; Johnson, 2000). The present thesis employed the Big Five personality inventory to account for premorbid personality factors in confabulation (see Appendix E2 for detailed description of the five personality factors by Johnson, 1998).

More specifically, LH's premorbid personality traits were assessed using a 120-item questionnaire ('IPIP-Neo') developed and validated by J.A. Johnson (1998), based on recent developments in the Big Five personality classification system. The 'IPIP-Neo' was read out to LH and he was asked to rate his premorbid personality. Since LH's compromised retrograde memory could interfere with his ability to judge his premorbid personality, his relatives were also asked to complete the questionnaire. They rated both LH's premorbid and postmorbid personality on the same items. In this way, measures of both premorbid personality and personality change could be obtained. The three total scores for each factor (self premorbid rating, independent-rater premorbid rating,

independent-rater postmorbidity rating) were compared with the standardised personality factor scores provided by J.A. Johnson (1998).

**Results.** LH's self-ratings and the ratings of his relatives are depicted in Figure 6-3.



**Figure 6-3. Big Five Pre- and Post-morbidity Personality Traits: Self- and Carer's Ratings**

LH's relatives judged his personality as premorbidly more extravert, than he did (see Appendix E2 for detailed scores). LH rated himself as low in 'agreeableness', indicating that he did not prioritise being liked or accepted. His relatives rated him as average on most facets of agreeableness except cooperation, confirming that he preferred confrontation rather than compromise to others needs. He was also self- and other-rated as not self-disciplined or capable of suppressing his impulses ('conscientiousness'). Interestingly, this characteristic was premorbidly low and remained low in his postmorbidity personality. Additionally, both he and his relative's scored his personality as very high in 'Neuroticism', reflecting his tendency to often experience negative feelings, showing "problems in emotional regulation" (Johnson, 1998), which also would "diminish [his] ability to think clearly, make decisions and cope effectively with stress" (Johnson, 1998). Lastly, his relative's judged his premorbid personality as average in 'openness to experience', with lower scores those of *emotionality*,

*suggesting that he not well aware of his feelings and he tended not to express his emotions openly.*

The rating's of LH's postmorbidity show that according to his relatives he was less extravert, and even less agreeable and conscientious than prior to his stroke. Crucially, he remained overwhelmed by negative feelings. Interestingly within the openness factor, the facet of 'imagination' was given a higher rating than its premorbid average level (from 38 to 75), while the intellect facet was rated as significantly lower (from 44 to 8). Emotionality scores, i.e. having access to and awareness of one's feelings, remained at their low premorbid level.

These personality changes were consistent with LH's postmorbidity cognitive profile and coping strategies. His previously low abilities and/or willingness to compromise with his social environment and physical condition had now become virtually absent. Instead, according to his relatives, he continued to experience intense negative emotions at times despite his anosognosia and his apparent jocular and apathetic behaviour (see also HADS results-Table 6-1). Interestingly, his relatives reported how LH had always been reserved about his emotions, particularly the negative ones. He instead tried to portray a self-confident, assertive and extravert image of himself even when his relatives suspected otherwise. Their occasional attempts to express this to LH were met with anger or withdrawal on his side. Finally, they felt his postmorbidity behaviour and particularly his confabulatory and anosognosic manifestations reflected an exaggeration of his premorbid copying skills.

#### 6.4.4 Study 4: Self - Representations in True and False Memories

Recent studies in autobiographical memory have shown that through autobiographical narratives a particular representation of self-identity in time, with synchronic and diachronic values, is constituted, maintained and used as a basis for further memory organisation, as well as future goal and action planning (for reviews see Barclay & DeCooke, 1988; Conway, Singer & Tagini, 2004; De Vries, Blando, & Walker, 1995; McAdams, 2001; Pillemer, 2001; Singer & Salovey, 1993; Stein, Wade & Liwag, 1997; Woike, Gershkovich, Piorkowski, & Polo, 1999). However, the role of self-representation in confabulatory narratives

has received less attention in neuropsychology (e.g. see Feinberg, 2001; Tallberg, 2001), despite indications of its central role (e.g. Conway & Tacchi, 1996; Fotopoulou et al., 2004; Johnson & Raye, 2000; see also Chapter 3). In this case-report, two aspects of self-representation, namely its 'valence' and 'agency' (see below), were investigated using a method adjusted from studies on autobiographical memory and identity formation (for review see Conway & Pleydell-Pearce, 2000).

#### *Materials and Procedures*

Self and interpersonal representations in the accurate and false memories of LH were investigated using a modified version of the McAdam's (1985) life story technique (see in McAdams et al., 2001). The interview began by informing participants, LH and five controls (matched for sex, education and age) that they were going to be asked to recall and reflect upon personally significant and self-defining events from their whole life. Next they were asked to describe twelve specific experiences in their lives including a particularly pleasant experience (high point), a sad experience (low point), a turning point, their earliest memory, an important childhood event, an important adulthood event, a recent important event, an important event of any lifetime period, a memory that displays something stable about the self, a decision-making memory, a morality memory and a goal memory (see Appendix E3 for questionnaire). Each of the 12 memory descriptions were fully transcribed and coded by two independent coders. They were blind to the hypotheses and the groups of the study, previously trained in the following coding system and paid for their participation. Participants' relatives and visitors provided corroboration information about each of the events narrated.

#### *Coding*

Three main categories were separately coded. These included: (1) Self-representation valence and agency, (2) 'Other'-representation valence and unity (3) Overall valence of memory. Self-representation rating included any statements explicitly providing information about the 'self' and its position in interpersonal relations (e.g. 'I never had any high sights', 'I became better, tougher', 'I always gave my family everything' etc). In this scoring category the self-representation could be scored with regard to its emotional valence, i.e. negative (e.g. being

lonely), positive (e.g. being happy), or neutral (neutral, ambivalent or hard to evaluate) and its agency, i.e. 'self' as active/responsible (e.g. one who cares for others) or 'other' as active/responsible and 'self' as passive (e.g. one who is supported by others). The meaning of positive and negative self-representations were defined based on a long tradition of measuring self-representations in autobiographical memory (e.g. McAdams & Bowman, 2001; Nelson, 2003; Wilson & Ross, 2003; See also Chapter 3).

More specifically, positive self-representations were defined as phrases or sentences that described a positive outcome for the self or a decidedly positive-affect state. Examples included: pleasure, growth, strength, efficacy, confidence, understanding, recovery, gain, praise, recognition, learning, improvement, gratification, and strengthening of desired interpersonal relations (e.g. sympathy, love, inclusion, intimacy) or ultimate concerns (e.g. religious beliefs). By contrast, negative self-representations were defined as phrases or sentences that described a negative outcome for the self or a decidedly negative-affect state. Examples included: displeasure, reduction, decrease, incompetence, fear, anger, sadness, fall, loss, deterioration, insult, illness, injury, offence, abuse, annoyance, and weakening of desired interpersonal relations (hatred, antipathy, exclusion, alienation, separation) or ultimate concerns (see also Chapter 3).

Given the delusional reduplications which accompany confabulation in some patients (e.g. see case study below), two aspects of others' representation were coded separately. The relevant coding category focused on the relation between unity and valence of others' identity. This included statements which revealed the ability to perceive others' identities as emotionally complex, often ambivalent towards or for the self, but still integrated entities (e.g. accurate memory: "the vicar realised the position I was in and he tried to help me out, but he only made it worse"). The notion 'others' in this context, included other people (e.g. his wife), other objects or places (e.g. his car) or parts of his body potentially treated as separate agents. In contrast, statements were correspondingly coded, which included reduplications of the same 'other', i.e. splitting of it into two or more distinctive entities in time and place, with the same [positive (+), or negative (-)], or opposite emotional significance (+/-) for the self. The overall emotional valence of each accurate or confabulatory account was measured on a five-point

scale: 1 = negative; 2 = emotional shift from positive to negative; 3 = neutral; 4 = emotional shift from negative to positive; 5 = positive. Although this scale did not allow for relative ratings among different valence categories (e.g. positive versus very positive), it did include the rating of emotional shifts. This consideration is important in rating self-related memory narratives, as the investigation of such shifts in autobiographical memory has shown that they are both frequent in personal narratives and central to the formation and expression of one's self-representation and identity (for review see McAdams, 2001).

Statements to be coded were single or multiple phrases or sentences that described information about one's self-representation with a single thematic content e.g. the following sentences by LH "...I became a departmental head at a very very early age for insurance...and the next thing I know I was running a department....I had me own staff, me own department..." were considered as belonging to a single theme expressing a positive self-representation of gaining authority. All statements included in the confabulation protocols were candidates for coding, as it was considered arbitrary to separate accurate statements from the 'confabulated' context in which they were recalled e.g. in a protocol LH referred to how on his first job he was 'authoritative' in trying to modernise the company's old-fashioned dressing code (confabulation) and argued that this effort gained him a managerial position in the company (accurate development but on different grounds). Both descriptions were considered for coding.

### *Results*

Controls produced 12 accurate memories in the interview, although some of their memories were less coherent and less specific than others. LH produced seven accurate memories and five confabulations. In order to compare the accurate accounts produced by LH during the interview with an equal amount of confabulatory narratives, the first two spontaneous self-referential confabulations produced by LH in the same week were identified and corroborated by information given by relatives and nursing staff. They were given to the raters for coding along with the other memories. The two independent raters agreed on 92% of the selected items to be coded and 98% of the specific classifications made. Their remaining differences were resolved by discussion.

**Accurate Memories.** Overall, LH included more self and interpersonal representations in his accurate memories (42 representations in seven memories) than controls (41 representations on average in 12 memories each). This result appeared to relate to LH's impaired ability to retrieve events specific in time and their details. Instead, he often produced general, poorly contextualised and narrated events that were focused around multiple descriptions of positive self-representations, rather than the description of specific events. The following narrative is characteristic:

**High Point:** "Oh. There's Zelkions of them man. [Can you think of a specific one?] ...First position of authority. Which absolutely praised me in the whole dam school. I was made house captain. How old was that? I can't remember even if I was in the tech high. I'd be 10. Well, they didn't really make anything official. The announcement coming out: [LH] house captain. I was thinking well, they picked the wrong boy out (laughs). But, I mean... lots of things. I took ill, I got... what the hell did I got., I went to a new school for the first time. I got a kidney disease, I was in agony for the last fortnight...In fact in the end we did a three or four day camping session, I had to carry a small sack, everybody else had to carry in the tents, I just couldn't bare... but in the end they said, you know: "[LH], he is alright. He is cool (laughs). [LH]... house Captain". But you see the thing is ...oh no I was going to ramble again...but ya, things I had them happening all my life".

Interestingly, LH portrayed himself and his relation with others in more negative terms than controls in his accurate memories. Yet the overall valence of his accurate memories (mean 2.7; SD 1.3) did not differ from that of controls (mean 3.4; SD 0.1). This result is explained by the observation that although LH described several unpleasant events in his life in which he was either ill, weak or lonely, he typically ended his narration by describing how he overcame the difficulties and what a beneficial effect that events had on him. The above example is again characteristic. He gave similar answers to questions about a sad event (how his mother's early death made him stronger), an early adulthood event (how a first negative experience with a girl taught him a lesson), a moral dilemma (how he took the right decision in dealing with a difficult moral situation in his family), and an event that shows self-continuity (how he has become lazy because his intellectual abilities were always greater than those of others). Similarly to controls, LH focused more on active and responsible self-representations (e.g. achieving goals, loving or misbehaving towards others) than passive ones (e.g. loved or being hurt by others). No other noteworthy difference was observed



between LH's and control's accurate memories. Percentages of coded statements of self- and interpersonal representations in LH's and controls' accurate memories and LH's confabulations are shown in Table 6-5.

**Table 6-5. Percentages of Self-representations in True Memories and Confabulations**

Agency	Valence	LH's	LH's	Controls' True
		Confabulations	True Memories	Memories
		% <sup>1</sup>	% <sup>2</sup>	% <sup>3</sup>
Self	Positive	42.8	21.4	38.8
	Negative	28.6	40.5	24.4
	Neutral	5.3	14.3	12.9
Other	Positive	8.9	7.1	9.8
	Negative	12.5	11.9	11.7
	Neutral	1.8	4.7	2.3

<sup>1</sup> Percentage of the total number of self-representation statements in LH's confabulations.

<sup>2</sup> Percentage of the total number of self-representation statements in LH's true memories.

<sup>3</sup> Percentage of the total number of self-representation statements in controls' true memories.

**Confabulations.** The self-representation depicted in LH's confabulations had a number of differences from that described in his accurate memories and those of controls. First of all, in his seven confabulations he included 56 different references to his self-representation, showing greater preoccupation with his effort to describe himself in positive terms. In addition, he showed even greater disorganisation of recall. More specifically, he was unable to place events in time, although he repeatedly tried to do so (see also Fotopoulou et al., 2004) and he confused different events between them. He gave very little sensory details of the narrated events, failed to refer to specific people, locations, and other details. Instead, his vague, disorganised memories seemed to focus around specific ideas he wanted to convey about himself. Events and facts appeared as almost a random background to these self-enhancing ideas. These included his determination and achievements in life, his recognised authority and his superior intellectual abilities. The latter was also described as responsible for his ability to achieve goals without significant effort or even experience. Although these values were in fact part of his self-representation premorbidly, as confirmed by his accurate memories but also by his relatives' accounts of his premorbid personality, they were erroneous in the present context and in the perplexed way by which he

retrieved past events. Moreover, as his relatives noted, they were grossly exaggerated and had overshadowed any other, perhaps less positive, components of his premorbid self-representation. The following narrative is characteristic (for more examples see Appendix E4):

**Decision-Making Event:** There's all sorts of things. Important decisions... I elected which way I wanted to go in life, and I've done it. And it's proved out to be a bit of a hassle. Because these are people who aren't particularly bright. I mean I don't think it is my arrogance, they might be, but I don't think they're as bright as me... get above me. And, they come up with the most ridiculous things. And since me last birthday I thought, ah, I've really had enough of this. So I started to be a lot more honest with people and tell them what I think of what they're doing. But actually, they all say how grateful they are I've done that. [Hm.] Because they're so inexperienced. The danger comes when they think they are experienced and they want to do the same bloody thing. [So do you remember any more details about the day you took such a decision? What happened?] Oh... to be totally honest? Fairly recently, actually. Probably about ten years ago. But, in the first place, to be devious and do the job. It'd be... probably right at the end of me teens. About, sort of, 19 to 21, that sort of area. Um, now... it's a lot easier, but people absolutely hate me for it. Because I regularly- well, they think I'm kicking against the pricks. Telling them what I think of their decisions. Because if they blew me out now, I could just write a cheque and pay me mortgage off. The house is mine. Um... and in the worst scenario you know, I could live. But, the problem is, particularly when- what the hell is the company called? What were we before we became what we are now? And I can't remember what we're called now, either. I've never bothered to look at it. Um... see, that was a mess. The company was a mess. It came so close to closing down, it was just unbelievable. I think I told you it took the third telephone call in one morning to stop the company being closed down. Uh...(looks perplexed). [You were talking about the decision you took to...interrupted by the patient:] It's easier to talk about the company, you see. *Laughs.* [I see].

*[Corroboration Notes: LH's hospitalisation coincides with his 'last birthday'. It is true that LH is more 'outspoken' since that time but this could hardly be described as honesty and it was definitely not the result of his decision. Some of his other associations have kernels of truth in them, e.g. indeed his company was recently bought by another company and thus changed name, but are hard to understand. His family is not aware of any other period he claimed he took the decision of becoming more honest, or more critical of others. According to them he was always stating his opinion clearly and often went against authority in his profession]*

LH's confabulations, similarly to his accurate memories, included more active than passive self-representations. However in his confabulations he included markedly less negative self-representations than in his accurate memories. Moreover, these unpleasant descriptions did not refer to himself but rather to the aggressive statements and behaviours that he showed towards others. More specifically, he appeared frustrated at others' 'lower intellectual' or other abilities and he repeatedly described how he communicated these beliefs to the responsible parties, how he 'set the record straight' and how he returned the

'insults' and established his authority. He described how he achieved what he wanted once he had taken control over the situation. Once again he used, or rather misused, misinterpreted and wrongly combined, events from his past to contextualise such thoughts and feelings. Interestingly, LH rarely expressed, in his true or false memories positive feelings toward others, such as sympathy, concern, or longing. In addition, unlike controls who narrated social occasions such as relative's weddings and the birth of children etc, he never placed the focus of a memory on anybody but himself. Also, in his memories he included several references to issues of health and disability. Lastly, in his two spontaneous confabulations, he seemed to fabricate different and rather bizarre reasons for his admission. The following spontaneous confabulation is characteristic (see also Appendix E4 for more examples):

"I'd just like to be at home, away from it. Because so many buffoons make so many mistakes, it's just getting ridiculous. And I didn't realize who these people were that kept popping around. So I started giving them bigger insults than they'd been giving me. [Did you say insults?] Yeah, because what they're doing- what happened was, I saw these two bloody pens, and I was passing through Carlisle. I said yeah, no problem, I'll go for them. There's nobody there, and nobody would hand them out. I said well, I'll bend me journey on Friday on the way to the ferry, just- did I say Carlisle? I should've said Morpeth. So I bend me journey over that way, to pick those pens up for you, when the lady said 'oh they're all at their morning's art session'. They should be heading back. I said I'll see if I can catch them on the road. Caught them ringing the buses up. Knowing I got the pens they put me on this bus to go back to the centre [referring to his hospital ward], and I've been in their bloody hands ever since! [Hm. Do you remember when this happened?] What do you mean when? I know it happened, I know the girl who made a misdemeanor which was terrible and I ended up cutting the bloody can for it. And I've seen her since she just sort of blushed a little tinge. I'll not tell you what I called her cause she blushed even deeper".

*[Corroboration Notes. Any connection of these events to reality was impossible to establish, except from the fact that the patient did indeed often passed through Carlisle as part of his professional activities. In different sessions, he has mentioned similar versions of these confabulated reasons of admission]*

**Overall Valence.** The overall valence of controls memories showed a mild positive bias,  $M= 3.4$ ;  $SD = 0.1$ , while LH's accurate memories were slightly more negative ( $M= 2.7$ ;  $SD = 1.3$ ), although within one SD below the controls' mean. In contrast, five out of his seven confabulations were rated as pleasant, or as ending in pleasant terms for LH, and thus their valence was more positive on

average,  $M = 3.9$ ;  $SD = 1.7$ . This score approximates that of controls. However, it should be noted that his two negative confabulations referred mostly to fabricated reasons for his admission (see above). Although the latter are negative if scored at face value as here, they are actually ‘pleasant alternatives’, if one considers the ‘reality’ they correspond to, i.e. LH’s accurate reasons for admission (see also Chapter 3).

**Representation of Other’s Emotional Identity.** There was no differences in amount of times LH (two) and controls ( $M = 1.2$ ;  $SD = 0.8$ ) appeared to perceive others in emotionally ambivalent terms in accurate memories, or in confabulations (two descriptions by LH). Moreover, none of the controls or LH represented ‘others’, people or places, as split into two or more different identities (see case study below for reduplication examples).

In summary, LH’s confabulations portrayed a self-representation which was predominately active and positive and relied on the exaggeration of premorbid values, positive character traits and praised achievements. The latter were also present in his accurate memories but to a lesser degree and balanced by a greater number of negative self-representations. In addition, in his confabulatory narratives LH alluded to his postmorbid condition, mostly his hospitalisation, but provided fantastic and different reasons for hospital admission, which shared only one common characteristic: they did not portray an impaired image of himself. Instead, they portrayed his current state as the result of others’ errors or incapability. LH actively expressed frustration and aggression towards others in his accurate, but most frequently in his confabulated memories.

#### 6.4.5 Summary of Findings

LH’s neuropsychological profile was indicative of severe cognitive disruption consistent with ruptured ACoA aneurysm diagnosis. While his general intellectual (verbal), semantic and language abilities were only mildly affected, LH showed substantial problems in specific cognitive domains such as perceptual organisation, orientation, new learning, autobiographical memory and executive functions. His memory abilities were also contaminated by confabulation and perseveration, particularly in free recall conditions and affecting mostly events of

his life, and orientation. In addition, LH showed lack of motivation and borderline depression and anxiety scores despite apparent apathy.

LH's awareness of deficits was poor and he appeared generally unable to retain a realistic and stable representation of his deficits and confabulated about his alleged abilities. His memory showed a mild suggestibility tendency and his 'defensive' premorbid personality traits appeared exaggerated in his confabulations. Finally, his accurate memories portrayed a positive, strong and able self-representation, which was maintained and even exaggerated in his confabulations despite the contrary facts of his postmorbid condition.

## **6.5 Discussion**

### 6.5.1 Neurocognitive Deficits

LH's neuroradiological and cognitive profile was characteristic of the profile shown by the rest of the patients in the CI confabulation subgroup of the study (bilateral patients; see Chapter 2). He showed damage to the medial prefrontal cortex and other proximal areas resulting in severe memory and executive functions impairment. The latter included disinhibition, perseveration, and lack of flexibility, abstraction and self-monitoring. This profile is consistent with most of the 'retrieval deficit' hypotheses put forward in the literature (see Chapter 1). A somewhat surprising finding was LH's relatively good performance on two tests of reasoning (Cognitive Estimates and 20 Questions Test) and one test of problem solving (Tower Test). In some retrieval models, such functions have been linked with more 'bizarre' and 'fantastic' forms of confabulation (e.g. Burgess and Shallice, 1996). LH showed such confabulations (e.g. his obscure narrations of his reasons of admission), yet he did not present with such deficits. Moreover, LH showed mood and motivation abnormalities and somewhat problematic social conduct. These observations have also been raised before in the confabulation literature and have more generally been linked with lesions of the OMPFC (Bechara et al., 2000; Berlin et al., 2004; Joseph, 1999; Malloy et al., 1993; Rolls, 2000; Stuss, 1991). His confabulation was more frequent in the episodic memory domain and in orientation questions, but was not restricted to these domains (see also Dalla Barba et al., 1997; Fotopoulou et al., 2004;

Kopelman et al., 1997; see also Chapter 4). Crucially, his performance on these standardised neuropsychological tests, as well as on the Dalla Barba Battery was similar to that of the rest of the bilateral confabulating patients of the study (see Chapter 2).

### 6.5.2 Positive Features

The experimental investigations of LH's confabulations revealed that they showed positive features which could not be explained based solely on the above memory and executive functions impairments (see also Chapters 3, 4, and 5). Indeed, the behaviour of LH in the previous chapters, as well as the current investigations revealed that LH portrayed a positive image of himself in his confabulations (Study 4). In Chapter 5 it was shown that the wishful character of confabulation was not the result of an emotional bias but rather the result of a specific self-serving emotional bias. Three aspects of the self were investigated in the present chapter in order to further specify the nature of these self-related motivational biases in confabulation. These investigations targeted the role of suggestibility, the role of premorbid personality traits and the role of self-awareness and representation in confabulation. These are briefly discussed below and they will be further addressed in Chapter 8.

### 6.5.3 Suggestibility

During the suggestibility scale, LH was given negative feedback and repeated exposure to misleading information. His answers were influenced more than those of the general population, yet not more than expected, given his memory and intellectual impairments. These results are consistent with LH's spontaneous production of confabulations. The latter were often influenced by random environmental prompts and when challenged, LH would alter his responses and provide alternative confabulatory versions of a given narrated event. However, as Moscovitch (1989) has previously suggested, this appeared to be a secondary phenomenon in LH's presentation. More specifically, his confabulations were both easy to elicit and direct, yet they existed independently of such leading efforts and they were at times accompanied by corresponding actions or intentions for action (see also Schnider et al., 1996). Moreover, both LH and his relatives described his premorbid personality as highly assertive and

rather resistant to suggestion and more generally to authority (see also below). Thus, it is unlikely that suggestion had a primary causative role in LH's confabulation tendency, although it might have contributed to the production of several secondary confabulations aimed to provide support or, explanation for original confabulations.

#### 6.5.4 Premorbid Personality

LH's premorbid personality profile contained a number of characteristics previously associated with confabulation (Berlyne, 1972; Gainotti, 1975; Weinstein, 1996; Williams & Rupp, 1932; see also Chapter 1). In particular, his relatives described LH as a very sociable and outgoing person, an extravert. However, they noted that this did not concern his emotions and inner thoughts. According to them LH put on a façade of assertiveness and self-confidence, while in reality he was overwhelmed by anxiety and other emotions. LH's ratings of his own premorbid personality confirmed these observations. His relatives also noted how LH used work, social interaction, alcohol, hobbies and other activities as a distraction from his worries and potential problems. According to his wife "He was definitely one of those that prefer to hide from their problems rather than face them and he always said so himself". Moreover, although LH was rated as postmorbidly 'impulsive', a finding consistent with his prefrontal lobe lesions (see also Berlin et al., 2004), his premorbid personality was also rated as very impulsive. Thus, given these premorbid traits, his postmorbid personality, his anosognosia and the self-enhancing content of his confabulations could be interpreted as exaggerations of his premorbid character.

More specifically, given the difficult circumstances of his deficits and their social implications LH's apathy and anosognosia could be seen as an exaggerated form of conscious or unconscious denial (Weinstein & Kahn, 1955), of impulsivity and extraversion (Williams & Rupp, 1932). Furthermore, one could postulate that had another patient with less sensitive self-esteem and different coping strategies suffered LH's brain damage he might have not developed confabulation and anosognosia (e.g. Gainotti, 1975), or his symptoms might not have lasted for so long (Talland, 1961; 1965). Although these factors may have had a role in the formation of the content his confabulations (see below), it is not likely that premorbid personality alone was causative of confabulation.

Specifically, it is highly unlikely that a specific neurological syndrome was entirely caused by personality factors, essentially unrelated to brain and cognitive dysfunction. Indeed, LH's lesions and his cognitive profile were typical of patients with memory-related confabulation (see Chapter 1). However, a large group study with appropriate controls is required in order to empirically verify whether personality factors can distinguish confabulating from other amnesic or dysexecutive patients.

#### 6.5.5 Past Self-Representations and Current Goals

Although LH's personality characteristics and his exaggerated premorbid coping strategies may not have caused his confabulations they might have coloured their content. As briefly discussed in Chapter 5, one's autobiographical memory is deeply connected with one's self-representation and one's self-identity in a given social context. Social psychology has emphasised that memory is not simply a cognitive function keeping a record of the past. Personal memory allows individuals to construct stories about themselves, their family and their nation, i.e. their origins, and these narratives contribute to the filtering of reality, the formation of future intentions and predictions and more generally the construction of an organised and continuous sense of self in time (e.g. McAdams, 2001; Neisser, 1988; Nelson, 2003). Thus, when brain dysfunction and cognitive deficits hampers one's ability to form autobiographical memories one's self-identity and sense of self-continuity is also at risk. Yet confabulating patients, unlike amnesic patients, do not behave as though they have lost access to information vital to their self-representation and personal identity. They do not admit ignorance, as amnesic patients do. Instead, they continue to recollect past events and facts, albeit erroneously. In this way they continue to draw images of themselves and their role in their social environment. In LH's case, these self-images seemed to rely on premorbid self-values and personality characteristics. Thus, the construction of current autobiographical memories and their corresponding self-representations were highly influenced by his premorbid self-regard and his previous strategies of coping with stressful and perplexed situations.

In addition, LH's confabulations appeared influenced by his current needs and goals. Thus, LH often distorted reality in a way consistent with his wishes and inner drives. For example, when wishing to leave the ward he often told staff his



car was parked just outside and he had to move it immediately or he would get fined. In sessions preceding his lunch he often mentioned his hunger and then immediately went on to describe relevant false events such as the opening of a new canteen in the area. Other times he suddenly began treating the examiner as a waitress and asking what was on the day's menu. Following the examiner's questions it turned out he was either hungry, or thirsty. Once given some drink and when possible offered a snack these confabulations disappeared instantly. In the face of these pressing needs, LH potentially employed past self-representations and values to try to satisfy them. For example, in wanting to leave the ward, he often claimed he had some important business meeting to attend. The potential relation between current emotions, past self-representation and confabulation is further addressed in Chapters 7 and 8.

#### 6.5.6 Awareness of Illness

One distinctive class of previous self-representations used by LH as material for his current self-regard included his premorbid representation of his cognitive and health condition. More specifically, LH mostly relied on his premorbid life circumstances when answering questions about his current cognitive and medical state and thus he confabulated. More generally, his awareness of his memory and other deficits was severely affected. He could only momentarily gain access to his postmorbid condition and often this took the form of 'metaphorical' confabulations, i.e. relevant information acknowledged and described but expressed at an irrelevant context. His attitude towards such questions fluctuated from apathy to jocular remarks. He also occasionally exhibited frustration but this was directed at others' actions or intentions rather than his own condition. Occasionally, he did acknowledge some difficulty but this was attributed to others rather than his illness.

These brief moments of insight suggested that he was deeply concerned about his postmorbid mental state and his self-esteem was threatened by his amnesic and confabulatory state. These observations suggest that although LH was anosognosic, he did have some forms of implicit awareness of deficit and these coloured his confabulations. Similar fluctuations in awareness and other forms of implicit awareness of deficits have been frequently described in confabulating patients (Burgess & McNeil, 1999; Feinberg, 2001; Moscovitch,

1989; Ramachandran, 1995; Solms, 2000; Stuss, 1991; Talland, 1961; Weinstein, 1996). More generally, unawareness of deficits has been repeatedly described in the literature on confabulation and its occurrence is most often associated with cognitive functions of self-monitoring and reality monitoring (Johnson et al., 1991; Blumer & Benson, 1975; Schacter, 1991; Stuss, 1991). These in turn are most often associated with frontal lobe dysfunction and particularly OMPFC lesions (see Stuss, 1991; Deluca, 2000 for reviews). However, it should be noted that other investigators have put forward less centralised and more domain-specific theories of awareness (e.g. Bisiach & Geminiani, 1991) and no generally accepted theory of unawareness exists in the literature (Burgess & Shallice, 1996; Stuss, 1991). This issue will be further discussed in Chapters 7 and 8.

In conclusion, LH's confabulatory self-representations were not based on true self-defining autobiographical events, realistic appreciation of his current condition, or goal-directed satisfaction of his inner needs. Given the pressing influence of the latter inner desires, as well as his cognitive deficits and his premorbid personality traits, LH portrayed a highly positive self-representation in his confabulations. More specifically, LH appeared to select self-enhancing elements of his autobiography or of his thoughts and fantasies (see also Chapter 4) and create a highly self-congratulatory mnemonic collage, albeit incoherent, disorganised, poor in detail and falsely rooted in reality (see also Chapter 5). Thus, it appears that LH was not only unable to monitor his current self and current reality but his false memories showed an over-reliance on past self-enhancing instances and were guided by current inner needs and preoccupations. In other words, what was characteristic of his confabulations was not only what was missing, i.e. the appreciation of current reality and the appropriate recall of the past, but also what remained, i.e. the dominance of premorbid self-values and current inner drives and goals.

## Chapter 7 : A Case-Report of Paranoid Confabulation

### *The Fragmented Self and Negative Emotions*

*The greatest hazard of all, losing one's self, can occur very quietly in the world, as if it was nothing at all. No other loss can occur so quietly; any other –an arm, a leg, five dollars, a wife etc. –is sure to be noticed.*

*-S.Kierkegaard*

#### 7.1 Introduction

Confabulation has been studied within different paradigms in neurology, psychiatry and neuropsychology. Classically, confabulation was investigated in studies of the amnesic-confabulatory syndrome (see Chapter 1). However, the term confabulation has also been used in a variety of other neurological syndromes in the absence of amnesia (Deluca, 2000; Feinberg & Ciacino, 1997). One of these syndromes is anosognosia for hemiplegia, as typically caused by frontoparietal right-hemisphere (RH) damage (Babinski, 1914). However, no clear distinction exists between the two types of confabulatory behaviour and the direct relation between anosognosia for hemiplegia and confabulation remains controversial (Feinberg et al., 1994; Lu et al., 1997; Venneri & Shanks, 2004; see also Chapter 1). In this study, the latter type of confabulation was termed 'motor-related' and was contrasted with the classic 'memory-related' confabulation type (see Chapter 1). Moreover, neuroanatomical, cognitive and emotional differences were observed between memory and motor-related confabulation in the previous chapters (Chapters 2, 3, and 5). Further specification of these differences is the aim of the present chapter.

More specifically, the present study reports the cognitive profile of a patient who suffered a RH infarct resulting in left hemiparesis, hemianopia, and neglect, as well as marked neuropsychiatric symptoms, such as false autobiographical memories and delusional reduplications. Although transient anosognosia for hemiplegia is quite common following acute RH lesions, the chronic type described here is less frequent (Berti et al., 1996; 1998; Cocchini et al., 2002; Gold et al., 1994; Rode et al., 1998; Venneri & Shanks, 2004). The

study focuses on the content of the patient's confabulations and anosognosic statements, aiming at (1) investigating the cognitive deficits underpinning the patients' confabulations; (2) providing further support, specification and explanatory power to the findings of the previous group studies on motivated confabulation (Chapters 3, 4 and 5) and (3) identifying similarities and differences between this type of motor-related confabulation and the memory-related confabulation described in the previous chapters. More specifically, this chapter will focus on the role of awareness of deficit, suggestibility, premorbid personality traits, self-representation and memory awareness in motor-related confabulation. Finally, it will briefly discuss its results in comparison to the similar investigations undertaken in the previous case-report on memory-related confabulation (Chapter 6). This issue will be further addressed in the following chapter.

## **7.2 Case Report**

### 7.2.1 Personal History

Patient AO, right handed, was an 87-year old woman, who had worked as a secretary for the fire brigade prior to her retirement. AO was a widow and had no children. She had always been in close contact with her niece and nephew, who described her as premorbidly sociable and active, although she always tended to be "a lady who spoke her mind and didn't suffer fools gladly". Relatives, friends and AO herself all agreed that she was a very independent, competent, somewhat eccentric and strong-willed woman.

### 7.2.2 Medical History

AO had a previous history of hypothyroidism, recurrent urine infections and compromised visual acuity in the left eye, which had been treated successfully by a left cataract extraction and lens implant. She had no other previous medical or psychiatric history. She presented with headache and sudden onset of severe left hemiparesis. She was transferred to hospital where it was confirmed that she suffered a total right anterior circulation infarct resulting in dense left hemiparesis with dyspraxia, left homonymous hemianopia, left-sided

neglect and urinary incontinence. Subsequent CT scans were consistent with an infarct diagnosis, showing a small low attenuation lesion in the right internal capsule region, as well as some low attenuation in the periventricular white matter, consistent with ischaemia or age related changes (see Figure 7-1 below).



**Figure 7-1. AO's CT scan.** Post-admission cranial CT scan of patient AO shows generalised prominence of the ventricular system and of the extracerebral CSF spaces consistent with global atrophy. These appearances are most prominent in the frontal and temporal regions. There is also some periventricular white matter hypodensity indicative of ischaemic or age related change. A lacunar infarct is noted within the posterior limbs of the right internal capsule.

AO was discharged to a nursing home following a brief rehabilitation period during which she made little significant progress with respect to mobility, praxis and vision. Care staff reported that AO presented with memory problems and was often confused and disoriented in time and place. She developed persistent false ideas about the staff, often of a paranoid nature, and could not

distinguish between her dreams and reality. There was some improvement over time and her cognitive state stabilised, but AO continued to fabricate stories about her whereabouts and about her physical abilities. Psychiatric examination at the time and at one-year follow-up reported anosognosia, confabulation, persistent delusions, severely fluctuating mood but no depression.

At the time of the assessment, two-years post injury, AO's neurological report included severe lower limb hemiparesis, total paralysis of upper limb below the shoulder and impaired tactile sensation of left upper and lower limbs, mild facial palsy, homonymous hemianopia and visuospatial neglect without extinction. There were no clinical indications of proprioception loss, personal neglect, asomatognosia or somatoparaphrenia. She required 24-hour nursing care as she was immobile and dependent for all basic living functions except feeding. She was forgetful and irritable but she did not appear as generally confused (lost points in the MMSE included orientation, calculation and construction) and was cooperative. She was orientated to person but her orientation in time and place fluctuated across sessions (see also Table 7-1). She still produced spontaneous confabulations and appeared unaware of her motor difficulties.

AO also showed some neuropsychiatric symptoms. During the assessment period, she had two isolated incidents of Cotard's delusion, i.e. the delusional belief that one is dead (Cotard, 1882). Indeed, she was convinced she was dead and that staff were 'preparing her for her burial'. Additionally, she showed indications of other misidentification delusions, mostly reduplicative paramnesia, i.e. erroneous identification and reduplication of places (see Feinberg & Keenan, 2005; Joseph, 1986b for reviews). For example, she claimed she was not in 'her room', but in another of the several identical ones she 'owned' in the same nursing home. Across testing sessions she produced various paranoid versions of this theme (see also below). AO even reached the point of telephoning the police or legal offices on several occasions to report that she was being kept against her will, she was in physical or financial threat and danger. For example, following the events of 9/11 in the USA she called the police and reported that terrorists had captured her relatives and she was in the same danger.

### **7.3 Neuropsychological Examination**

In order to identify the crucial cognitive and emotional deficits underlying AO's behaviour we administered extensive neuropsychological assessment. Her close relatives and friends helped substantially in verifying her answers and providing details about her premorbid life and personality. A control group of five neurologically healthy adults were tested on the tests that lacked published norms. These controls were residents at AO's nursing home. There were three females and two males (age range: 81-91 years; mean age: 86; mean education = 11). Where appropriate their performance scores were compared to that of AO's using the methods developed by Crawford & Howell (1998) and Crawford & Garthwaite (2002) for obtaining point estimates and confidence limits of the abnormality of an individual patient's test score when the control sample is modest in size (e.g.  $N < 5$ ).

#### 7.3.1 Pre- and Post-Morbid Intelligence

AO's performance on the WAIS-III is summarised in Table 7-1. Overall, AO's Full Scale IQ showed moderate deterioration in comparison with her Wechsler Test of Adult Reading (WTAR) predicted WAIS-III score of 94. Her Verbal IQ was preserved but AO appeared quite dyspraxic and could not start most of the WAIS-III Performance subtests. This was partly due to her visual impairments and also because of the high demands most of these tests make on executive functions, visuospatial and construction abilities (see also her performance on the copy condition of the Rey Complex Figure Test).

#### 7.3.2 Language

AO's spontaneous speech was normal, showing normal flow, articulation and prosody. Her comprehension also appeared intact and AO performed well on semantic abilities bedside tasks (see Table 7-1). However, AO tended to speak endlessly, failing to take turns in conversation and although she would readily express humour herself, she would occasionally take the humorous remarks of others literally and become offended. In general, she did not appreciate the more subtle aspects of communication (impaired pragmatics of communication, Friedland & Miller, 1998). This behavioural pattern is consistent with her RH pathology (Brownell & Stringfellow, 1999; Gardner et al., 1983).

**Table 7-1. Neuropsychological Evaluation of AO's Intellectual Abilities**

Test	Score	Age-Adjusted Level
<i>Intelligence</i>		
<b>WAIS-III</b>	<b>Index Scores</b>	
Verbal IQ	107	Average
Performance IQ	58	Impaired
Verbal Comprehension	103	Average
Perceptual Organization	50	Impaired
Working Memory	113	High Average
Processing Speed	-	-
Full Scale IQ	84	Low Average
<b>WTAR</b>		
Estimated IQ	94	
<i>Other Tests</i>		
<b>HADS</b>		
Anxiety Score	10	Borderline
Depression Score	10	Borderline
<b>Grated Naming Test</b>	7/30	Impaired
<b>Semantic Abilities</b>		
<b>Bedside Tests</b>		
Colour Pointing in Pictures	60 % Correct Rate	Normal
Word Semantic Categorisation	85 % Correct Rate	Normal
Word Semantic Naming	80 % Correct Rate	Normal
Symbolic Gestures on Request	100 % Correct Rate	Normal
<b>WMS- III</b>	86 % Correct Rate	Normal
<b>Orientation Sub-test (18.04.02)</b>		
<b>WMS- III</b>	33 % Correct Rate	Impaired
<b>Orientation Sub-test (10.05.02)</b>		
<b>Mini-Mental State</b>	22/30	Impaired

### 7.3.3 Attention and Executive Functions

AO's eyesight was highly defective, showing left homonymous hemianopia and marked visuospatial neglect of her left side in spontaneous behaviour, posture, reading and standard neuropsychological tests such as Letter Cancellation, Line Bisection and the Balloons Test (Table 7-2). AO's auditory attention, as measured by the 'Test of Everyday Attention' (TEA) (Robertson et al, 1994), was clearly abnormal showing problems with sustained attention, consistent with AO's right-frontal lobe pathology.



**Table 7-2. Neuropsychological Evaluation of AO's Executive Functions & Attention Abilities**

Test	Score	Age-Adjusted Level
<i>Executive Functions Tests</i>		
<b>Hayling Test</b>	SS 9	Impaired
<b>Brixton Test</b>	Discontinued	Impaired
<b>BADS Test</b>	SS 54	Impaired
Rule Shift cards	PS 1	Impaired
Action Programme	PS 0	Impaired
Key Search	PS 1	Impaired
Temporal Judgement	PS 3	Average
Zoo Map	Discontinued	Impaired
Six Elements	Discontinued	Impaired
<b>Cognitive Estimates</b>	Error Score: 6	Normal
<b>Luria Rhythmic Tapping</b>	9/10	Normal
<b>DK-EFS Verbal Fluency</b>	F/11 A/6 S/11	SS 9
<b>DK-EFS Semantic Fluency</b>	I/5 II/7	SS 3
<i>Attention Tests</i>		
<b>Letter Cancellation</b>	27 (L-sided neglect)	Impaired
<b>Line Bisection</b>	5 (L-sided neglect)	Impaired
<b>Balloons Test</b>	A- L0 R3; B- L0 R2	Impaired
<b>Test of Everyday Attention</b>		
Elevator Counting	5/7	Impaired
Elevator Counting with Distraction	SS=5	5%ile
Elevator Counting with Reversal	SS=9	25%ile

AO also performed poorly on most tests of executive functions (see Table 7-2) with the exception of the D-KEFS Letter Fluency test (Delis-Kaplan Executive Function System, 2001). It should however be noted that AO's performance could have been contaminated by her visuospatial and construction deficits. Her performance was average on the Temporal Judgment subtest of the Behavioural Assessment of the Dysexecutive Syndrome (BADS) and on the similar but more demanding Cognitive Estimates Test, consistent with her intact general cognitive judgement (see also WAIS-III verbal IQ scores).

#### 7.3.4 Anterograde Memory

AO's anterograde memory abilities as assessed by the Wechsler Memory Scale- Third Edition (WMS-III) are summarised in Table 7-3. Her General Memory Index Score showed only moderate memory deterioration, attributable

mainly to her poor performance on visual memory tests, which in turn was, at least partly, attributable to her impoverished vision and visuospatial attention. By contrast, AO's performance on verbal memory subtests was average, she made only a few minor intrusions in these tests and her performance was normal in recognition subtests.

### 7.3.5 Autobiographical Memory

The Autobiographical Memory Interview (Kopelman, et al., 1990) was used to assess AO's knowledge and memory of her personal past (Table 7-3). Her relatives were interviewed before and after her assessment and asked to verify her answers. AO appeared to remember well the events of her life but presented problems in remembering personal semantic information, particularly of her recent life. Instead she remembered the facts of her childhood better than any other period of her life. She also showed some difficulty in remembering autobiographic incidents from her early adult life and she confabulated about certain postmorbid life events. These results were consistent with the impression AO gave in spontaneous conversation, during which she often referred to her childhood, providing impressive details of the remembered experiences. These recollections were consistent across sessions. By contrast, although she generally showed intact knowledge of recent events and personal facts (pre- and post-stroke), at times she was confused about them, could not retrieve them accurately nor in the right order, and she produced elaborated confabulations in their place.

**Table 7-3. Neuropsychological Evaluation of AO's Memory**

Memory Test	Score	Age-Adjusted Level
<b>WMS III</b>	<b>Index Scores</b>	
Auditory Immediate Memory	99	Average
Visual Immediate Memory	81	Low Average
Immediate Memory	71	Borderline
Auditory Delayed	99	Average
Visual Delayed	84	Low Average
Auditory Recognition Delayed	100	Average
General Memory	92	Average
Working Memory	96	Average
<b>Rey Complex Figure</b>	<b>Raw Scores</b>	
Copy	0/36	Impaired
Immediate Recall	-	Discontinued

Delayed Recall	-	Discontinued
<b>Memory Test</b>	<b>Score</b>	<b>Age-Adjusted</b>
<b>AMI</b>	<b>Raw Scores</b>	
<i>Personal Semantic Memory</i>		
Childhood	17/21	Normal <sup>a</sup>
Early Adult Life	16/21	Borderline
Recent Life	12/21	Impaired
Total	45/63	Impaired
<i>Autobiographical Incidents</i>		
Childhood	8/9	Normal
Early Adult Life	4/9	Borderline
Recent Life	8/9	Normal
Total	20/27	Normal
<b>Confabulation Battery</b>	<b>AO</b>	<b>Controls</b>
Personal Semantic	15 %	0
Episodic	33 %	1.3 %
Orientation	10 %	0
General Semantic	13.3 %	2.66 %
D'K Semantic	30 %	6 %
D'K Episodic	10 %	2 %

7.3.6 Mood

AO's mood most frequently appeared as negative and she scored accordingly in a self-report measure (see HADS scores; Table 7-1). She showed frequent episodes of intense distress, tearfulness, and accompanying confabulations (see below). However, during other, less frequent, sessions AO's mood improved. At these times, she appeared to regain access to information previously unavailable or distorted and she seemed more realistic about her abilities. Fluctuation of mood, memory and awareness performance has been observed before in both confabulating and anosognosic patients (e.g. Baddeley & Wilson, 1986; Ramachandran, 1995; Talland, 1965).

7.3.7 Confabulation

AO did not only confabulate in direct relation to her anosognosia, e.g. insisting that she has been walking since her stroke. She also confabulated about other activities, e.g. she maintained that she often went to the village in Scotland where she had spent her memorable childhood years; and about the behaviour of others towards her, e.g. she believed that her relatives were taking advantage of

her finances and staff were forcing her to shift rooms during the night. Her relatives in their initial efforts to understand AO's symptoms had termed these confabulations 'her wishful fantasies' and had tried to be sympathetic, but AO's forceful conviction in the accuracy of her memories and her persistent accusations had eventually caused severe distress in her family.

In order to quantify AO's confabulations and formally verify their presence, the "Dalla Barba Confabulation Battery" (1993) was administered to AO and the control group (see Chapter 2 for test details). AO's and controls' confabulation scores are summarised in Table 7-3. AO confabulated across all the sections of the battery; most frequently, she confabulated when answering episodic questions and "I don't know" semantic questions. AO's confabulation scores on both Personal and General Semantic questions were relatively low, in contrast to her hits, which were high (80% and 60% respectively). Moreover, her confabulation score on the General Semantic questions was low in contrast to the relatively high rate of confabulations produced by normal subjects on this section.

#### 7.3.8 Summary

Although AO's CT scans did not identify the exact location of her cortical lesions, her neuropsychological profile was indicative of severe and chronic cognitive disruption consistent with anterior RH damage diagnosis. While her general intellectual (verbal), semantic and language abilities were unaffected, AO showed substantial problems in specific cognitive domains such as visuospatial perception (neglect), attention, construction, executive functions, and pragmatic communication skills. She also showed mild anterograde memory impairment and her autobiographical memory appeared contaminated by confabulation and delusions, particularly for events of her recent postmorbidity life. Lastly, she showed fluctuations in orientation and mood, prevalence of negative emotions and paranoid beliefs.

### **7.4 Experimental Investigations: Confabulation and the Self**

The above investigations examined potential cognitive deficits associated with anosognosia and the production of confabulations. The following section focuses on the positive aspects (Jackson, 1932) of AO's symptomatology. These included the subjective experience of her deficits (awareness of deficits), the

potential role of suggestibility and personality traits in confabulation, as well as the potentially motivated self-representations elicited by confabulation.

#### 7.4.1 Study 1: Awareness of Deficit

The major issue of difficulty in AO's management and social interactions was her chronic anosognosia for hemiplegia and its related confabulations. Two years post-stroke she appeared unaware of the fact that her motor functions had been affected by stroke, she could not walk and that she would not be able to live independently. The awareness of her deficits across different behavioural and cognitive domains was assessed by a lengthy semi-structured interview, which was developed to clinically explore the nature of AO's understanding of her own postmorbidity condition (see Chapter 6 and Appendix E1 for test details).

*General Postmorbidity Condition Awareness.* AO showed intact general knowledge of her medical history but she appeared unaware of most of the resulting deficits and their implications. Her awareness appeared particularly compromised in relation to her hemiplegia, neglect, memory and communication problems, as well as their everyday life implications. She was more aware of her executive difficulties, her dyspraxia and the changes in her emotional condition.

*Observation of her own impairments.* AO's reduced awareness was influenced by direct demonstration of her difficulties in a complex way. In some instances, she did not admit her deficits even upon demonstration. Other times, she admitted the observed inability (e.g. inability to move left leg), but continued to explicitly deny the impairment (paralysis) by either minimising its importance (e.g. 'I could walk but I might have a bit of problem while turning') or misattributing, through aggressive and paranoid confabulations, its cause to other non-self related sources (see also Study 4). For example, when asked if she could move both legs she initially replied yes. She then spontaneously tried lifting her legs. She slightly lifted her left leg with her hands and commented: "Oh, yes, this one is a bit weaker". When asked again if she could move both her legs she then replied: "Well I cannot move this one so easily because of the fall. They let me fall one day and I've hurt this side [staff had indeed reported a similar but minor incident several months ago]. I reported it but they won't put it down cause they are afraid I'll ask for compensation". These clinical observations imply that

although AO explicitly denied her motor deficits, she implicitly expressed them through misinterpretations, minimisations or confabulations (see also Study 4).

*Future Perspective.* AO's perspective on her future condition was also defective. She oscillated between extreme pessimism ("I wish I would die") to completely unrealistic plans ("I am going to get a taxi, move my things... I'll find my old friends in Newcastle and I'll get a flat on my own there"). Interestingly, AO would not anticipate difficulties in certain tasks even when she had just failed them and had showed intact recognition of such performance. For example, following a neglect task, AO elaborated on her "blind-side" and narrated how she sometimes lost things placed on her left. However, when after few minutes of distractive activity AO was asked whether she could re-perform the task successfully she showed no sign of recognition of her previous failure, tried to perform the task and failed to acknowledge her difficulty.

*Awareness and Confabulation.* AO's unawareness was often accompanied by the presence of confabulations (see also below). These included false excuses of failure to perform a task, unrealistic future plans and spontaneous false memories (e.g. "I have been walking to the centre many times since I've been in here, but they don't know, you see."). Crucially, most of the abilities that AO showed low awareness of (e.g. everyday living independence, walking, social communication), featured in the most common of her confabulations (e.g. her alleged walks, the 'suspicious' selling of her flat by her relatives, her captivity in the nursing home, the conspiracy against her by staff members etc).

#### 7.4.2 Study 2: Confabulation and Suggestibility

The potential relation between AO's confabulations and suggestibility was also assessed (see Chapter 1). AO's responses to memory questions did not 'yield' to external suggestion, as measured by the Gudjonsson Suggestibility Scale (1997) (see Table 7-4). The scale (GSS2) comprises a narrative paragraph containing a story of an event and 20 questions that are asked about the story, following free recall. The 20 questions are then asked a second time, following negative feedback, and provide suggestibility scores (see Chapter 6 for tests details). AO's initial Yield 1 scores (giving in to suggestive questions prior to negative feedback) were abnormally high, partly explicable by her poor memory.

However, her low Shift score (number of times subjects change their answers following negative feedback) indicates that negative feedback and exposure to distracting information did not appear to influence AO’s answers and indeed her Total Suggestibility score was within the normal range.

**Table 7-4. AO’s performance on the Suggestibility Scale**

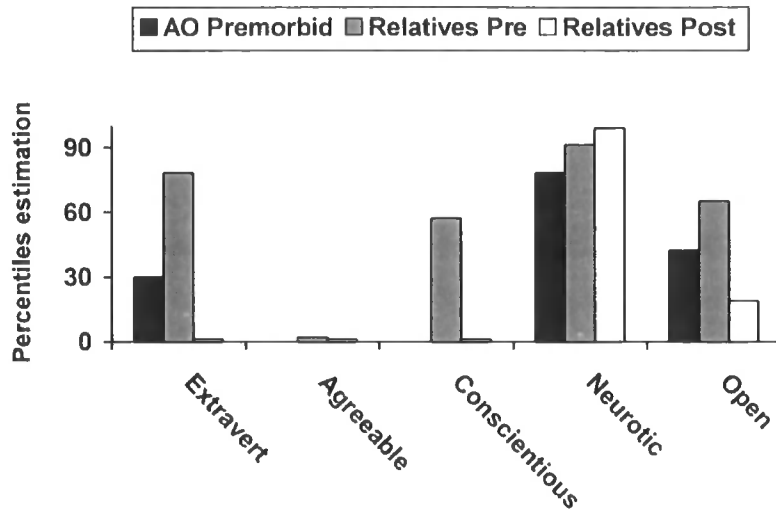
Suggestibility Scale	AO	Norms
Immediate Recall	13	19.7 (6.1)
Delayed Recall	9	18.4 (6)
Yield 1	9	4.5 (3.6)
Yield 2	11	5.5 (4)
Shift	2	3.0 (3)
Total Suggestibility	11	7.5 (5.3)
Distortions (Immediate)	2	1.15 (1.2)
Distortions (Delayed)	2	1.26 (1.8)
Fabrication (Immediate)	0	0.4 (0.7)
Fabrication (Delayed)	0	0.5 (0.7)

7.4.3 Study 3: Pre- and Post-Morbid Personality

AO’s premorbid personality traits were assessed using the same 120-item questionnaire as the one used in the assessment of LH (see Chapter 6). The questions were read out to AO and she was asked to rate her premorbid personality. AO’s only mildly compromised retrograde memory was considered sufficient to allow her to perform such task. However, AO’s relatives were also asked to complete the questionnaire; once for AO’s premorbid personality traits and once for her postmorbid ones. In this way, measures of both premorbid personality and personality change could be obtained. The total scores for each factor of all three ratings (self premorbid rating, independent-rater premorbid rating, independent-rater postmorbid rating) were compared with the standardised personality factor scores provided by J.A. Johnson (1998).

Results. AO’s relatives judged her as *premorbidly* more extravert and less self-disciplined or capable of suppressing her impulses (‘conscientiousness’) than she did (see Figure 7-2). Both AO and her relatives scored her as low in ‘agreeableness’, indicating that she did indeed “speak her mind” and did not prioritise being liked or accepted. Additionally, they both scored her personality as very high in ‘Neuroticism’, reflecting her tendency to often experience negative

feelings, showing “problems in emotional regulation” (Johnson, 1998), which also would “diminish [her] ability to think clearly, make decisions and cope effectively with stress” (Johnson, 1998).



**Figure 7-2. Big Five Pre- and Post-morbid Personality Traits: Self- and Carer’s Ratings**

The rating’s of AO’s *postmorbid* personality show that according to her relatives she was less extravert, and conscientious, i.e. she was more impulsive, and even more overwhelmed by negative feelings than before her stroke. Interestingly, the facet of ‘imagination’ remained very high and ‘adventurousness’ (tendency to experience new things) remained close to its premorbid average level, while the intellect facet was lower. Emotionality scores, i.e. having access to and awareness of one’s feelings, had severely dropped (see Appendix F1 for detailed scores).

These personality changes were consistent with AO’s postmorbid cognitive profile and coping strategies. Her intellectual abilities were mildly deteriorated without that affecting her rich imagination or wish to be exposed to novel situations. However, her abilities and/or willingness to attend to or compromise with her social and physical condition had become virtually absent. Instead, she experienced intense depressive emotions and felt quite anxious at times (see HADS results-Table 7-1). Interestingly, her relatives reported how following her stroke AO also had abnormally negative emotional reactions to the



slightest frustration, including past unpleasant events, which at the time of occurrence had not really affected her, e.g. her abortion or the selling of her flat. When AO was questioned about such events she indeed acknowledged that in the past she tended to 'forget' her problems by working, but she now felt these losses were "terrible and unbearable". Nevertheless, she did not associate her overwhelming negative emotional reactions with her stroke; instead she attributed them to an array of fabricated causes and events by producing paranoid and hostile false beliefs (see below).

#### 7.4.4 Study 4: Self - Representations in True and False Memories

##### *Materials and Methods*

Two aspects of self-representation in AO's confabulatory narratives, namely its 'valence' and 'agency' (see below), were investigated using a method adjusted from studies on autobiographical memory and identity formation (for review see Conway & Pleydell-Pearce, 2000). This test, based on a modified version of the McAdam's (1985) life story technique (in McAdams, 2001), is described in detailed in Chapter 6 (see also Appendix E3 for detailed questionnaire). AO and three controls (matched for sex, education and age) were asked to recall and reflect upon 12 personally significant and self-defining events as in the previous chapter. In order to compare the accurate accounts elicited by AO and control participants during the interview with confabulatory narratives, the first 12 spontaneous self-referential confabulations produced by AO in the same week were identified and corroborated by information given by relatives and nursing staff. Materials, procedures and the three main categories coded were identical to the ones used in LH's case report (see previous chapter).

##### *Coding*

A brief description of the coding system is given again below, but this time with examples from AO's memory protocols. The coded categories included: (1) Self-representation valence and agency, (2) 'Other'-representation valence and unity (3) Overall valence of memory. Self-representation rating included any statements explicitly providing information about the 'self' and its position in interpersonal relations (e.g. 'I am a cripple', 'they all hate me', 'I was always praised by him' etc). In this scoring category the self-representation could be

scored with regard to its emotional valence, i.e. negative (e.g. being inferior), positive (e.g. being superior), or neutral (neutral, ambivalent or hard to evaluate) and its agency, i.e. 'self' as active/responsible (e.g. one who hurts others) or 'other' as active/responsible and 'self' as passive (e.g. one who is hurt by others).

Given AO's delusional reduplications of people and places, two aspects of others' representation were coded separately. The relevant coding category focused on the relation between unity and valence of others' identity. This included statements which revealed the ability to perceive others' identities, including other people (e.g. her niece, nursing staff), other objects or places (e.g. her room, her town) or parts of her body potentially treated as separate agents (e.g. 'this hand won't move'), as emotionally complex, often ambivalent towards or for the self, but still integrated entities (e.g. accurate memory: "It was terrible. My aunt was very strict; she took pleasure in punishing us all the time. But she saved me, you know, when I took ill, I had this poisoning and I was very poorly"). In contrast, statements were correspondingly coded, which included reduplications of the same 'other', i.e. splitting of it into two or more distinctive entities in time and space, with the same [positive (+), or negative (-)], or opposite emotional significance (+/-) for the self (e.g. she believed she had been to this "this horrid place" before (the town), except it was in Scotland where she grew up, and "it was wonderful. It looked the same, and yet it wasn't"). The overall emotional valence of each accurate or confabulatory account was measured on a five-point scale: 1 = negative; 2 = emotional shift from positive to negative; 3 = neutral; 4 = emotional shift from negative to positive; 5 = positive.

Statements to be coded were sequences of phrases or sentences that described a single thematic content e.g. the following sentences "...I cannot stand it any longer, being in her command...she lives down the road, and they come whenever they want to. They come without asking my permission" was considered a theme expressing explicitly a negative dependent self-representation. All statements included in the twelve confabulation protocols were candidates for coding, as it was considered arbitrary to separate accurate statements from the 'confabulated' context in which they were recalled e.g. in a protocol AO referred to how powerless she felt against her nephew who had bought several rooms in the nursing home, despite her objections (confabulation). In the same protocol she

also explained how dependent it made her feel leaving all her financial affairs to him (accurate). Both statements were considered.

### *Results*

The two independent raters agreed on 88% of the selected items to be coded and 96% of the specific classifications made. Their remaining differences were resolved by discussion. Controls and AO produced 12 accurate memories in the interview although the latter's accounts were not always coherent and included multiple events. AO did not confabulate during the interview. This was explicable by the fact that her answers were predominately drawn from her remote past for which AO had preserved recollection and rarely confabulated (see also the AMI results).

**Overall valence.** The mean valence of controls' memories showed a mild positive bias,  $M = 4.1$   $SD = 1.4$ , while AO's accurate memories were equally distributed along the valence scale and their mean did not show any bias,  $M = 3.3$   $M = 1.3$ . Although the mean valence of AO's confabulations,  $M = 2.2$ ,  $SD = 1.2$ , did appear to fall approximately one standard deviation below that of the controls' mean it should also be noted that nine out of her 12 confabulations were rated as unpleasant, while only four, five and seven of the three controls' memories were rated as unpleasant.

**Self and Interpersonal Representations.** Percentages of coded statements of self- and interpersonal representations in AO's and controls' accurate memories and AO's confabulations are shown in Table 7-5. Overall, AO included more self and interpersonal representations in her accurate memories (38 representations) than controls (25 representation on average) but AO's abnormally talkative presentation could be at least partly responsible for this finding. AO portrayed herself as more negative and passive than controls in her accurate memories, e.g. "they tricked me badly, I'll never forget the disappointment, I was hopeless", or, "She made a lot of trouble and put me down a lot when he came back. She insulted me in everyway she could". Controls portrayed themselves overall in more active terms than AO, e.g. "It was difficult, but there again I managed it all myself you see and my whole family acknowledged it". Overall, although AO represented herself and her relation with others in mildly more

passive and negative terms than control participants, her self-representation in accurate memories did not show striking differences in comparison to the self-representation of controls.

**Table 7-5. Percentages of Self-representations in True memories and Confabulations**

Agency	Valence	AO's True Memories	AO's Confabulations	Controls' True Memories
		% <sup>1</sup>	% <sup>2</sup>	% <sup>3</sup>
Self	Positive	13.1	20.8	20
	Negative	15.8	9.4	13.3
	Neutral	10.5	11.3	22.8
Other	Positive	18.4	9.4	14.8
	Negative	34.2	43.4	16
	Neutral	7.9	5.7	13.3

<sup>1</sup> Percentage of the total number of self-representation statements in AO's true memories.

<sup>2</sup> Percentage of the total number of self-representation statements in AO's confabulations.

<sup>3</sup> Percentage of the total number of self-representation statements in controls' true memories.

The self-image depicted in AO's spontaneous confabulations was markedly different from her self-representation in accurate memories. AO included 53 different indications of self and interpersonal representations in her confabulations. AO depicted herself in passive and negative terms even more frequently than in her accurate memories. She often referred to herself as being treated with hostility by others, e.g. "this is how cruel they can be to me. There was a rise of voice and I was so upset", as being alienated by others, "she doesn't care about me anymore, she just left me here" and as being deprived of her independence, e.g. "They are afraid I'll slip and fall down. It is upsetting, they are putting me off everything. They want to control everything". However, AO also expressed active seeking of autonomy and power in her confabulations, e.g. "Well, I told them, I won't have it, I can walk to the chair, I can manage it without them, it is my chair, I have paid for it and I can walk to it whenever I want to". Interestingly, AO rarely expressed, in her confabulations, positive feelings, such as sympathy, concern, longing etc towards others. Most importantly, AO confabulations included several references to issues of health and disability. She described herself as ill or disabled mainly in passive terms, i.e. attributing responsibility to others, e.g. "I am getting infuriated about these girls that say they haven't got to help me. I have to tell the nurse to find out who told her I hadn't

walked. It wasn't the doctor's advice. If they had given me some exercise I could walk". In contrast, in active terms, she referred to herself as able and healthy, e.g. "I don't report it but one night there was nobody, the staff had gone and I had to go on my own [to the toilet]. I managed. But I don't tell them".

**Representation of Other's Emotional Identity.** Although in accurate memories AO appeared to perceive others as ambivalent emotionally (7 descriptions) more often than controls (3 descriptions on average), this tendency diminished in her confabulations (3 descriptions). Instead, in her confabulations certain 'others' (people and places) were represented as split into two or more different identities (5 reduplications), usually with opposite emotional significance (4/5 instances). For example, AO referred to a hospital physiotherapist who had treated her following her stroke as two distinct therapists, one whom she associated with pleasant and encouraging experiences and a separate one whom she described in very negative terms ("she was awful, she finished me") and as responsible for the termination of her physiotherapy. She could not understand how "two therapists so much alike could have such different opinions" and she believed that perhaps the 'disliked' one might not be properly qualified, "there must be something set I am telling you". On a different occasion, AO insisted she was not in her room, she was made to believe she was in it by way of "making them look the same, furnishing them the same" and placing her personal belongings there but she "just knew" it was not her room. She believed she was in another room she owned because her nephew had bought two or three of these rooms in the nursing home where she was living. She didn't like these "other rooms" and she hated "being moved at night". In reality, none of these events had taken place. It is important to note that the above delusions, apart from the reduplicative paramnesia about her room, were false 'beliefs' or false 'memories' (delusional reduplications without misidentification, Weinstein et al., 1956). AO never erred about (mis-recognised) the identity of someone in his or her presence.

In summary, AO's confabulations portrayed a self-image vastly different than that of her accurate memories. While in accurate autobiographical memories AO described herself in slight unpleasant and passive terms (more so than controls), this was greatly exaggerated in confabulations. In the latter, AO

described herself as mainly disliked, intruded, plotted against, made ill, excluded, and deprived of information. She rarely expressed activity or responsibility about her postmorbidity disabilities. Instead, in active terms she depicted herself as healthy, autonomous and competent and she expressed little interest for others in her confabulations. The latter also included reduplications of people and places, showing an inability to represent others beyond the potential emotional ambivalence she felt towards them. Finally, the overall valence of AO's confabulations was strongly negative, unlike her true memories and those of control participants.

#### 7.4.5 Study 5: Recollective Experience

The retrieval of autobiographical memories is characterised by a self-reflective mental state of time travel or reliving of the past (Tulving, 1985). The qualitative characteristics of this recollective experience have been the focus of much recent research on autobiographical memory recollection and memory distortion (see Gardiner & Richardson-Clave, 2000; Johnson et al., 1993; Rajaram & Roediger, 1997 for reviews). By contrast, the study of recollective experience in confabulation has received less attention (e.g. see Dalla Barba, 1993a,b; et al., 1997b).

#### *Materials and Methods*

Recollective experience was investigated by a self-report questionnaire consisting of 26 memory statements (see Appendix F2). These consisted of the first 13 true incidents that had taken place during the previous month and that AO had spontaneously mentioned during previous sessions, as well as the first 13 events confabulated by AO during these sessions. The statements were read out to her in random order and she was asked to judge whether the corresponding events were true or not. Each statement that AO recognised as a true memory was accompanied by a fixed set of recollective experience questions. These concerned confidence in accuracy, event typicality, frequency of rehearsal, importance of consequences, emotional intensity, emotional valence, presence of images, image clarity, presence of movement in images and image recall effort. The questions and their corresponding response options (reported on 5-point scales) were based on Heaps and Nash's (2001) study, which elicited false childhood memories in

normal adults (undergraduate students) using a variation of the interview method originally reported by Loftus and Pickrell (1995). Controls' scores from Heaps and Nash (2001) study were used as a comparison basis for AO's recollective experience ratings.

*Results*

AO's scores are summarised in the Table 7-6. AO recognised correctly all true events and misrecognised as true 11 of her own confabulations. AO claimed she remembered less information about her confabulations than she did about her true memories and she rated her confabulations as less typical than her true memories. However, on average she experienced her confabulations with greater emotional intensity than her accurate memories. Given the multiple dependent variables, multivariate statistical tests were used in order to evaluate the significance of these differences. The sample of the analysis consisted of the individual true and false memories that AO accepted as true and thus rated their recollective experience. Similarly to Heaps & Nash (2001) the present study found that in AO's memories amount remembered and confidence in accuracy ratings were highly correlated for both true and false memories ( $r = .6, p < 0.005$ ). In addition this study found that amount was significantly correlated with ratings of clarity of visual images ( $r = .6, p < .01$ ). To avoid multicollinearity, amount remembered ratings were not included in subsequent analysis. Responses to imagery related questions, which included dichotomous measures, were analysed separately (see below).

**Table 7-6. AO's Ratings of Recollective Experience.**

Recollective Experience Categories <sup>1</sup>	AO			
	True Events		Confabulations	
	M	SD	M	SD
Amount Remembered	3.00	1.09	1.72	0.90
Confidence	3.54	0.93	3.18	1.16
Rehearsal Frequency	1.18	0.75	1.27	0.90
Typicality	1.18	1.66	0.36	0.67
Importance of Consequences	2.18	1.77	2.18	1.47
Emotional Intensity	2.27	1.19	3.00	1.34
Emotional Valence	2.63	1.62	1.63	1.62
Image Clarity	3.33	1.00	3.00	1.41
Recall Effort	0.11	0.33	1.37	1.5

<sup>1</sup> Rated 0-4, with higher numbers indicating greater amounts (see Heaps & Nash, 2001).

A multivariate analysis of variance (MANOVA) was performed with confidence in accuracy, event typicality, importance of consequences, emotional intensity, valence, image clarity and recall effort as dependent variables and true or confabulatory memory status as an independent variable. Results of evaluation of multivariate normality and homogeneity of covariance matrices assumptions were satisfactory. The MANOVA revealed no significant difference in the dependent variables between AO's true and false memories,  $F(7,9) = 1.2, p = .36$ .

A multivariate analysis of covariance MANCOVA was also performed with the same variables but using rehearsal frequency as covariate. Results of assumptions were again satisfactory. The MANCOVA found no significant differences between true memories and confabulations on the different aspects of recollective experience,  $F(7,8) = 1.1, p = .43$ . Thus, it appeared that even when the effects of rehearsal frequency were accounted for, AO's true memories and confabulations did not reliably differ on major aspects of recollective experience. Heaps & Nash's (2001) have also observed no difference between the recollective experience ratings of true and false memories in neurologically healthy adults, but only when the effects of rehearsal frequency were statistically controlled.

AO reported imagery in 72% of her confabulations and 82% of her true memories. AO's imagery included movement in 37% of her confabulations and in 67% of her true memories. Finally, AO rated all of her true memories as associated with a field perspective (i.e. had a view approximating to the actual experience), while she associated 40% of her confabulations with an observer's perspective (i.e. saw herself in the memory). Independent Mann-Whitney tests were performed between true memories and confabulations for imagery presence (yes or no), imagery movement (static or dynamic) and image perspective (field/observer). The critical alpha level was .016 (Bonferroni correction). There was no difference in image presence,  $Z = .5, p = .6$ ; image movement,  $Z = 1.2, p = .2$ ; or image perspective,  $Z = 1.9, p = .05$ , between true memories and confabulations. Although the last difference was not found to be significant in the small sample of memories assessed here, healthy adults (Heaps & Nash, 2001) showed a similar tendency of associating false memories with an observer's perspective.



In conclusion, it appears that although AO showed some tendencies to experience her confabulations differently from her true memories, these differences were not statistically significant, as assessed in the present study. The possibility that AO experienced her confabulations as true memories is addressed in the discussion section below.

#### 7.4.6 Summary of Findings

In summary, AO's neuropsychological profile was indicative of severe and chronic cognitive disruption consistent with RH damage diagnosis, although only a small internal capsule lesion was detectable by neuroimaging investigations. More specifically, while her general intellectual (verbal), semantic and language abilities were unaffected AO showed substantial problems in specific cognitive domains such as visuospatial perception (neglect), attention, construction, executive functions, and pragmatics of speech. She also showed mild anterograde memory impairment and her AM appeared contaminated by confabulation and delusions, particularly for events of her recent pre- and post-morbid life. In addition, she showed reduced awareness of her deficits, fluctuations in orientation, mood and insight, prevalence of negative emotions, paranoid thoughts and exaggerated premorbid personality traits. Finally, her confabulations were not susceptible to external suggestion. Instead, they were typically of a delusional quality, persistently and with great conviction portraying a victimised self-representation. AO experienced these false memories similarly to her accurate recollections.

### **7.5 Discussion**

#### 7.5.1 Confabulation and AO's Neuropathology

AO's detectable brain damage included only a small right internal capsule lesion and some degree of generalised atrophy. Her neuropsychological profile was indicative of fronto-parietal right-hemisphere damage, although given AO's age, the contribution of age-related changes could not be excluded. Crucially, a similar lesion has been observed by Schnider and colleagues (1996) in another severely confabulating patient. Unfortunately, these authors did not describe the precise content and emotional quality of their patient's confabulations. However, according to their view, spontaneous confabulation (in this context 'spontaneous'

meaning ‘acted-upon’ confabulation) can occur even following such a discrete lesion given its participation to a more general functional system, linking limbic and medial temporal lobe regions (i.e. regions traditionally implicated in memory, such as the amygdala) with the orbitofrontal cortex.

### 7.5.2 The Cognitive Deficits Underpinning AO’s Confabulations

AO’s cognitive profile was similar to the profile shown by the rest of the patients in the C3 confabulation subgroup of the study (unilateral patients DO and JO; see Chapter 2). AO was not clinically amnesic. However, she did show visual memory impairment and some difficulty in recalling recent autobiographical memory events. Moreover, AO showed indications of executive functions impairments, including mainly inhibition, set-shifting, planning and problem-solving deficits. A somewhat surprising finding was AO’s relatively good performance on the Cognitive Estimates Test, a demanding test of reasoning, despite her impaired performance on similar test of temporal estimation (BADs). This finding suggested that AO may have a specific temporal appreciation deficit (e.g. see Dalla Barba, 1997b). AO also performed on an average level on a letter fluency test, while she was impaired in the semantic version of this test. This dissociation was observed in many confabulating patients of the study (see Chapter 2), including LH (see previous Chapter) and suggests that these patients show a particular difficulty in retrieving information from a given semantic category. Moreover, given that both AO and LH did not show a general impairment in semantic knowledge, their impaired performance on this test was more likely linked with a deficit of flexibility and goal-directed retrieval of semantically related information, rather than semantic categorisation. Crucially, this selective deficit has been linked with lesions to the OMPFC (e.g. Stuss et al., 2002) and thus suggests that although AO’s cortical lesions were not visible on CT investigations, she did show the cognitive deficits associated with right OMPFC lesions, or functional disconnection of these areas from their subcortical limbic connections (Schnider et al., 1996).

### 7.5.3 Emotional Changes & Postmorbidity Personality

AO showed mood abnormalities and somewhat problematic social conduct. These difficulties have been described before in the confabulation

literature and have more generally been linked with lesions of the OMPFC (Berlin et al., 2004; Damasio et al., 1985; Joseph, 1999; Rolls, 1999; Stuss, 1991). In the present study, it was also observed in the bilateral confabulation patients. However, AO's mood and the quality of her behaviour towards others were different than that of the C1 and C2 groups (see Chapter 2 and 6). More specifically, she did not show apathy, or euphoria. Instead, she was mostly anxious and sad, she demanded immediate satisfaction of her needs and the slightest delay or mistake from the part of the staff triggered in AO great irritability, anger, despair, paranoid thoughts and confabulations. More generally, she appeared as particularly vulnerable to negative experiences or news and she was likely to experience panic, confusion, and helplessness when under such pressure.

#### 7.5.4 Confabulation Domains & Quality

Another difference from the bilateral patients was that AO's confabulations were most often related with her physical disabilities (hence the term motor-related confabulation). However, her confabulations frequently also extended to the episodic memory domain and less often to other domains such as orientation, personal semantic and 'don't know' questions. Moreover, AO confabulated less often than bilateral patients and, her confabulations were more organised and their themes were more restricted and more persistent (e.g. compare with previous case-report). In other terms her confabulations were more delusional in character (see Chapter 1). This observation was consistent with the qualitative classification of confabulation in bilateral and unilateral confabulating patients (see Chapter 2). However, as discussed before (see Chapter 1) the distinction between confabulation and delusion is a wider conceptual and interdisciplinary issue, which escapes the scope of the present study.

#### 7.5.5 Confabulation, Premorbid Personality & Suggestibility

AO's premorbid personality traits included a number of characteristics previously associated with confabulation (Berlyne, 1972; Gainotti, 1975; Weinstein, 1996; Williams & Rupp, 1932; see also Chapter 1). In particular, her relatives described AO as a very sociable and outgoing person, an extravert. This characteristic has been linked with confabulation in the past (see Williams &

Rupp, 1932; see also Chapter 1). AO was also overwhelmed by anxiety and other negative emotions in difficult situations. Her relatives and also AO herself also noted how she tended to use work and social interaction as a distraction from her worries. In AO's own words, "you don't deal with sorrow, you just get on with it and you keep busy". Given these premorbid traits and coping strategies, AO's anosognosia and its related confabulation could be interpreted as an exaggerated form of conscious or unconscious denial of deficit, a psychological coping mechanism (Weinstein & Kahn, 1955). Furthermore, one could postulate that a patient with a less sensitive self-esteem and different coping strategies might have not developed confabulation and anosognosia (e.g. Gainotti, 1975; Weinstein & Kahn, 1955). Crucially, LH showed similar premorbid personality characteristics including high ratings of extraversion and neuroticism. However, although these factors may have a role in the formation of the content of confabulations (see Chapter 6 and below), it is not likely that premorbid personality is causative of confabulation. More specifically, it is highly unlikely that a specific neurological syndrome is entirely caused by personality factors, essentially unrelated to brain and cognitive dysfunction (see also Chapters 1 and 6). However, aside from the above theoretical postulations, a large group study with appropriate controls is required in order to empirically verify whether personality factors can distinguish confabulating from other non-confabulating patients with similar deficits.

In addition, AO's memory was not susceptible to suggestion. Even when presented with misleading information and given negative feedback AO did not yield her original answers. This finding suggests that AO's personality was not compliant, as also shown by her Big Five ratings. LH's suggestibility scores were higher. This finding may also have a role in the difference of confabulation quality between the two patients. AO's confabulations were specific, well-organised, persistent and resistant to correction. LH's confabulations showed some predominant themes but their content was mostly ephemeral, disorganised, not specific and easily directed by questioning. Thus, although suggestibility was not sufficient to explain the production of confabulations in either patient, in LH it might have contributed to the formation of secondary confabulations and thus it might have contributed to the disorganised quality and wide thematic range of LH's confabulations (see also Chapter 6). Finally, it should be noted that the

above qualitative characteristics of confabulation were similar in most of the patients of the corresponding C1 and C3 confabulation subgroups (see Chapter 2).

#### 7.5.6 Memory Awareness in Confabulation

Since the pioneering work of Tulving (1985), the relation between episodic memory and its subjective experience has generated significant interest among memory researchers. Tulving proposed that episodic memory is distinguished from semantic memory on the basis of a distinct type of awareness, namely 'autonoetic consciousness'. This is a self-reflective mental state of time travel or reliving of the past, which is contrasted with 'noetic consciousness', the awareness accompanying semantic knowledge (see also Conway, 2001) and 'anoetic consciousness', which is linked to implicit memory (Wheeler et al., 1997). In neuropsychology, although few studies have directly investigated recollective experience in confabulation (e.g. Dalla Barba et al., 1993a; 1997b), the issue is central to the theoretical conceptualisation of the symptom, as a prototype form of autobiographical false remembering. Johnson and colleagues (1997) found that in their confabulating patient the qualitative characteristics of a fabricated and an accurate memory were similar. Unfortunately, they did not ask him to rate his memories. By contrast, Dalla Barba and colleagues (1993a; 1997) directly studied recollective experience in confabulating patients by using the 'remember/know' paradigm. 'Remember' judgements are made if patients revive the experience (autonoetic consciousness), whereas 'know' responses indicate that they simply recognise the event as true or familiar without subjective experience of remembering. Both correct and confabulatory autobiographical events were accompanied by 'remember' judgements.

In the present chapter the qualitative characteristics of recollective experience were investigated and were consistent with the above results. AO's recollective experience of her false memories did not differ significantly in quality from the corresponding recollective experience accompanying her true memories (Study 4). In William James's (1890) terms AO experienced her false memories with the *warmth, intimacy and immediacy* of accurate personal memories. Although this finding calls for further investigation, it raises the possibility that the false beliefs and memories surrounding AO's anosognosia were not mere rationalisations of false perceptions or the filling-in of memory gaps (for review

see Whitlock, 1981). This conclusion is also consistent with the previous investigation that showed that AO did not accept as true any suggested information, even when she was given negative feedback about the accuracy of her memory (suggestibility study).

Of course, the breakdown of the ability to appreciate that non-real events, e.g. imagined events, dreams, thoughts, are not true memories is axiomatic to confabulation (see previous discussion; also Burgess & Shallice, 1996; Hirstein, 2004). However, the present findings suggest that confabulations are confused with real memories at the level of autobiographical or episodic memory awareness. Patients actually experience their false memories as real. This observation has important implications for the nature of the relation between human memory and awareness, as well as for the relation of confabulation to delusion and other classes of false beliefs about one's self. However, these issues escape the direct scope of this chapter, particularly since few fundamental aspects of such concepts are generally accepted and more confabulating patients need to be assessed (for discussions see Dalla Barba, 2000; Johnson et al., 1997; Kopelman, 1999; Moscovitch, 1999). For the purposes of this thesis, the implications of this finding will be addressed in direct relation to the results of the other investigations (see Chapter 8).

#### 7.5.7 Self-Representations and Awareness in Confabulation

The present findings demonstrated that the content of AO's confabulations included two extreme types, both mostly relating to her physical and social postmorbidity state. Namely, 'wishful' and 'paranoid' confabulations.

##### *Wishful Confabulations*

In wishful confabulations AO portrayed a positive image of herself based on premorbid self-values (see also Chapter 6; Fotopoulou et al., 2004). These were selective instances of poor autobiographical memory retrieval and reality monitoring, e.g. not remembering, or not appreciating the consequences of one's illness, despite repeated explanations by one's physician. AO's assessment revealed a number of such 'awareness clefts' which mostly concerned issues of bodily integrity and independence in everyday living and thus were mainly related to her anosognosia for hemiplegia. Thus, it appeared that her self-representation in

such confabulations and anosognosic statements, was not updated according to current reality criteria. Instead, it appeared largely constrained by premorbid goals, expectations and current needs and drives (Conway & Pleydell-Pearce, 2000; see also Fotopoulou et al, 2004). This explanation of motivated confabulation has been previously put forward in relation to amnesic patients with bilateral ventromedial prefrontal cortex lesions (Conway & Tacchi, 1996; Fotopoulou et al., 2004; Solms, 2000; see also Chapter 6) and it will be further addressed in the following chapter (Chapter 8).

#### *Negative Emotions and Paranoid Confabulations*

AO's wishful false memories and beliefs, as described above, were less prominent than the observed paranoid confabulations and reduplications. In the latter, she portrayed an image of herself which was deceived, defeated and deprived of its knowledge, abilities and independence. She further accompanied these representations with the expression of the corresponding negative emotions. In this sense, what AO confabulated, though it was not in accordance with the facts, *it was emotionally on target* (see also Kinbourne, 2000). Indeed, AO experienced intense negative emotions (sadness, anxiety and anger), which she both explicitly acknowledged (e.g. HADS; Big Five Questionnaires results) and implicitly revealed through the constructions of markedly unpleasant confabulations and delusions. Crucially, although AO was able to process the negative emotions corresponding to her postmorbidity condition, she could not cognitively evaluate and explicitly express her postmorbidity condition itself, nor integrate the relevant memories into her current self-representation. As described above, the latter remained instead largely attached to premorbid values, expectations and goals. These observations reveal a decoupling of reality-based emotions from their corresponding cognitive representations. In AO's case, and perhaps in other similar cases, this uncoupling led to the formulation of extreme paranoid confabulations.

More specifically, although AO showed some implicit awareness of her deficits and expressed the corresponding negative emotions (e.g. she justified her intense disappointment with care staff by claiming that if they had provided her the necessary exercise she could walk, thus implying that she could not walk as the situation was), she appeared to misinterpret their significance and misattribute

them to external sources. Thus, she *externalised* such negative thoughts and emotions from her own self-image (see also Marcel et al., 2004). For example, her own deficits were attributed to the actions and mistakes of other people, her unwanted nursing home room was 'not her room, but some other identical room that others force her to move into', and the town in which she moved following her stroke was not in fact town x, but the town in which she happily grew up, which in her disappointment the local government had renamed as x. Although further research is required to establish in which type of patients such implicit awareness of deficits occur, these differences between explicit unawareness and implicit emotional processing may throw additional light on the theoretical debates about the complicated role of the right-hemisphere in emotional processing and anosognosia (for discussions see Gainotti, 2000; Heilman et al., 2000; Tucker et al., 2000; Turnbull et al., 2004b). Crucially, for the further study such fragmented awareness of one's postmorbidity may contribute to the formation of confabulations. This mechanism of confabulation construction will be further addressed in the following chapter.

*Neuropsychiatric Symptoms and the Right-hemisphere*

AO's symptoms included a number of delusional reduplications. This observation is also consistent with increasing evidence that indicates that delusional misidentification disorders, when they occur in relation to neurological conditions are more commonly associated with predominance of RH damage, even in the context of bilateral and particularly bifrontal lesions (e.g. Benson et al., 1976; Feinberg & Shapiro, 1989; Feinberg & Roane, 1997b; Forstl et al., 1991a; Hakim et al., 1988); or even in generalised brain disorders like Alzheimer's disease (e.g. Forstl et al., 1991b; Mentis et al., 1995). For example, Staff and colleagues (1999) showed that in Alzheimer's disease the presence of content specific delusions, including misidentifications, was associated with areas of hypoperfusion in the right anterior hemisphere (see also Levine & Grek, 1984). Furthermore, such delusions can occur with confabulation (Baddeley & Wilson, 1986; Box et al., 1999; Dab et al., 1999; Mattioli et al., 1999; Stuss et al., 1978) and anosognosia for hemiplegia (e.g. Levine & Grek, 1984).

Despite this increasing consensus about the role of RH dysfunction in reduplicative delusions, its exact neuropsychological basis remains unexplained.



A number of different cognitive theories have been proposed (e.g. Alexander et al., 1979; Ellis & de Pauw, 1997; Feinberg & Shapiro, 1989; Frith et al., 2000; Joseph, 1986a; Levine & Grek, 1984; Young, 2000). For example, delusional misidentifications are interpreted as the consequence of a rational judgment superimposed on a false emotional perception, i.e. lack of familiarity (for reviews Ellis & de Pauw, 1997; Young, 2000). However, these approaches are not sufficient to explain the positive (in Jackson's sense, 1932) aspects of the delusions (see also Feinberg & Roane, 1997b; Fleminger, 1997), such as the observed selectivity of misattributions or misidentifications (e.g. why AO misidentified her room but not her furniture, or why AO *had familiarity* with the room she claimed "was not hers"; she knew she had been before in *that* room, although she insisted "*this* was not her room"). Crucially, such theories cannot explain why AO constructed and accepted bizarre beliefs (note, for example, that AO's cognitive estimation and reasoning abilities were not impaired). Through the latter she did not simply negate the ownership of the misidentified objects or people (misidentification); instead, she narrated memories involving the presence of doubles (reduplication). Finally, in a way reminiscent of how misoplegic patients are endlessly preoccupied with their hated paralysed arm (see also Kaplan-Solms & Solms, 2000), she appeared emotionally engaged and preoccupied with the presence, description and confabulatory identity of these 'disturbing' duplicates (e.g. "I hate this room, I do not want it, they made me come here"; see also Fleminger, 1997). This predominance of negative emotions and their misattribution to external, this time non-existent sources, suggests a link between AO's paranoid confabulations and these reduplications.

The present investigations revealed that AO's delusional reduplications typically involved two split identities that had the opposite emotional valence and significance for her. Although further research in these symptoms is required, this finding warrants some speculation. Reduplicative delusions may reflect a more severe instance of emotional and cognitive fragmentation of one's self-representation and self-other differentiation than paranoid confabulations. In these delusions negative self-related emotions are externalised from the impaired self-representation as in paranoid confabulations, but in this case it is not just the 'agency' of internally generated (i.e. though memory) emotions that is misattributed to others (e.g. these 'experienced' yet disturbing emotions are

caused by them, they hate me). It is also the 'ownership' of externally-triggered (i.e. through perception) negative emotions that is misattributed to other sources (e.g. this perceived yet disturbing entity is not my room). In the same speculative sense, AO's isolated incidents of Cotard's delusion may represent instances of exaggerated cognitive incomprehensibility and depersonalisation of experienced negative emotions (this experienced yet disturbing 'self' is not me).

In summary, AO's confabulations and delusions exemplify how a specific organic dysfunction (anterior RH damage) can lead to impairments in specific cognitive abilities (reality congruent self-representation), which in turn is aetiologically related to a series of dynamic changes in the relation between cognition and emotion (e.g. externalisation of self-related negative emotions from self-representation). In this sense, the false memories and beliefs described above are not caused by psychogenic compensatory (defence) mechanisms. Instead, they are neurological equivalents of such mechanisms, tied to specific neural and cognitive dysfunction. Furthermore, it is precisely because they are caused by specific neurological damage that their investigation can be informative with respect to their neural correlates. Of course, the above explanations are incomplete. For example, the exact neural, cognitive (e.g. spatial, motor, mnemonic) and emotional components of the mental ability for high-order self-representation and self-other differentiation are not fully understood. Yet, the cross-disciplinary perspective that this study introduced may serve to point research attention towards the counterintuitive fragmentation of the emotional and cognitive components of self-representation, which can then be targeted by specific neuroimaging or other investigations. The implications of these findings will be further discussed in the following chapter (Chapter 8).

## Chapter 8 : Discussion

*“Originally the mere existence of a presentation was a guarantee of the reality of what was presented”*  
S. Freud, *Negation*, 1925

*“Were it not for the intervention of the ego, or of those external forces which the ego represents, every instinct would know only one fate- that of gratification”*  
Anna Freud, 1946  
*The Ego and the Mechanisms of Defence*

### 8.1 Confabulation: Deficit or Motivation?

The main objective of the thesis was to address the following question: “Is neurological confabulation motivated”? (see Chapter 1). In the first experimental chapter of the thesis (Chapter 3), it was demonstrated that spontaneous confabulations rewrite the past, present or future of the patient in a pleasant and self-enhancing way. In other words, the content of confabulation is not randomly generated. Instead, confabulating patients show a positive emotional bias in their false recollections. This bias has been experimentally demonstrated before in a case-report (Fotopoulou et al., 2004) and in a retrospective study of selective cases in the literature (Turnbull et al., 2004a). The current thesis represents the first experimental group study on confabulation that focuses on this bias. The findings presented, provide evidence for the hypothesis that the content of confabulation is motivated.

In classical studies, this hypothesis was described in purely psychological terms (e.g. Weinstein & Kahn, 1955; for a review see Chapter 1). In subsequent neurocognitive models, the potential role of motivation in confabulation was de-emphasised (see Deluca, 2000 for a review). By contrast, these theories explained confabulation in relation to several cognitive deficits, including amnesia, dysexecutive syndrome, impaired temporality and impaired strategic retrieval (see Chapter 1). However, more recent models of confabulation re-introduced the motivational hypothesis in neuropsychological terms. More specifically, they addressed the potential motivational influences in parallel with the cognitive deficits accompanying confabulation (Conway & Tacchi, 1996; Fotopoulou et al., 2004; Solms, 2000; Turnbull et al., 2004a). In other terms, they provided a

theoretical framework that explained how brain dysfunction can cause alterations in the dynamic relation between the emotional and cognitive processes that normally serve memory. The following example from the current thesis is used to clarify this point.

Patient WM often confabulated about his parents' whereabouts and could not accept they were no longer alive. WM frequently visited his mother's former house in a vain 'search of time lost'. There, he was repeatedly told by the new house owners that his parents had died several years before and the house had new occupants (see also Chapter 1). This behaviour could be explained with reference to several cognitive deficits: (i) an inability to recall the corresponding accurate experiences, e.g. his sister's repeated reminders of their mother's death. (ii) an inability to remember that a change has occurred in his habitual circumstances (e.g. he no longer lived with his parents; see also Burgess & McNeil, 1999). (iii) an impaired ability to guide memory through the appropriate environmental cues (e.g. the physical changes in his parents' house) (Kopelman et al., 1997); (iv) an inability to access and retrieve the corresponding memories (e.g. his mother's funeral) and (v) an inability to control and reason about his memory output, e.g. his age, which he occasionally recalled accurately, which suggested his parents would have been of greater age than he claimed (Burgess & Shallice, 1996; Moscovitch, 1989; Schacter et al., 1998). (vi) a potential inability to subjectively distinguish between life-time periods (Dalla Barba, 2000). Thus, he could have mistakenly attributed to his current experiences (e.g. "I went shopping with my mother yesterday"), events that in fact took place in different periods (e.g. they did go shopping together while she was alive) (see also Schnider, 2003).

Indeed, the present thesis confirmed the contributing role of memory deficits (Chapters 2, 5 and 6), executive functions deficits (chapters 2, 4, 5, 6 and 7) and impaired temporality (Chapter 3) in confabulation. Hence, the results of the neuropsychological and experimental investigations were consistent with the impairments identified in most 'deficit theories' (see Chapter 1). Nevertheless, none of these impairments, or their combination, was sufficient to account for the positive bias observed in confabulatory content. For example, these deficits theories cannot explain why most of WM's false recollections were pleasant. At the same time as his parents' death, WM went on trip with a close friend. He met

his former girlfriend. His sister moved to a bigger house. Yet, WM was not confused about these pleasant events, and he did not confabulate unpleasant versions of them. He was at times unable to recall them, but he never failed to recognise them. By contrast, he could not recognise, nor accept the death of his parents and all the associated events that followed their death. Instead, he insisted that “they must be alive”. This positive emotional bias requires a theoretical framework capable of incorporating the relation between emotions and memory. Moreover, the rest of the present experimental investigations studied the relation of this bias to some of the cognitive dysfunctions observed in confabulation (Chapters 4, 5, 6 and 7). Therefore, these studies can provide additional specification to the proposed theoretical framework of motivated confabulation.

## **8.2 Confabulation: Deficit *And* Motivation**

The starting point of the thesis’s theoretical framework is that autobiographical memory has the fundamental function of generating and maintaining a meaningful and motivated representation of one’s self in the world. This includes information about one’s self-goals and the ways to achieve them in interaction with the environment (Conway & Pleydell-Pearce, 2000; see also Chapter 1). The representations, stored in memory, allow the individual to operate in evolutionarily adaptive ways on reality. These functions are clearly affected in confabulating patients (for discussions, see Baddeley & Wilson, 1986; Conway & Tacchi, 1996; Solms, 2000). Nevertheless, the latter persistently strive, through the generation of false autobiographical memories, to construct their self-representation and use it to interact with their environment (Conway & Fthenaki, 2000; Fotopoulou et al., 2004). Thus, according to this view, the production of confabulations is the direct result of brain damage and cognitive dysfunction. In this respect, confabulation is not intentional (for discussion, see Chapter 1). Nevertheless, confabulatory content is both motivated and meaningful from the subjective perspective of each patient. This framework, described in detail below, will be used to discuss the findings of the thesis. However, before proceeding to the theoretical discussion of the cognitive and emotional nature of confabulation, it is necessary to address its neuroanatomical basis.

### **8.3 The Neuroanatomical Basis of Confabulation**

In previous studies, severe confabulation has most often been associated with frontal lobe lesions and particularly the ventromedial prefrontal cortex. Less clear is the contribution of other surrounding areas, such as the dorsolateral prefrontal cortex, the basal forebrain, the anterior cingulate, and other 'anterior limbic' areas (Deluca, 2000; Johnson et al., 2000; Kroll et al., 1997; Moscovitch & Melo, 1997; Schnider, 2003; see also Chapter 1). In the present thesis, confabulating patients showed neuropathologies frequently associated with confabulation (see Chapters 2, 6 and 7). They had bilateral lesions at the orbital and medial prefrontal cortex (OMPFC, see Chapter 2), or other 'paralimbic areas' (Mesulam, 2000) and possibly limbic areas, such as the basal forebrain. However, unilateral discrete subcortical lesions and more generalised brain damage were also observed. Thus, lesion localisation was not precise enough to provide definite conclusions about the neuroanatomical basis of confabulation. However, the neuropsychological profile of these patients provided additional insight into their neuropathology.

The cognitive deficits of the bilateral patients were indicative of damage to OMPFC, without excluding the possibility of lesions to adjacent basal forebrain areas. More specifically, their clinical presentation included a number of symptoms typically resulting following OMPFC lesions. These mainly included a selective semantic fluency deficit, disinhibition, social inappropriateness, and lack of insight (see Chapter 2). Moreover, confabulating patients showed a variable impairment in standardised 'frontal' tests, which are developed to mainly assess the functional role of the dorsolateral prefrontal cortex (for recent discussions see, Knight & Stuss, 2002; Mesulam, 2000; Moscovitch & Winocur, 2002; Stuss et al., 2002). In addition, the bilateral confabulating patients showed severe memory impairment and disorientation. These deficits were comparable in degree, but not in quality, to those of a small group of amnesic control patients with diencephalic and temporal lobe lesions (see Chapter 2). The memory deficits could relate to lesions in the OMPFC, as well as to basal forebrain lesions, albeit non-detectable in the present study. The latter are known to have effects on episodic memory, in light of their dense cholinergic projections to the cerebral cortex (Arnstein & Robbins, 2002; Mesulam, 2000).

Based on the above, confabulation in bilateral confabulating patients is potentially associated with lesions to OMPFC, as well as to basal forebrain areas. However, the neuropathological and neuropsychological evidence of the present thesis was not sufficient to identify the potentially dissociable role of these areas in confabulation. The possibility remains that given the dense interconnections between these 'anterior limbic system' structures (e.g. see Mesulam, 2000), lesions to any of these formations could cause confabulation. This view is consistent with Schnider's proposal about the role of a functional disconnection between core limbic structures, e.g., amygdala, and the orbitofrontal cortex (Schnider, 2003). Moreover, this view is supported by the current finding that discrete unilateral and subcortical lesions lead to severe confabulation (see Chapter 2). Given these findings, further study into the distinct role of these areas in the nature of confabulation could be undertaken in the future. For the purposes of the present thesis, recent data about the functional role of the OMPFC, as well as the basal forebrain, are considered below and will be subsequently discussed in relation to confabulation.

### 8.3.1 The Functional Role of the Orbital and Medial Prefrontal Cortex

Following the classic neurological case of Phineas Gase, damage to the OMPFC in humans has been repeatedly linked with deficits in affective regulation, including emotional impulsivity, lack of initiative, lack of concern for one's condition, aberrant risk-taking and socially inappropriate behaviour (e.g. Berlin et al., 2004; Damasio, 1999; Joseph, 1999; Knight & Stuss, 2002; Malloy, Bihle, Duffy & Cimino, 1993; Mesulam, 2002). Interestingly, these patients typically show this social and emotional disturbance in the context of relatively intact intellectual and executive abilities (Bechara et al., 2000; Mesulam, 2002). The role of the OMPFC in affective regulation is also supported by converging data from various other sources. These include animal studies (e.g. conditioning and extinction studies in lesioned monkeys, Baxter et al., 2000; Watanabe, 2002; Schultz, Tremblay, & Hallerman, 2000; Rolls, 2000); recent neuroimaging investigations in humans (e.g. reward and extinction of reward learning, Elliott, Dolan & Frith, 2000; Elliot et al., 2003; Gottfried & Dolan, 2004; O'Doherty, et al., 2001); and psychopathological data (increased activation of orbitofrontal

cortex in obsessive compulsive disorder, Abbruzzese, Bellodi, Ferri, & Scarrons, 1995).

From a theoretical point of view, the inability of patients with OMPFC lesions to integrate the emotional response into an appropriate social and cognitive context has been considered by Damasio and colleagues (for review see Bechara et al., 2000) as resulting from a defect in the activation of 'somatic markers'. These include somatosensory states (based on autonomic and proprioceptive afferences) that provide the individual with 'gut feelings' associated to the outcomes of their actions. These somatic markers allow individuals to anticipate the future consequences of their present actions and thus guide decision-making through 'signalling' the outcomes of responses to be selected or inhibited. In its most sophisticated form, such a mechanism identifies the emotional reaction of others in the environment and also dictates the behaviours most appropriate for social approval and positive interpersonal reaction to the individual's goals. Thus, dysfunction of this system has also been linked with empathy, theory of mind abilities and social judgement (Bechara et al., 2000; Gallagher & Frith, 2003; see also Hirstein, 2004 for a review).

Various other similar theoretical proposals have been put forward to explain the primary role of the OMPFC in regulating emotion and arousal (e.g. Elliot et al., 2000; Rolls, 2000; Ressler, 2004; Shimamura, 2000). For example, Rolls (2000) associated the decoding and readjusting of the reinforcement value of stimuli as functions of the OMPFC. He showed that these regions are associated with (i) the assessment and representation of primary (unlearned) reinforcements, such as taste and touch; (ii) the learning and reversing of reinforcement contingencies (learning which stimuli are rewarding and which are non-rewarding in every situation); and (iii) the control and correction of reward- and punishment-related behaviours. Elliot et al., (2000) suggested that the OMPFC becomes active when there is insufficient information available to determine the appropriate course of action. In such circumstances, the selection of appropriate responses, actions or stimuli is based on their likely reward, so that a feeling of familiarity or of "rightness", rather than the identity or the location of the stimuli, guides their selection.



Taken together, these studies suggest that the functions of the OMPFC guide behaviour through the monitoring of the affective consequences of one's actions. This is achieved through the maintenance of task- and reward-relevant activations and inhibition of irrelevant or inappropriate neural activity. Similar inhibitory control functions are performed by lateral regions of the prefrontal cortex (Mesulam, 2002; Shallice, 2002; Stuss et al., 2002). The exact functional fractionation of the prefrontal cortex is still highly debated (for discussions see Bechara et al., 2000; Berlin et al., 2004; Moscovitch & Winocur, 2002; Shallice, 2002; Shimamura, 2000; Stuss et al, 2002). Nevertheless, the above notions of social and reward-orientated inhibition and impulsivity, are distinguishable from functions of working memory, reasoning, motor inhibition, and response suppression in purely cognitive tasks (Goldman-Rakic, 1996; Petrides & Milner, 1982; Petrides, 1998). This is consistent with the frequent finding that patients with OMPFC lesions, including confabulating patients, may perform well on standardised 'frontal tests' (e.g. Dalla Barba, 1993a; Mesulam, 2002), or at least their performance on these tasks may not show a reliable pattern of impairment (Schnider et al., 2003; Moscovitch & Winocur, 2002).

### 8.3.2 The OMPFC and Memory

Crucially, most of the above studies have used memory paradigms (e.g. reward conditioning and extinction methodologies) to study the emotional functions associated with the OMPFC. Thus, they have highlighted that one of the fundamental functions of memory is maintaining and constantly updating a record of stimuli, environmental conditions and corresponding actions, which are capable of satisfying the individual's inner needs and goals in the most efficient way. More recently, neuroimaging studies have linked the OMPFC with conscious reflection (Wheeler et al., 1997), self-referential mental activity (Keenan et al., 2000; 2001; 2003; Kelley et al., 2002; Kircher & David, 2003; Kircher et al., 2000; 2001; 2002; see also Gilliam & Farah, 2005 for a review) and most importantly the retrieval of emotional and self-related episodic memories (e.g. see Addis et al., 2004; Conway et al., 2001; 2003; Fink et al., 1996; Greenberg et al., 2005; Lepege et al., 2000; Levine et al., 2004; Maguire et al., 2001; Markowitch et al., 2003; Piefke et al., 2003).

In addition, the neuroanatomical connections of the OMPFC seem suitable for the regulation of the relation between memory and emotions. More specifically, orbitofrontal and adjacent subcallosal cortices receive input from posterior cortical integration areas and other prefrontal cortex regions. They also receive input from many limbic regions. Thus, they represent the site of convergence for ex- and interoceptive, i.e. proprioceptive and visceral, information (Bechara et al., 2000; Rolls, 2002). Lateral and medial portions of this basal frontal cortex have different networks of connectivity. The medial sector is particularly related to hippocampal and parahippocampal regions, and the posterior cingulate and retrosplenial areas, while the lateral section has strong connections with the amygdala, sensory and premotor regions (Mesulam, 2000; Tucker, Derryberry, & Luu, 2000). Thus, a lesion of the OMPFC could disrupt the relation between internal emotional reactions and the corresponding external stimuli.

The above functions of emotional learning are not performed by the OMPFC alone. Instead, they are also mediated by wider 'anterior limbic' systems that include both cortical and subcortical structures, such as the amygdala and the ventral striatum (Bechara et al., 2003; Ledoux, 1996; 2000; Rolls, 2000). The amygdala receives pre-processed polysensory information and its left and right nuclear complexes respond differently to different aspects of emotional stimuli (Markowitsch et al., 2000; 2003). The ventral striatum has also been linked to the processing of emotional information (Bechara et al., 2003; Cardinal et al., 2002; Davidson et al., 2000) and it may be seen as a subcortical extension of this anterior frontal-limbic circuit.

The exact relation between the OMPFC and these limbic structures is at present unclear and the specific mechanisms and neural correlates of affective regulation are not as yet fully understood. Some studies suggest that the OMPFC is involved predominately in the processing of positive emotions or reward-related stimuli, while the amygdala serve the processing of negative emotions, such as fear, anger and anxiety-related emotions (Adolphs, 1999; Cardinal et al., 2002; Maratos et al., 2001; O'Doherty et al., 2001; Piefke et al., 2003). However, other studies contradict such findings (see Piefke et al., 2003 for review). Another view suggests that the contribution of the OMPFC appears crucial in the control and coordination of the emotional processes mediated by other limbic structures, in

the same way that dorsolateral prefrontal cortex monitors and controls a number of more basic cognitive processes (for discussions see Bechara et al., 2000; Rolls, 2000; Mesulam, 2002; Shimamura, 2000). For example, patients with both amygdala and orbitofrontal cortex lesions perform poorly on a test of emotion-based learning and emotion-based decision making (Bechara et al., 2003). However, amygdala-lesioned patients appeared to have more fundamental deficits than patients with OMPFC lesions (see also Bechara et al., 2000; Cardinal et al., 2002 for discussion).

The above observations about the unique role of the OMPFC in emotional memory are confirmed by the findings of the present thesis. Namely, confabulating patients with lesions of the OMPFC, showed emotional biases in tests of emotional memory (Chapters 4 and 5), while patients with lesions to other prefrontal areas (e.g. dorsolateral prefrontal cortex), did not show such a bias, nor did amnesic patients with lesions to other parts of the limbic system, e.g. the hippocampus. These findings may represent a dissociation between emotion-based learning (which is thought to be in most part implicit) and explicit episodic memory, as traditionally associated with hippocampal structures and related circuits (e.g. Squire, 1992; Tulving, 1985). The long history of this claim dates back to the classic report of Claparede (Claparede, 1911) and involves multiple reports of intact emotion-based learning in people with amnesia (for reviews see Eichenbaum & Cohen, 2001; Turnbull et al., 2005b). However, before proceeding to the relation of these emotional learning mechanisms to confabulation, it is necessary to examine the role of the basal forebrain in amnesia and confabulation.

### 8.3.3 The Functional Role of the Basal Forebrain

Amnesia has been traditionally associated with damage to temporal or diencephalic structures (Squire, 1992; Tulving, 1985). Other brain regions intimately involved in the long-term processing of episodic information are situated in the basal forebrain (septal nuclei, diagonal band of Broca and the nucleus basalis of the substantia innominata) (Alexander & Freedman, 1984; Damasio et al., 1985; Vilkki, 1985; Phillips et al., 1987; Irele et al., 1992; Morris et al., 1992; von Cramon et al., 1993; Beeckmans et al., 1998; Hashimoto et al., 2000; Schnider et al., 2000; Fujii et al., 2002). A memory-related role for these areas is plausible in light of the cholinergic cell density in the septal region, but

activation or blockage of intraseptal GABA receptors has also been proven sufficient to disrupt working or episodic memory processes (see von Cramon et al., 1993; Thiel et al., 2002, for discussions; see also Chapter 1). Generally, the neurochemical effects of acetylcholine upon neurons of the cerebral cortex are associated with motivational valence, attentional tone, and memory (for a review, see Mesulam, 2000). These effects become obvious following damage to the basal forebrain regions, as often found in Korsakoff's patients and in Alzheimer's disease. However, these neurological diseases show involvement of other cortical and subcortical areas, and thus do not often allow insight into the specific role of these areas in memory and in confabulation (see Chapters 1 and 2). More discrete lesions are found in ACoA patients and tumor patients, but several methodological difficulties related to these pathologies also prevent accurate lesion localisation (see Chapters 1 and 2). More generally, the specification of the role of cholinergic pathways of the basal forebrain in long-term memory, and their contribution to the functional role of the OMPFC, awaits further investigation.

In the monkey, single unit recordings show that neurons of these regions are sensitive to the motivational significance of sensory stimuli, i.e., when the animal is hungry, these neurons alter their activity only when a remembered 'favourite' food is detected (Rolls, 2002). More generally, the neurochemical effects of the ascending cholinergic pathway from the basal forebrain are in position to enhance the immediate neural impact and long-term memorability of motivationally relevant events (Mesulam 2000). Although further research of these functions in humans is required, these findings suggest a functional link between the OMPFC and the basal forebrain. Specifically, both functions seem to have a role in emotion-based learning and in the association of sensory events with their rewarding value.

Of particular interest for the present thesis, are the investigations of emotional learning in Korsakoff patients and in patients with isolated lesions to the basal forebrain. For example, Markowitch and colleagues (1984) showed that alcoholic Korsakoff patients showed increased memory recognition for material of personal and positive emotional significance. Interestingly, in studying the performance of alcoholic Korsakoff patients in cognitive estimation and affective judgment, Brand and colleagues (2003) found that Korsakoff patients showed a

marked tendency to mis-judge the emotional significance of single neutral or negative words as positive. Similar emotional biases have been observed in a few patients with isolated basal forebrain lesions (Babinski et al., 1997; von Cramon et al., 1993; Zeman & King, 1958). These patients tended to “avoid negatively affecting stimuli” (von Cramon et al., 1993, p. 1175) and to remember better experiences of great emotional and personal significance.

Taken together, these findings suggest that these patients show a positive bias in their memories, which could relate to the bias observed in the confabulating patients of the present thesis. However, although confabulation is highly prominent in Korsakoff patients and amnesic patients with basal forebrain damage, the presence of the above emotional biases in conjunction with the presence of confabulation in these patients has never been addressed by these or subsequent studies on this type of patients. By contrast, the relation between emotion and spontaneous false memories, as produced by confabulating patients, was studied in the present thesis. The cognitive and emotional mechanisms by which such biases are created are discussed below.

## **8.4 The Deficits of Confabulation and their Loyal Attendants: Emotions**

### 8.4.1 The Deficit of Temporality: The Role of *Past* Emotions & Rewards

A recurrent hypothesis in the literature is that confabulation is caused by an impaired sense of temporality and chronology (see Chapter 1). The findings of Chapter 4 showed that confabulating patients were more likely than amnesic non-confabulating patients to misrecognise past events as currently relevant. Thus, these findings could be directly interpreted according to the neurocognitive models that postulate that disrupted temporality is the primary source of confabulations (Schnider et al., 1996; Dalla Barba, 2001). The ‘deficit’ model put forward by Schnider and colleagues (1996; see Schnider, 2003 for review) was used as a working hypothesis. This group has argued that confabulating patients have a deficit in adjusting their current thinking to on-going reality, due to their inability to identify the correct temporal context of memories. In more recent

versions of this theory, confabulation was conceptualised as impairment in the deactivation or suppression of irrelevant thoughts and memories (Schnider, 2001).

However, the present experimental findings suggested an extension of this model. More specifically, the present findings showed that confabulating patients were more likely to misrecognise as currently relevant, positive rather than negative memories (Chapter 4). This positive bias was consistent with the positive bias observed in the context of spontaneous confabulations (Chapter 3). Taken together, these findings suggest that confabulating patients have greater difficulty in de-activating memories with a positive emotional value, rather than memories with a negative emotional value. In other words, confabulating patients face difficulties in de-activating memories that are no longer associated with positive emotions. Therefore this finding suggests that in confabulating patients the memory traces that were previously associated with positive values are the ones less likely to be inhibited. In Myslobodsky and Hicks' (1994) terms, confabulations are "memories that want to get themselves recalled" (p. 225).

Interestingly, the brain networks that Schnider and colleagues (et al., 2002; Schnider, 2003) have associated with the production of confabulation, i.e. the anterior limbic system, are traditionally linked with the control and regulation of emotion (see above). Schnider and colleagues have indeed acknowledged the association of the anterior limbic system lesions observed in confabulation patients with the 'reward system'. For example, Schnider et al, (2002) cited animal studies which showed that monkeys failed to suppress their previous responses to cues that were no longer *rewarded*, and postulated 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" (p. 60). However, Schnider and colleagues (1996; Schnider, 2003; Schnider, 2004) have repeatedly argued against motivational hypotheses in confabulation. Nevertheless, their arguments and experiments have only targeted the 'gap-filling hypothesis' and the 'suggestibility hypothesis' (see Chapter 1). They have not addressed the potential emotional biases observed in the content of confabulation (Conway & Tacchi, 1996; Fotopoulou et al., 2004; Turnbull et al., 2004a).

By contrast, the present findings suggest that indeed the two functions, i.e. de-activating irrelevant memories and monitoring affective outcomes, may represent two sides of the same phenomenon. More specifically, whilst Schnider's model can account for the failure of confabulating patients to de-activate irrelevant memories, their theory cannot explain which irrelevant memories become candidates for activation in the first place. The results of the present experimental investigations reveal that the past memories that are most likely to be falsely activated as currently relevant memories, are the ones that have been previously associated with positive emotions. Thus, as Fotopoulou and colleagues (2004) have argued, Schnider's model of confabulation could be extended to include instances of motivated confabulation, which are not elicited by the model's 'neutral' experimental procedure. In everyday-life circumstances, there is an endless number of memory traces available for recollection. Confabulating patients are no longer able to select between these memory traces based on current reality criteria, i.e. select the memories that could effectively guide their interaction with their current environment. Instead, they seem to permanently rely on the memories that generated positive outcomes in the past, irrespective of whether these still generate the same outcomes or not. This provides support for the hypothesis that confabulation is associated with both cognitive dysfunction and motivational factors. Moreover, this view is consistent with the literature on the functional role of the OMPFC, which suggests that this area of the prefrontal cortex is involved in the inhibition of previously rewarded responses (see above).

Indeed, this deficit could be seen as the equivalent of cognitive and behavioural impulsivity in the memory domain. In a recent paper, Moscovitch and Winocur's (2002) considered both Schnider's proposal (see above) and the recent evidence on the role of the OMPFC in marking stimuli and representations with their expected positive emotional consequences, i.e. 'feelings of rightness' (Elliot et al., 2000). They claimed that from the point of view of memory retrieval, felt-rightness is an intuitive, rapid endorsement or rejection of memories according to the goals of the memory task. In their terms, cognitive impulsivity in the memory domain is "manifested as the absence of a mechanism for felt-rightness, which leads to the hasty acceptance of any strong, recovered memory as appropriate to the goals of the memory task, even if it is not" (p. 202). Although at first sight these authors seem to take into account the role of emotional processes in memory

retrieval, their position ultimately 'de-emotionalises' the described processes. More specifically, their position implies that feelings of rightness relate to the goals of the task, i.e. the 'reward' of appropriate recollection itself, irrespective of any reward generated from the recollection of one memory over another. In this aspect, their view approximates Schnider's proposal. According to both views, emotions have only a minor 'reality monitoring' role in retrieval.

However, both the above studies on the functional role of the OMPFC, as well as the results of the present thesis on confabulation, suggest that reward values have a more salient role in memory retrieval. Specifically, they show that the mental associations that are 'strong' (in Moscovitch and Winocur's terms, see above) candidates for recollection, are the ones previously associated with reward or other positive values. Familiarity and 'feelings of rightness' are mere subcomponents of these more pervasive motivational mechanisms (see also Elliot et al., 2000). In summary, Moscovitch and Winocur's above position could be paraphrased as follows: "Cognitive impulsivity' in the memory domain, is manifested as the absence of a mechanism for felt-rightness. This leads to the hasty acceptance of *any memory or thought that is associated with positive emotional (rewarding) value*, as appropriate to the goals of the memory task, even if it is not".

#### 8.4.2 The Deficit of Inhibition: The Role of *Current* Emotions and Fantasies

The confabulating patients studied in this thesis produced a number of fabrications during the assessment period. Moreover, as the experimental findings of Chapter 4 highlighted, confabulating patients were significantly more likely than amnesic controls, to misrecognise events that had actually never taken place (i.e. their fears or wishes for the future), as events currently relevant in their lives. Although such statements had been thought of and expressed by the patients before (e.g. during the first phase of the experiment), they were never experienced as real life events, i.e. they were merely 'mental events', thoughts or fantasies. Thus, the material upon which confabulations are built may go beyond experienced memories and personal facts to thoughts, fantasies and potentially other mental constructs and representations, e.g. dreams.



This view is consistent with previous descriptions of confusion between dreams, fantasies, thoughts and memories in confabulation (see Chapter 1). On the contrary, these findings are not in accordance with temporality hypotheses (see above), which suggest that confabulation can always be traced to actual past events experienced by the patient (see Chapter 1). However, these findings are in accordance with other ‘deficit’ models of confabulation, which have postulated that a defective sense of temporality or chronology is not the primary cause of confabulation. In the latter models, it is itself seen as a symptom of a more fundamental retrieval deficit (e.g. Burgess & Shallice, 1996; Kopelman, 1999; Moscovitch, 1989; see also Chapter 1). However, given the focus of these models on cognitive factors, they are not sufficient to address another aspect of the present findings. Namely, the present data also showed that patients’ pleasant fantasies about the future, rather than their unpleasant future fantasies (Chapter 4), were more often misrecognised as memories. Thus, these results provide further support for the hypothesis that the content of confabulation is motivated.

Specifically, these findings suggest that it is not only past positive memories that are not easily inhibited by confabulating patients. Instead, representations associated with current goals, fantasies, needs and potentially somatic drives may also be falsely activated and accepted as true memories (see also Conway & Tacchi, 1996; Solms, 2000). For example, RM’s frequent false beliefs that his mother had just called the ward to speak to him (see Appendix A3), were caused by his inner wish to speak to his mother. The latter did call the ward on some specific evenings, but never during the day. However, RM formed the belief that he was on the phone, as soon as he heard the telephone ring and sometimes even in the absence of a ringing sound. Given the pressuring motivational character of the need, the corresponding ‘rewarding’ representation was selected over other candidate thoughts and memories, irrespective of its low pertinence to reality. Interestingly, RM repeatedly expressed this belief throughout the duration of the study, despite the numerous disappointments that followed his discoveries that his mother was not on the phone (see Chapter 6 for similar examples from patient LH). In Solms’s terms, the patient “displayed a pervasive tendency to misperceive external reality on the basis of his internal (and usually wishful) schemata” (Kaplan-Solms & Solms, 2000, p. 208).

This view is in accordance with more recent studies that have highlighted the role of the OMPFC in the unlearning (extinction) of arbitrary and temporarily associations between neutral stimuli and rewarding outcomes (e.g. Rolls, 2000; see also above). In the case of confabulating patients, this lack of inhibition of reward-associated representations is revealed in the domain of memory, and particularly in memory retrieval. It is thus worth highlighting that the impairment of memory inhibition and selectivity described above, and the associated wishful confabulatory processes, may be particularly vulnerable to the specific arousal state required by a 'retrieval mode' (Tulving, 1985; see also Conway & Pleydell-Pearce, 2000). This mental state necessitates a redirection of attention from the environment to one's self, i.e. a direction of attention from behaviour, perception and action to thought, memory and bodily sensation, (autonomic and proprioceptive afferences).

Interestingly, recent studies have put forward evidence regarding the role of the OMPFC, and potentially the basal forebrain, in mediating a background arousal state, which could relate to the neurocognitive state of retrieval mode. More specifically, they have proposed that the OMPFC has a unique role in maintaining a default, restful, yet alert, baseline homeostatic state of brain activity that functions as a dynamic between exteroceptive and interoceptive deployment of attention (e.g. Raichle et al., 2001; Nagai et al., 2004). It is thus possible that the inability of confabulating patients to inhibit irrelevant representations of reward, may relate to the level of arousal required to successfully direct one's attention from external stimuli to internal somatic markers. This is also supported by other neuroimaging investigations that have associated the activation of the OMPFC and the basal forebrain with retrieval mode states (Duzel et al., 1999; Lepege et al., 2000). However, further confirmatory studies are necessary before valid claims about the relation between confabulation, arousal and retrieval mode can be put forward.

In summary, the above discussion suggests that in confabulation motivational mechanisms interact with cognitive deficits in the production of the symptom. Specifically, confabulating patients have an impairment in selectively activating the memories, or other mental representations that pertain to the goals of the present task (Schnider et al., 2002; see also Moscovitch & Winocur, 2002).

Instead, they activate memories and other mental representations that achieved goal attenuation in the past or that are associated with current emotions and drives. Thus, components of irrelevant experiences, thoughts or fantasies can influence confabulatory content. This leads to both temporal misplacements of events, as well as content distortions and fabrications of never experienced events. This deficit is seen as the equivalent of cognitive and behavioural impulsivity in the memory domain. Other non-amnesic patients with lesions at the OMPFC show behavioural impulsiveness and inability to delay and filter gratification-seeking options and choices, even in the light of disadvantageous environmental conditions. Similarly, confabulating patients with lesions to the OMPFC and potentially the basal forebrain, show retrieval impulsiveness and the inability to delay and filter gratification-seeking memories and representation choices, despite counter reality indications. This view, describes how a particular cognitive deficit can alter the dynamic relation between cognition and emotion. In turn, this alteration can highlight certain motivational influences, which pre-existed in implicit form, but were moderated through selective inhibition.

#### 8.4.3 The Deficit of 'Controlled' Retrieval: The Role of Past Selves

The motivational mechanisms, described above as operating in confabulation, interact with cognitive deficits at a pre-retrieval level. This was proposed by Schnider and colleagues, who showed that suppression of presently irrelevant memory traces seems to be realised prior to the conscious stage of retrieval, through transient inhibition of synchronized neocortical activity (Schnider, Valenza, Morand, & Michel, 2002), instigated by the orbitofrontal cortex through frontal-subcortical loops (Treyer, Buck & Schnider, 2003; see Schnider, 2003 for a review). This is also consistent with recent studies on the OMPFC, which show that these regions modulate implicit, rather than explicit, forms of emotional memory (Bechara et al., 2000; Turnbull et al., 2005b; see also above).

However, the cognitive deficits associated with confabulation are not limited to this early pre-retrieval stage. Instead, impairment in a number of more thorough selection, check and monitoring processes (Burgess & Shallice, 1996; Moscovitch & Melo, 1997; Schacter et al., 1998), as well as relevant attribution processes (Johnson et al., 2000) are implicated in the production of confabulation.

These more thorough, cognitive checks of memory plausibility and accuracy most likely follow the early, rapid (intuitive and implicit) decision to accept or, reject an item as true, particularly under conditions of uncertainty or when the initial response is incompatible with other knowledge or memories (Moscovitch & Winocur, 2002). The present thesis (see Chapters 5, 6 and 7) revealed that in confabulation, emotions and self-values have a strong influence on the faulty outcome of these later retrieval stages, as they did on the earlier stages. The findings of these studies are presented below.

The experimental investigations of Chapter 5 revealed that although confabulating patients were able to recall emotionally salient (positive and negative) narrative information similarly to emotionally neutral information, they did show selective biases when recalling emotional narratives in self-referent conditions. Specifically, they showed a difficulty in recalling the negative valence of self-referent narratives. They instead distorted the information in a way that portrayed positive information about themselves. It thus appeared that these patients are particularly prone to memory errors in conditions that involve the recall of information relevant to their own self-representation. Moreover, these errors, i.e. distortions of content and emotional valence, seem to serve one specific function; namely, sustaining a positive self-representation.

The above findings are further supported by the description of a confabulating patient with bilateral damage to the OMPFC (Chapter 6). LH's confabulations portrayed a self-representation which predominately relied on premorbid values of self-esteem and self-regard, e.g. professional competence. Thus, the content of his confabulations were dominated by positive character traits and praised achievements of his previous life. The latter were also present in his accurate memories, but to a lesser degree, and balanced by a greater number of negative self-representations. In addition, in his confabulatory narratives, LH alluded to his postmorbid condition, mostly his hospitalisation, but provided fantastic and different reasons for his hospital admission, which shared only one common characteristic: they portrayed a non-impaired image of himself. Moreover, the description of his current self-representation was highly influenced by his premorbid self-regard, even in the light of obviously conflicting current circumstances. For example, in describing his failures on current memory tasks,

LH often referred to his laziness. He justified his performance by explaining he has always felt superior to others intellectually and therefore was bored during such exercises. Moreover, he was sure he would triumph in the end, despite the results, as he had always done in his academic and professional life in the past. These descriptions exemplify how patients continue to rely on premonitory achievements and self-values in interpreting their current interaction with the environment, despite counter-indications.

## **8.5 Confabulation and the Self in Memory**

### 8.5.1 Confabulation and the Self-Memory System

The above findings suggest that self-values and self-goals have a determining influence on the construction of memories during retrieval. This interdependence of self-goals and memory retrieval processes has been particularly emphasised by Conway's model of autobiographical memory (Conway, 2001; Conway et al., 2004, see also Chapter 1). More specifically, the Self-Memory System (SMS) suggests an intimate and reciprocal relation between one's current self-goals (the 'working self') and the retrieval of one's past. In several other similar models of retrieval (Burgess and Shallice, 1996; Moscovitch, 1989), as well as in alternative theories of episodic retrieval (e.g. Tulving, 1985; Wheeler, Stuss & Tulving, 1997), the intentional and organised access to one's memories is mediated by executive functions. In the SMS these functions indeed operate in the service of one's past, i.e. they assist the access to memories, they pursue their specificity and monitor their accuracy. However, in this model executive functions also operate in the service of one's present, i.e. one's current self-representation and its associated self-goals and values. More specifically, the working self guides and filters the availability of memories to consciousness in ways that are consistent and congruent with the current goals of the individual (see Chapter 1).

Based on this model, Conway and colleagues (Conway and Tacchi, 1996; Conway & Fthenaki, 2000) have conceptualised confabulation as a disconnection between the goals of the working self and the autobiographical knowledge base. When this relation is disrupted, as in the case of damage to the prefrontal cortex,

the working self is no longer fully constrained, or guided by the autobiographical memory base, which is inaccessible. Thus, as the 'self' becomes partly disconnected from the knowledge base, the formation of autobiographical memories is heavily shaped by unconstrained self-goals ('wishes'). As a consequence, the degree of involvement in memory construction of the wished-for-self (ungrounded goals and plans) is disproportionately larger than that of the "actual" self (Conway & Pleydell-Pearce, 2000). For example, the frontal patient OP, reported by Conway & Tacchi (1996), persistently narrated a set of plausible, self-related but confabulated memories. These rewrote her previous disappointments in familial interactions into a history of successful and supportive intimacy with family members.

Fotopoulou and colleagues (2004) also employed the SMS to account for the positive emotional bias observed in their confabulating patient ES. They stressed how the patient's memories were formed, based on the emotional consequences of particular thoughts or memory components, so that the patient was more likely to affirm thoughts or memories that had positive affective consequences. Crucially, this study also stressed the dynamic relation between the cognitive impairments observed in ES, and the positive aspects of his confabulation, i.e. their pleasant content. Following the surgical intervention for the removal of a recurrent meningioma in the pituitary and suprasellar region, ES suffered damage to areas usually associated with confabulation, such as the basal forebrain and surrounding regions. As a consequence, his autobiographical memory recall was contaminated by clouding and temporal confusion (see also Baddeley & Wilson, 1986), and he was unable to voluntarily select, monitor and verify the thoughts and memories that reached his consciousness (see also Burgess & Shallice, 1996; Moscovitch, 1989). However, ES's knowledge of his habits, personal values and his self-regard appeared unaffected by the brain damage. Thus, given his inability to reach optimal retrieval accuracy and control by using generative retrieval processes, these goals and premorbid self-representations, i.e. the unconstrained working self, appeared to dominate his retrieval efforts. Ultimately, these self-values coloured ES's attempts to recollect his past and thus led to wishful confabulations.

The positive bias observed in the confabulations of the patients assessed in the present thesis could be interpreted in a similar way. Confabulating patients with bilateral prefrontal lesions depicted themselves in their confabulations in more positive ways than the corresponding reality suggested. Moreover, they presented severe memory impairment and executive dysfunction. Thus, it is assumed that their working self was compromised by frontal damage, as well as by its lack of grounding in the autobiographical memory base, which was now compromised and partly inaccessible. Therefore, their false recollections were guided by an unconstrained and dysfunctional working self. As a consequence, representations pertaining to current or past goals were activated. Conversely, currently relevant memories were distorted if they failed to confirm the goals and expectations of the working self. Hence, although confabulations were in conflict with reality, they were in accordance with patients' goals and emotions. In brief, confabulations were motivated.

Thus, the present thesis shows that the autobiographical memory of confabulating patients functions under the 'totalitarian' influence (Greenwald, 1980) and conservative control of a premorbid self-representation, and past or current self-goals and wishes. These influences are so exaggerated, that incongruent information deriving from reality, e.g. the negative self-related stories of the present experiment (Chapter 5), are '*confabulated away*', i.e. distorted in content and valence to the point that they become congruent with the patients' premorbid or wished-for self-representation.

#### 8.5.2 Goals, Emotions and Autobiographical Memory Distortion

These conceptualisations are supported by a plethora of studies on autobiographical memory, which have demonstrated the interdependence of memory and current self-goals (for reviews see Conway & Pleydell-Pearce; McAdams, 2001; Walker, Skowronski, & Thompson, 2003; Wilson & Ross, 2003). Given the centrality of this aspect to the present thesis, these studies will be briefly discussed below.

In recent decades, a wide-range of naturalistic and lab-based investigations has focused on how specific goals and emotions may influence autobiographical memory (for reviews see Conway & Pleydell-Pearce, 2000; McAdams, 2001;

Pillemer, 2001; Singer & Salovey, 1993; Stein, Wade & Liwag, 1999; Walker, Skowronski & Thompson, 2003; Woike, Gershkovich, Piorkowski & Polo, 1999). A common notion underlying these studies is that the current self-representation, with its associated traits, goals and emotional predispositions, influences the recollection of the past (Bartlett, 1932; Fischhoff & Beyth, 1975; Greenwald, 1980; Hastorf & Cantril, 1952; Ross, 1989). For example, Barclay (1996) described the primary function of autobiographical memory as being to assist individuals to maintain self-coherence and continuity in time. This function may be so important that memories may be altered, distorted or inhibited in order for central components of the self-representation to remain unaltered.

Furthermore, Wilson and Ross (2003), emphasise that people selectively remember the past, or even distort it, in order to serve motives of both self-consistency (Conway & Ross, 1984; Ross, 1989) and self-enhancement. For instance, people tend to re-appraise memories of their remote past in a negative way, in order to form the belief that they have improved over time. This reconstruction serves the motive of current self-improvement and self-esteem enhancement (see also Greenwald, 1980; Walker et al., 2003). Emotions and goals are also especially salient in the construction of what Singer and Salovey (1993) named 'self-defining memories', Pillemer (1998) termed 'personal event memories' and McAdams called 'life stories'. These memories serve fundamental processes of personal and social identity formation and thus their recollection is influenced by goals of self-regard and self-consistency (see also Bluck & Habermas, 2001; Fivush, 1998; Neisser, 1988; Pasupathi, 2003). Taken together, the above studies highlight the interdependence of self-goals and autobiographical memory.

### 8.5.3 Goals, Emotions and False Episodic Memories

Similar observations have been made in cognitive psychology with respect to the production of false episodic memories in neurologically healthy individuals. Specifically, several studies have showed that memory for self-relevant information is superior to memory for 'objective', i.e. not self-related information (see Czienskowski, 1997; Gillihan & Farah, 2005; Symons & Johnson, 1997 for reviews). Whilst there is disagreement on whether the self is a unique structure that requires specialised processing or whether it is just one of the efficient ways



of structuring, representing and elaborating information (see Gillihan & Farah, 2005 for discussion; see also Chapter 5), there is consensus regarding the uniquely effective function of the 'self' in encoding information, maintaining it in memory and retrieving it. Specifically, it results in spontaneous, efficient processing of material that is often well organised and exceptionally well elaborated (Symons & Johnson, 1997). Most crucially for the present thesis, this strong self-referent effect has a trade-off in cases of memory distortion. In other words, while self-reference increases memory accuracy, it also increases the possibility of memory distortion. For example, Johnson and colleagues (1996) found that affective self-focus improved the recognition performance of neurologically healthy individuals. However, they observed that self-focus also increased source memory errors, as it reduced attention to the sensory and semantic properties of the stimuli. These authors concluded that false memories and distortions are more likely in conditions of self-focused attention.

Thus, relying on well-developed structuring framework, such as the self-representation, may facilitate one's memory. Nevertheless, it can also distort it in the process of shaping it according to the expectations and characteristics of one's self-representation. This is particularly true in confabulating patients, whose executive and memory deficits constitute the adaptation of their self-representation to a highly problematic and changing reality. Johnson and colleagues (1991; Johnson et al., 1997; 2000) have not directly addressed the issue of motivation in confabulation (although see Johnson, 2000 for a discussion). Nevertheless, emotions and self-related goals have a central role in their reality monitoring framework (Johnson, 2001; Johnson & Multhaup, 1992). Recently, they have found that available schemas, motives, goals and emotions influence the development of false memories (Johnson, 1999; Johnson & Sherman, 1990; Mather, Johnson & De Leonardis, 1999). In discussing these findings, Johnson (2000) has suggested that there is no reason to assume that such influences would become inoperative following brain damage. Instead, she postulated that there is a possibility that these factors are exaggerated in cases of frontal damage and particularly in confabulating patients. It is precisely this point that was revealed in recent single-case studies on motivational confabulation (Conway & Tacchi, 1996; Fotopoulou et al., 2004) and further specified in the thesis's findings.

8.5.4 Premorbid Personality and Confabulation: The Role of the 'Long-term Self'

The findings of the thesis suggest that self-related emotions, drives, and schemas have a determining influence on confabulatory content. Furthermore, given that emotions and goals (the working self) guide the retrieval of information from the knowledge base across various hierarchical levels of emotional and memory organisation (Conway & Pleydell-Pearce, 2000), the dysfunction of the working self may influence confabulatory content at different levels. More specifically, the formation of memories by the working self-knowledge base interaction can range from single representations elicited by simple somatic drives, to personal memory narratives unfolding under the influences of goals relating to different life-time periods and self-defining events. Some of the simplest emotional influences on memory retrieval were examined at previous sections. At this point, the most organised and abstract levels of one's self-representation are considered. These could be described as the 'long-term self', a term introduced recently by Conway and colleagues (Conway, Singer & Tagini, 2004), to describe those aspects of the self-representation, which exert a more permanent influence on one's self-regard.

This notion was based on previous models of personality and other models of autobiographical memory (e.g. Kihlstrom & Hastie, 1997; Neisser, 1988). More specifically, self-representation is organised around a number of self-defining memories, as well as non-temporally specific self-related knowledge, i.e. personal semantic and trait information. These are progressive schematisations of acquired self-related knowledge and experience that determine the understanding of the on-going interaction of individuals with their environment. Thus, during these interactions, the above long-term aspects of self-representation provide a framework of fast, effective and meaningful appreciation of the present in the light of the past. On certain occasions, this function may even lead to the distortion of recent or current experience in the process of fitting to past values and schemas ('principle of memory conservatism'). Conversely, each new experience has the potential of influencing these abstract and more permanent records of self-representation, so that newly observed aspects of the world and the self can be accommodated in a more stable self-representation ('principle of memory adaptation'). The balance between these two principles is mediated by

the working self, based on the objective of achieving optimal goal attainment in the necessary interaction with the physical and social environment.

The results of the present thesis suggest that the content of confabulations maybe further influenced by patients' most enduring psychological characteristics, namely their personality traits. This was suggested by the two single case-studies reported, in that patients' premorbid personality traits were exaggerated and the appreciation of their current reality was filtered, in accordance with these characteristics. For example, in LH's case, the construction of autobiographical confabulations was potentially influenced by his previous strategies of coping with stressful and perplexing situations. For instance, in order to deal with stressful circumstances premorbidly, LH would typically employ avoidance strategies and engage in distractive activities, such as excessive preoccupation with work and leisure activities. Interestingly, although due to his hospitalisation, LH was unable to employ these strategies he appeared to experience himself as actively involved in professional activities. Further, during brief minutes of awareness, he acknowledged that he found it easier to talk about work than face his problems. More generally, the findings of the present experiments suggest that in confabulation, given the working self's dysfunction, goal attainment in memory is attempted without an appropriate consideration of reality-constraints. In this equation, the principle of conservatism, i.e. the maintenance of schematised self-representation irrespective of reality changes, can reach pathological levels. In other words, reality may be distorted or even totally ignored in the face of long-term past self-characteristics and values.

Indeed, the patients' premorbid personality has been proposed as one of the aetiological factors of confabulation (see Chapter 1). The present thesis revealed that suggestibility, i.e. a tendency to adjust one's memory responses according to external feedback and suggestion, did not have a primary causative role in confabulation. However, it might have contributed to the production of several secondary *ad hoc* confabulations aimed to provide support or, an explanation of original confabulations (see Chapters 6 and 7). By contrast, other critical premorbid personality traits such superficial extraversion, denial or avoidance coping strategies (see above example), neurotism, and sensitive self-esteem were identified in both patients under investigation. Such characteristics

have been associated with confabulation in previous studies (Berlyne, 1972; Conway & Tacchi, 1996; Gainotti, 1975; Johnson, 2000; Weinstein, 1996; Williams & Rupp, 1932). However, it is highly unlikely that personality factors alone can distinguish confabulating from other amnesic or dysexecutive patients. Instead, the production of confabulation appears to be based upon specific neurocognitive deficits. As exemplified in the present thesis, personality factors may merely colour confabulatory content (see Chapters 1, 6 and 7 for discussion). However, it is not possible to draw meaningful generalisations about this factor based on two confabulating patients. A large group study with appropriate controls is required in order to address this issue further.

In summary, confabulation following lesions to the OMPFC and associated areas is conceptualised as the product of a disordered self-representation system. The construction of the autobiographical 'self' is severely disrupted. Patients' memory construction is influenced by implicit premorbid feelings of 'rightness', as well as more complex, abstract and explicit self-representations and self-related goals. Patients seem unable to inhibit such representations and emotions, particularly when the latter had premorbidly been linked with reward or positive values, and when they coloured patients' premorbid identity and self-representation. Moreover, current potential needs for the attenuation of similar goals render these past-associations stronger candidates for recall. Confabulations appear to convey the 'satisfaction' of these emotions, fantasies and longings in the realm of memory, irrespective of physical reality and social constraints. Finally, in an impaired memory retrieval system, it is the rewarding value and self-reference of these memories and representations that induces them to be strong candidates for recollection, and provides them with felt 'credibility' during later retrieval stages of memory monitoring and attribution (see also below).

### **8.6 Confabulation and the Bodily Self**

Confabulation, as discussed above, is a memory disorder. However, confabulation is also linked to other non-memory-related symptoms, such as anosognosia for hemiplegia (see Chapter 1). The relation between the two forms of confabulation (referred to as 'memory-related' and 'motor-related',

respectively) has not been sufficiently considered in the literature (see DeLuca, 2000; Feinberg & Roane, 1997a; see also Chapter 1). In the present thesis, three patients with isolated right-hemisphere lesions and anosognosia for contralesional hemiplegia were assessed. Although this small sample warrants limited generalisation, the differences and similarities observed between the behavioural patterns of the two forms of confabulation were highly revealing, particularly with respect to the organisation of the 'self' and emotional biases in confabulation.

#### 8.6.1 Confabulation and Anosognosia for Hemiplegia

In the present thesis, right hemisphere confabulating patients appeared less confused and disoriented than the bilateral patients. They were also able to coherently represent themselves in time, presenting concrete, organised and specific autobiographical memories, discounting, of course, their marked confabulation about postmorbidity life events. Despite this relatively preserved self-organisation and representation, these patients were found to be *selectively* impaired in self-awareness (anosognosic). Such an 'awareness cleft' normally regarded issues of body and mental integrity (e.g. left-sided hemiplegia) and their direct everyday-living implications (see also Feinberg, 2001; Gainotti, 1975; Ramachandran, 1994; Weinstein & Lyerly, 1968). They behaved as though they were not attending to their deficits and they explicitly denied their disabilities. Instead, they narrated confabulations about their recent past, which included the respective abilities, e.g. walking. However, these patients constantly demanded immediate satisfaction of their needs and the slightest frustration or delay provoked anger and sometimes despair.

Moreover, the wishful, anosognosic, confabulations were not the only, and in fact, not even the main type of confabulatory behaviour observed in these patients. The majority of their confabulations were negative in valence, often 'paranoid' in content, and delusional in form, i.e. persistent, mono-thematic and resistant to correction. These confabulations did not often extend to the remote past. Instead, they focused on recent events (postmorbidity period) and were mostly, but not exclusively, related to the patient's deficits. During these confabulations, which were often intermingled with reduplications of person or space, the self-image portrayed was very different to the wishful confabulations of the same patients or of the patients with bilateral lesions discussed above. Indeed, in

'paranoid' confabulations the self was mainly represented as passive, dependent, ill or disabled, and at the mercy of others' hostility or indifference. These negative self-representations and their corresponding emotions were interpreted as implicit forms of awareness of deficit, in that they conveyed the emotions and self-representations associated with the deficits of these patients. Moreover, they appeared against the background of a relatively intact autobiographical memory and thus they represented strikingly isolated failures of memory and reality appreciation.

Even more remarkably, as these unpleasant and 'paranoid' confabulations reoccurred they included the same set of erroneous beliefs, with minimal variations. In this respect, these false memories had more common features with delusional memories, than with typical confabulations (see Chapter 1). Although the question of differentiating confabulation and delusional memories requires further investigation, the present findings suggest that delusional memories may differ from confabulations in that they occur on the background of relatively preserved memory and are linked with right-hemisphere lesions. Similar conclusions have been put forward by Feinberg and colleagues in a recent review of the literature on delusional misidentifications and reduplications (Feinberg & Keenan, 2005).

Moreover, although these spontaneous confabulations appeared as negative in valence (see Chapter 3), the present experimental findings suggest that they might share some similarities with the wishful confabulations produced by bilateral patients. More specifically, right-hemisphere patients showed the same bias as bilateral patients in remembering negative self-referent prose narratives in more positive terms (Chapter 5). These findings suggests the motivational mechanisms associated with memory-related confabulation (see above), apply to motor-related confabulation. In other words, motor-related confabulation could also be conceptualised as a disruption in the ability for self-representation in time and an abnormal reliance on past self-values. More specifically, although these patients showed some implicit awareness of their deficits and expressed the corresponding negative emotions, they appeared unable to form the corresponding self-representations. Instead, the significance of these negative emotions was misinterpreted and they were misattributed to external sources. Thus, similarly to

the bilateral patients studied, the self-representation of right-hemisphere patients remained attached to premorbid values and abilities. The experienced negative and perhaps intuitive feelings (see above) were *externalised* from patients' self-image and identity (for examples see Chapter 7). Thus, although at first sight these patients produced negative self-representations in their confabulations (e.g. my brother is in hospital because he had a stroke), these representations in fact replaced worse self-related scenarios (e.g. I am in hospital because I had a stroke).

Finally, during these confabulations, these patients appeared largely confused and their self-representation was significantly disorganised. Indeed, the presence of such confabulations in right hemisphere patients was empirically observed in association with a severe disintegration and splitting of 'self-' and 'other-' representations in the construction of personal narratives (see Chapter 7). In this sense, the self-representation of these patients appeared fragmented. On the one hand, they conveyed anosognosic and wishful self-representations, e.g., "I can walk, I am able", which were built upon premorbid self-values. On the other hand, they described extremely negative representations of self-degradation, perceived as caused by others, e.g. "All this is their fault, they hate me".

Similar reports of cognitive misattributions of emotional experiences have been reported before in both transient and chronic anosognosic patients and have been interpreted as partial, implicit and misinterpreted knowledge of deficits (Feinberg & Roane, 1997a; Kaplan-Solms & Solms, 2000; Marcel et al., 2004; Ramachandran, 1995; Turnbull et al., 2002; Turnbull et al., 2004b; Venneri & Shanks, 2004). Most relevantly for the present thesis, Solms (1999) proposed a specific link between anosognosia and feelings of loss following perisylvian lesions of the RH. He attributed the abnormal processing of loss in these patients to deficits in spatial cognition, and specifically the spatial representation of self-other separateness. More specifically, based on a series of RH patients (Kaplan-Solms and Solms, 2000), and from a psychodynamic tradition, Solms proposed that the profound anosognosia results from a consequent inability to cognitively and emotionally engage in a normal 'mourning' process, i.e. the ability to normally accept their deficits and their associated personal losses as their own. He also described how these patients exhibit complex patterns of 'splitting' (uncoupling), 'projection' (externalisation) and 'introjection' (internalisation) of

negative feelings and representations, in the absence of the ability to attribute them to their own self-representation (see also Bentall, 2003; Marcel et al., 2004; Ramachandran, 1995).

Solms stresses the implicit awareness of deficits observed in such patients, in that they show general irritability despite their selective anosognosia or anosodiaphoria, and occasional emotional outbursts. This psychological inability to process and self-attribute negative emotions is seen as a direct consequence of brain damage (spatial cognition deficit) and not as a purely psychological and compensatory mechanism, as previous psychodynamic models suggested (e.g. Weinstein & Kahn, 1955). Interestingly, in a recent paper Venneri and colleagues (2000) presented two cases of Alzheimer's disease, who denied the deaths of their spouses and instead developed a chronic severely delusional reaction to their bereavement. Neuroimaging investigation revealed a significant reduction of cerebral blood flow in the right frontal area.

In this sense, the false memories and beliefs described above are not caused by psychogenic compensatory (defense) mechanisms. Instead, they are neurological equivalents of such mechanisms, tied to specific neural and cognitive dysfunctions. Furthermore, it is precisely because they are caused by specific neurological damage that their investigation can be informative with respect to their neural correlates. In Schacter and Prigatano's (1991) terms: "Because defensive denial has been approached traditionally within a purely psychiatric framework, study of the subset of brain-damage patients who exhibit defensive denial represents an opportunity to develop a neuropsychological approach to this important phenomenon" (p. 259).

However, the exact neural, cognitive (e.g. spatial, motor, mnemonic) and emotional components of the mental ability for high-order self-representation and self-other differentiation are not fully understood. Thus, the above explanations are incomplete. Yet, the cross-disciplinary perspective that the present thesis introduced may serve to point attention towards the counter-intuitive fragmentation of the emotional and cognitive components of self-representation, which can then be targeted by specific neuroimaging or other forms of investigation. For example, with respect to domain-specific awareness and particularly bodily awareness and representation, investigations thus far have



ascribed the RH with a specialised role in imbuing bodily representations with emotional flavour and sense of personhood and thus separating self from non-self representations (Craig et al., 1999; Decety & Sommerville, 2003; Keenan et al., 2001; 2003; Kircher et al., 2001; 2002; Nakamura et al., 2001; Platec et al., 2004; Sugiura, 2000; Vogele et al., 2001). More specifically, the right prefrontal cortex, given its strong limbic connectivity (Tucker et al., 1996), has been described, in a number of lesion and neuroimaging studies as a specific convergence site for most of the neural processes essential to affectively personalise higher order experience of the corporeal self (motor and somatosensory representations) in space and in time (Damasio, 1994; 1999; Devinsky, 2000; Feinberg & Keenan, 2005; Keenan et al., 2003; Levine et al., 1998; Levine, 2004; Northoff & Bermpohl, 2004; Stuss & Alexander, 1999; for a critical review see Gillihan & Farah, 2005). The relation between awareness and confabulation is further discussed below.

In summary, motor-related confabulations differ from memory-related confabulations' on several dimensions. (i) They occur only periodically in the background of a relatively intact autobiographical memory. (ii) They are more specific in content and delusional in form. (iii) Crucially, they are predominately guided by negative emotions and paranoid thoughts. Although these emotions are associated with patients' impaired self-representations, the latter are explicitly denied by patients. Instead, negative feelings and unpleasant self-representations are attributed to others' actions or attitudes. In other words, although in such patients unpleasant feelings are expressed, they are kept at a distance from the self (i.e. externalised). Finally, in at least some of these patients, self-organisation is severely disrupted and split between positive premorbid self-representations and current unpleasant self-images.

#### 8.6.2 Unpleasant Confabulation in Patients with OMPFC Lesions: 8.6.3 Motivational Similarities between Different Confabulatory Forms

Although memory-related confabulation was found to be mostly wishful there was a minimal occurrence of negative emotions and apparently unpleasant confabulations in these patients (see also Fotopoulou et al., 2004). Such instances may represent a link between the mechanisms of the two types of confabulation outlined above. More specifically, bilateral patients constructed momentary and

contradictory self-representations according to fleeting inner pleasure-seeking states and past self-representations. However, patients may occasionally experience moments of increased insight and gain explicit or implicit awareness of the difference between their 'remembered' and current 'self'. Indeed, fluctuations in awareness and confabulation are frequently reported in the same patient (e.g. Baddeley & Wilson, 1986; Feinberg & Giacino, 1997; Stuss et al., 1978; Talland, 1961). Similarly to the right hemisphere patients this realisation could bring about negative feelings. Patients may also experience negative feelings due to environmental and social obstacles to their intended actions. For instance, they might experience frustration when they are not allowed to leave the ward. However, since these patients are not able to cognitively integrate these feelings in their self-representation, they may attribute them to others and as a consequence construct aggressive and paranoid confabulations.

For example, patients LH, FM, and PT occasionally justified their hospitalisation by claiming that they came to visit some ill relative. Although these confabulations had at first sight negative valence, they may have served the purpose of externalising the awareness of their medical condition away from the self-image. Weinstein, Kahn and Malitz (1956) have also described similar tendencies in cases of memory-related confabulation. In their view, this 'externalisation' of negative emotions and thoughts represents an important adaptive step towards realising one's own impairments. Interestingly, they claim that unpleasant confabulations of this kind occur during the final stages of recovery from confabulation. Finally, as discussed above, this mechanism was observed in motor-related confabulation and is thus common to both confabulatory types. This suggests that although a number of different cognitive deficits characterise the two confabulation types, they may share common motivational mechanisms. However, the similarities and differences observed between bilateral and unilateral confabulating patients in the present small sample, can only be put forward tentatively and call for investigation of these issues in future studies.

### **8.7 Confabulation and Awareness**

More generally, the present investigation of memory and motor-related confabulation can be informative with respect to autobiographical memory awareness, bodily awareness and by implication, self-awareness. Although the complex subject of self-awareness escapes the scope of this thesis, some tentative remarks could be made based on the present investigations. Episodic memory entails auto-noetic awareness (self-knowing), i.e. awareness of oneself in the past (Tulving, 1985). Thus, episodic memory allows one to mentally travel back in time to an earlier experienced event and ‘re-live’ the experience from a subjective point of view. In autobiographical memory, i.e. the subcomponent of episodic memory that concerns events and experiences of one’s life, auto-noetic awareness facilitates the sense of self-continuity in time. In other terms, “the self doing the experiencing now is the same self that did so at an earlier time” (Wheeler et al., 1997, p. 349). Thus, the ability to re-experience the emotions and sensations of the original event plays a central role in establishing normal recollective experience of the past.

Based on recent studies on the role of the OMPFC in affective regulation, it was proposed that the content of confabulation is coloured by the lack of deactivation of internally generated feelings and their corresponding representations. From this theoretical starting point, it is possible to further postulate that these feelings give confabulations and delusions their ‘credibility’ stamp against obvious reality challenges. In other words, it is because the association of previous memories and self-representations with feelings of ‘rightness’ and reward cannot be inhibited and progressively unlearned that these memories are activated and forcefully accepted as true. More specifically, in the present thesis it was shown that confabulating patients failed to inhibit the emotions associated with previous experiences, despite the potential irrelevance of the latter to the present context. Thus, memories or thoughts associated with positive emotions, or congruent with one’s premorbid self-representation acquired privileged access to retrieval. It is thus possible that these same, not updated emotions are responsible for generating feelings of normal recollective experience. In other words, the false memories activated have the emotional quality of experienced memories and gain credibility as such. Thus, in

confabulating patients the ability to recollectively travel back in time appears impaired, in that patients cannot 'free themselves' adequately from the emotions of the present and the successes of the past.

This proposal was supported by the present findings. More specifically, in motor-related confabulation (patient AO, Chapter 7) the recollective experience accompanying confabulations was comparable, in quality, to that accompanying accurate autobiographical memories. Moreover, the confabulatory protocols of bilateral patient LH revealed that his confabulations included more information about his self-representation and emotions than perceptual or temporal details. This was observed to a much lesser degree in his accurate memories (Chapter 6). Moreover, there are a few previous studies on confabulation that have addressed this issue (Dalla Barba et al., 1997b; Johnson et al., 1997; see also Chapter 7). These studies support the present findings. Most strikingly, as early as 1915, Moll in his systematic clinical study on confabulation observed that his patients recalled their confabulations better than real memories and he thought this related to the strong emotional quality guiding the fabrication of memories. However, the investigation of this issue in the present thesis was experimentally targeted in only one patient (see Chapter 7) and thus these conclusions are tentative. The issue of recollective experience in confabulation awaits further experimental investigation.

The above discussion of memory awareness is also relevant to the more general concept of self-awareness (Stuss, 1991) and thus to the symptom of anosognosia of deficit (see Chapter 1). Following the above conclusions on memory-awareness, one can further postulate that in confabulating patients, anosognosia or anosodiaphoria for current deficits represents a phenomenon complementary to motivated confabulation. More specifically, confabulating patients were unaware of their current impaired 'selves' because their self-awareness was attached to the emotional values and qualities of their past and intact self-representation. These observations are consistent with the clinical descriptions of the two presented case-studies (Chapters 6 and 7). Both patients relied on their premorbid cognitive and health conditions when answering questions about their current cognitive and medical state. Moreover, this proposal may explain why such patients seem so indifferent towards their deficits, even in moments when they 'intellectually' acknowledge their impotence. Conversely,

even when they are overwhelmed by the corresponding negative emotions of disability and dependence, they attribute such emotions to different non self-related sources. In brief, their self-representation has become permanently associated with positive emotions. Thus negative emotions are externalised to other sources and intellectual knowledge of deficits is treated with emotional indifference.

Interestingly, this thesis showed that confabulation and its associated anosognosia were confined to issues relating to the 'somatic self' in right-hemisphere patients, while they more generally affected the 'autobiographical self' in patients with bilateral lesions. These observations reveal how different deficits, i.e. the neurocognitive basis of body-representation and the neurocognitive basis of self-representation in time respectively, can both cause alterations in the dynamic relation between cognition and motivation. However, it should be emphasised that the neurophysiological, neuroanatomical and psychological basis of memory, bodily-, and more generally, self-awareness are complex issues that escape the scope of this thesis. The above postulations represent mere working hypotheses for further studies with confabulating patients and beyond.

In more general terms, the present thesis on confabulation exemplifies how the functional dominance of the prefrontal cortex, through inhibitory control, can modulate, rather than replace, more fundamental cognitive and emotional processes undertaken by phylogenetically and ontogenetically older structures (e.g. mesencephalic regions) (Jackson, 1879). In doing so, the prefrontal cortex creates the necessary conditions of cognitive and emotional flexibility, so that the more automatic sensory, motor and motivational patterns of functioning can be more effectively directed towards the attainment of long-term goals (see Shallice, 1988; Tucker et al., 2000 for discussions). The specific contribution of this thesis to this general topic is to address the inhibitory functions of the OMPFC on memory. The functions of the OMPFC are less understood than the ones of the lateral prefrontal cortex. More specifically, the lack of motor and cognitive inhibition following lesions to the lateral prefrontal cortex is known to disrupt the appropriate psychological distance from the environment and lead to stimulus-bound cognition, utilisation behaviour, perseveration and over-reliance on

environmental cues (e.g. Mesulam, 2000; Stuss et al., 2002). Similarly, lesions to the OMPFC may cause lack of emotional and cognitive inhibition and disrupt the appropriate psychological distance from intrapsychic processes. This would lead to an excessive reliance on intrapsychic information and signals, even in cases where these are in conflict with external reality. As a consequence, the individual would be at the mercy of pressing emotions and intuitions. In the present thesis, it was argued that this is the fate of confabulating patients. Namely, their autobiographical memory, and as a consequence, their self-awareness, are profoundly disrupted, by yielding to internal sensations, emotions and goals, and largely 'ignoring' the need to update these emotional signals according to ever-changing reality constraints.

## Chapter 9 : Conclusions and Implications

### 9.1 Conclusions

The main aim of the present thesis was to address the role of motivation in neurological confabulation. This aim was portioned out to a number of empirical questions as presented in the Introduction (Chapter 1). Based on the findings of the thesis the following conclusions can be drawn:

1. *Direct damage or functional disconnection, involving the ventromedial and orbitofrontal cortices, is implicated in confabulation.* This hypothesis was tentatively confirmed by the present thesis, but it requires further specification.
2. *Severe memory impairment commonly, but not necessarily, accompanies confabulation. However, it is not sufficient for its occurrence.* More specifically, memory-related confabulation was found to be accompanied by a varied pattern of memory impairment, most likely involving the damage of anterior limbic areas, such as the septal nuclei and other basal forebrain nuclei. In motor-related confabulation memory impairment was selective and most likely secondary to other body-representation impairments.
3. *Executive dysfunction is a common, but variable component of confabulatory syndromes.* Indeed, the present thesis showed that standardised ‘frontal’ tests of cognitive executive functions, although partly informative, were not sufficient to characterise the impairment associated with confabulation. The latter involved mainly the inhibition and control of emotions and emotion-related representations. This finding highlights the need to develop adequate emotion-based tools for the assessment of confabulation.
4. *The content of spontaneous confabulation is wishful, i.e. it shows a positive emotional bias.* This hypothesis was confirmed by the present thesis in the case of memory-related confabulation in bilateral patients. The content of severe

motor-related confabulation in unilateral patients showed a predominance of negative emotions. This finding requires further study.

5. *The content of confabulation shows a positive bias, over and above temporal source confusions.* This hypothesis was assessed only in the case of memory-related confabulation and was confirmed by the present thesis. It was also demonstrated that the content of memory-related confabulation showed a positive bias, over and above reality monitoring errors.
6. *The content of confabulation is self-serving, over and above the memory and executive deficits that might influence memory recall.* This hypothesis was confirmed and it was further argued that this self-serving bias relies on the disruption of the emotional mechanisms responsible for the updating of internal representations and memories according to their consequences in the environment.
7. *Suggestibility* had only a secondary influence on confabulation. This finding requires further study.
8. *Premorbid personality* traits were not causative of confabulation but could have contributed to the colouring of confabulatory content. This finding requires further study.

#### 9.1.1 The Characteristics of Confabulation

Confabulation is also associated with a number of clinical characteristics (see Chapter 1). In the present thesis, a critical literature review and the study of 13 severely confabulating patients suggested a reformulation of some of these characteristics. These conclusions are summarised below based on the framework introduced in Chapter 1, i.e. reformulation of Talland's (1965), Moscovitch's (1989) and Burgess & Shallice's (1996) proposals.



- (a). Confabulation is characterised by variable content coherence and internal consistency, ranging from plausible and coherent narratives to dream-like recollections.
- (b). The falsification range of confabulation includes both content distortions and context displacements.
- (c) The content of confabulation is most commonly based on autobiographical memory sources but can also contain semantic elements; The content includes both distorted and misplaced previous experiences and information, as well as the weaving of thoughts, fantasies, dreams and other internally-generated mental representations.
- (d.) The exact nature of confabulation is determined by the combination of damaged and preserved normal constructive memory processes.
- (e) Patients are typically unable to monitor the inappropriateness, implausibility, or incoherence of their false statements (over and above their falsehood) and when confronted appear perplexed, indifferent or simply confabulate further to support their claims.
- (f) Confabulation is not restricted to intentional gap-filling but the content of confabulation is both motivated and meaningful from the subjective perspective of the patient.
- (g) The role of premorbid personality traits in confabulation is secondary, it may colour the content of confabulations and it may lead to secondary *ad hoc* confabulations .
- (h) Memory-related confabulation may be accompanied by associated actions and other forms of confabulation, such as visual or constructive confabulation.
- (i) All confabulating patients seem to suffer from anosognosia, an unawareness of their memory deficit, or, at best, a profound lack of concern and lack of appreciation of its severity and extent. The more general relation between confabulation and anosognosia awaits further investigation.
- (j) The duration of confabulation varies among patients. Typically the symptom disappears or is reduced in frequency and variety of content following an acute period but chronic states are also described.
- (k) The frequency and thematic range of confabulation varies across and within patients. Typically confabulation is considered ephemeral and multi-thematic. This is particularly true for bilateral patients and patients with generalised brain dysfunction.
- (l). The nature of confabulation is typically as described by (k) and also easily sidetracked by questioning or environmental cues. However, across and within patients, confabulations delusional in character also occur. These may occur more often following right-hemisphere lesions.
- (m). Confabulation is distinct from the similar phenomena observed in acute confusional states.

## **9.2 Wider Implications and Future Directions**

In recent years, confabulation and anosognosia have been typically investigated with the aim of identifying their underlying cognitive deficits. By contrast, this thesis focused on a relatively neglected aspect of such symptoms, namely the emotional features of their content. The present thesis examined the content and emotional quality of confabulation experimentally and revealed that confabulating patients with bilateral lesions to the orbital and ventral prefrontal cortex show a positive and self-enhancing emotional bias in their confabulations. This is conceived as an inability to inhibit irrelevant reward-associated memories, thoughts and self-representations. The present thesis introduced a further empirical dimension to previous findings, namely that confabulatory content following right-hemisphere lesions may take the form of paranoid confabulations and delusional reduplications. Indeed, although these patients did construct wishful confabulations these were a minority in comparison with the aggressive and paranoid themes that dominated their false memories. The latter were based on a non-updated bodily representation, which conflicted with the implicitly experienced negative feelings of dependence and inability.

Thus, these findings suggest that the nature, and the emotional basis of confabulation appears more complex than originally suggested (Fotopoulou et al., 2004), as both pleasant and unpleasant emotions have determining influences on the content of confabulation. Further investigations will be required in order to assess whether bilateral versus unilateral prefrontal cortex damage is necessary and sufficient to explain the differences between these two types of confabulatory behaviour, or whether other factors will also have a determining role on this divergence. These could include differences between chronic and transient states, differences in memory or executive abilities and even premorbid personality factors. However, independently from these differences, the present thesis revealed that the content of confabulation is depended upon common motivational factors.

This conclusion has important consequences for the clinical management and rehabilitation of these patients. This is particularly applicable to chronic cases

like some of the patients assessed in this thesis, who pose great challenges to carers and other health professionals. However, although it is assumed that there are aetiological differences between chronic and transient cases of anosognosia and confabulation (Berti et al., 1996; Cocchini et al., 2002; Gold et al., 1994; Rode et al., 1998; Venneri & Shanks, 2004 for discussion), there is some evidence that suggests that they pose similar obstacles to rehabilitation, and that early intervention and management in these symptoms has great prognostic value (Gialanella & Mattioli, 1992; Jehkonen et al., 2001). In this respect, the study of the positive aspects of these syndromes in both transient and chronic states has great theoretical and clinical implications.

In addition, symptoms, such as confabulation and anosognosia, have wider theoretical importance. Understanding their basis could contribute to understanding one of the fundamental aspects of human nature: self-consciousness. The present investigations addressed the emotional underpinnings of memory consciousness, as they are revealed by their disruption in confabulation. In the past, very little, if any, research has focussed on such emotional factors in confabulation. A reason may be that the importance of the subjective experience of illness, so much favoured in other fields such as psychoanalysis, appeared for decades to fall outside the traditional scope of valid neuroscientific research. Nevertheless, given the recent interest increase in topics such as 'affective neuroscience' (Panksepp, 1998; Lane & Nagel, 2000), the traditional theorising about neurobehavioral problems could be broadened to include emotional influences and the subjective experience of mental disabilities (see Damasio, 1999; LeDoux, 1996; 2000; Tulving, 1985; Lane & Nagel, 2000; Kircher & David, 2003; Panksepp, 2003). Specifically, given the recent emergence of fruitful interdisciplinary fields such as neuropsychiatry and neuropsychanalysis, this thesis has argued in favour of a theoretical and empirical integration between neuroscientific and motivational accounts in the service of a more comprehensive understanding of the vicissitudes of self-awareness and consciousness.

Furthermore, the thesis has methodological implications. Traditionally, experimental paradigms are applied in research as a means of simplifying and controlling the multiple factors that could influence behaviour in 'real' everyday

life situations. However, in functions as complex as autobiographical memory, or executive functions, there is frequently a very weak correspondence between the experimental paradigms used to assess behaviour and the everyday life situations that elicit such behaviours (for discussions see Burgess & Robertson, 2002; Neisser, 1997). Thus, recently a number of studies began to employ experimental paradigms which approximate real-world situations (e.g. Wilson et al., 1996). More specifically, in the study of episodic memory, these efforts have used original autobiographical memories as experimental material (e.g. see Piefke et al., 2003). These studies revealed behavioural dimensions previously ignored by traditional experimental paradigms. The present thesis further applied such methodological considerations to the study of confabulation. These revealed that emotion and motivation have a determining influence on confabulatory content. These aspects were neglected in previous experimental studies that manipulated 'neutral' material. Therefore, the thesis demonstrated that increasing the 'ecological validity' of neuropsychological studies could lead to further insight into the complex cognitive and emotional processes that underlie the behavioural sequelae of neurological damage.

In conclusion, the present thesis represents an initial attempt to empirically address the multifaceted emotional underpinnings of confabulation. In this respect, it aimed to contribute to a significant three-fold scientific aim. First, to cast light upon the neglected affective aspects of neuropsychological symptoms such as confabulation. Second, to employ and further develop established experimental procedures to account for such phenomena, which have been hitherto described only by clinicians. Finally, to allow a fruitful interdisciplinary dialogue between clinicians and laboratory researchers, as well as between psychodynamic and cognitive schools of thought. Despite the obvious benefits of such an approach, one must be aware and be wary of the dense field of complexity uncovered. The present empirical findings could represent an interdisciplinary starting-point, but the cross-disciplinary terms and theories employed to accommodate these findings face, as a consequence, substantial reconstruction. As confabulating patients exemplify, any reconstruction of the past inevitably leads to some degree of distortion and speculative gap-filling. Nevertheless, for as long as the necessary information is not fully available, such a strategy appears to be well-motivated and highly adaptive.

## Appendices

### Appendix A

#### A1. Confabulating Patients: Age Adjusted WAIS-III IQ, Index Scores and WTAR predictions

Patient	Group	VIQ	(VIQ) Predicted	PIQ	(PIQ) Predicted	FSIQ	(FSIQ) Predicted	VC	PO	WM	PS
LH	C1	103	104	91	105	98	105	103	99	106	84
RM	C1	84	84	65*	87	74	84	70	64*	99	68*
OT	C1	71	90	65*	93	66*	91	68*	69*	73	60*
IR	C1	n.a.	73	62*	78	n.a.	73	n.a.	65*	n.a.	66*
BA	C1	79	107	74	108	75	107	78	82	82	68*
SA	C1	91	104	75	104	83	106	98	62*	63*	63*
PT	C1	82	90	n.a.	108	n.a.	106	94	n.a.	84	73
WM	C2	76	92	70	93	71	92	84	82	65*	81
FM	C2	78	80	n.a.	84	n.a.	80	80	65*	73	n.a.
CM	C2	83	91	83	93	81	93	76	91	78	69*
AO	C3	107	94	58*	96	84	94	103	50*	113	n.a.
DO	C3	123	104	62*	104	94	106	134	67*	108	63*
JO	C3	93	91	53*	94	73	92	105	54*	75	57*

*Note.* Group, KC = Korsakoff Confabulation Group, OBC = Other Bilateral Confabulation Group, RC = Right Hemisphere Confabulation Group; VIQ = WAIS-III Verbal IQ Score, (VIQ) Prediction = WTAR and Education level Predicted WAIS-III Verbal IQ Score, PIQ = WAIS-III Performance IQ Score, (PIQ) Prediction = WTAR and Education level Predicted WAIS-III Performance IQ Score; FSIQ = WAIS-III Full Scale IQ; WTAR and Education level Predicted WAIS-III Full Scale IQ Score. VC = WAIS-III Verbal Comprehension Index Score; PO = WAIS-III Perceptual Organisation Index Score, WM = WAIS-III Working Memory Index Score; PS = WAIS-III Processing Speed Index Score. \* = Scores more than 2 SD below the normative mean; n.a. = not assessed or discontinued.

## A2. Confabulation Ratings

Table 1. Confabulation Ratings: Confabulation Group

Patient	Group	Frequency	Plausibility	Novelty	Conviction	Production Mode	Mean	SD
LH	C1	5	4	5	5	5	4.8	0.5
RM	C1	4	4	5	4	5	4.4	0.5
OT	C1	4	4	5	5	5	4.6	0.5
BA	C1	5	5	5	4	5	4.8	0.4
MS	C1	5	4	5	4	4	4.4	0.5
IR	C1	5	5	5	4	5	4.8	0.4
PT	C1	4	4	4	5	5	4.4	0.5
WM	C2	4	5	4	5	3	4.2	0.8
FM	C2	4	3	4	4	3	3.6	0.5
CM	C2	4	5	4	5	4	4.4	0.5
AO	C3	3	4	5	5	5	4.4	0.9
DO	C3	3	5	5	5	5	4.6	0.9
JO	C3	3	5	4	4	4	4	0.7
Mean		4.1	4.9	4.6	4.5	4.5		
SD		0.8	0.7	0.5	0.5	0.8		

Note. Higher scores indicate more severe confabulatory behaviour

Table 2. Confabulation Ratings: Control Groups

Patient	Group	Frequency	Plausibility	Novelty	Conviction	Production Mode	Mean	SD
F1	Frontal	1	1	2	1	1	1.2	0.4
F2	Frontal	1	1	1	1	1	1	0
F3	Frontal	1	1	1	1	1	1	0
F4	Frontal	1	1	1	1	1	1	0
F5	Frontal	1	1	1	1	1	1	0
F6	Frontal	1	1	1	2	1	1.2	0.45
F7	Frontal	1	1	2	1	1	1.2	0.45
Mean		1	1	1.3	1.1	1		
SD		0	0	0.5	0.4	0		
A1	Amnesic	1	1	2	2	1	1.4	0.5
A2	Amnesic	1	1	2	1	1	1.2	0.4
A3	Amnesic	1	1	1	1	1	1	0
Mean		1	1	1.7	1.3	1		
SD		0	0	0.6	0.6	0		

Note. Higher scores indicate more severe confabulatory behaviour

### A3. Brief Case Reports

One typical patient of each confabulation subgroup is briefly presented below to illustrate the neuropathological, neuropsychological and behavioural characteristics of each group.

#### Case Study 1. RM: Confabulation Subgroup: C1

RM was a left-handed 19-year-old man with 11 years of education who worked as a window fitter. He had no previous psychiatric or neurological history. RM had recently moved with his mother from South England to the North-East, following his parents divorce. One week following RM's move to the North, RM was admitted to the hospital following a severe road traffic accident (October 2002). His GCS (Glasgow Coma Scale) on admission was 4/12. He was found to have a traumatic subarachnoid haemorrhage, left frontal and bilateral temporal contusions and his ventricles were compressed and small. He required a bifrontal decompression craniotomy and insertion of EVD five days post-admission following increased intracranial pressure. Subsequent CT scans revealed bi-frontal damage with small contusions in the left frontal lobe and a larger single contusion in the right medial aspect of the frontal lobe. There was extensive low density in left anterior frontal region. Low density was also noted in the right and left temporal regions. Bilateral riding bone flaps were also noted. There was less generalised swelling and the ventricles were now larger.

RM initially presented with residual right-sided weakness and variable confusional state. He made slow but steady progress in respect to his physical state but his confusion and disorientation persisted. He was transferred to a rehabilitation unit in March 2003, where his formal neuropsychological assessment took place in the period May to July 2003. He was found to be physically fully recovered and his confusion had cleared. He was orientated in place and person. His speech, comprehension, writing and reading were normal on bedside tests. However, his profound amnesia and spontaneous confabulation were immediately observable. He also showed clear indication of frontal lobe pathology, in that he had problems in initiating behaviour, planning ahead his activities and monitoring himself. According to his relatives his personality was also affected in that he was irritable, aggressive and argumentative. The involved clinical psychologists confirmed that RM showed emotional lability, irritability, distractibility and impulsivity. He presented with exaggerated mood swings and would often cry without apparent reason, only to become cheerful again after a few seconds. The patient also appeared anosognosic about his condition, in that he believed and supported that he had recovered fully from his accident and that he was "back to my own-self". He claimed that he could work, drive and live independently without any help or care. He insisted his memory was good and kept repeating personal semantic information (e.g. he cited his address and the names of his relatives correctly) to "prove his point".

*Neuropsychological Assessment.* Formal neuropsychological testing confirmed the above clinical observations. RM's general intellectual function (FSIQ 74) as measured by the WAIS-III was mildly deteriorated from the predicted premorbid level (WTAR FSIQ 74). This was mainly attributable to his low scores on Performance subtests (PIQ 65). By contrast, his verbal intellectual abilities remained intact (VIQ 84). His anterograde memory was severely compromised for both visual and verbal information (WMS-III Auditory and Visual Delayed Index Scores 55 and 68 respectively), while his working memory remained in high levels (Working Memory Index Score 96). His autobiographical memory, as measured by the Autobiographical Memory Interview (adjusted due to the patient's young age) was severely compromised (Total Personal Semantic Information Score = 38 and Total Autobiographical Incidents Score = 5), and RM produced several confabulations during the interview, including fabrications of novel events. For example, when asked to narrate the wedding of his sister, he narrated a lengthily event allegedly following the wedding during which RM protected his sister from her husband who physically abused her. Both his mother and sister confirmed this event was completely unrelated to RM's life and even added that RM had a good relation with

his brother-in-law. His performance on tests of executive functions, as assessed by the D-KEFS (see below for detailed description of this test battery), was severely impaired on most tests administered but he did show average performance in some selective tests and conditions. He showed low scores on the switching conditions of the Trial Making (SS = 2), Color-Word Interference (SS = 1), and Sorting (SS = 1) subtests, and on the perseveration measures of the Verbal Fluency (SS = 1), and Sorting (SS = 1) subtest. His overall performance was also defective on the critical conditions of the Trial Making, Verbal Fluency (both Letter & Category), Sorting, 20 Questions, Word Context, Tower and Proverb subtests. However, his scores were average in the error measure of the Trail Making subtest (SS = 9), the set-loss errors measures of the Verbal Fluency test (SS = 10), the primary contrast (SS = 13) and error measure (SS = 8) of the Design Fluency test, and the inhibition (SS = 10) and inhibition errors (SS = 10) measures of the Color-Word Interference subtest. His performance on the Haying Test (SS = 3) and on the Cognitive Estimates Test (Total Score = 12) were also poor. In summary, RM appeared to have difficulties in switching between mental sets, inductive and deductive thinking, spontaneous and reactive flexibility and he showed perseveration during testing. His abilities to inhibit automatic responses were compromised but to a lesser degree.

*Behavioural Observations.* RM was cooperative during sessions and but his motivation towards testing varied. He showed labile emotion, being often euphoric but very sensitive to poor performance and negative feedback. He was particularly concerned of performing poorly on memory tests and occasionally refused to complete them. He was also hyperactive and very distractible. For example, each time the clinic's phone rang he would interrupt his efforts to complete a task and would say: 'This could be my mother' even though he knew his mother only called him once a day and only the days she would not visit him. RM was also 'hyperactive' in conversation in that he switched from one subject to another in great speed, did not take turns, did not cease speaking or even singing during formal testing and insisted on narrating lengthily and irrelevant to current conversation events of his life. Most of these were confabulations.

RM presented as a very pleasant man but caring staff found his management very challenging mainly due to the content of his confabulations, which typically concerned violent events, and his lack of self-monitoring. RM engagement in rehabilitation activities was also difficult as he was constantly insisting his brain function was normal and he had no memory or other cognitive problem. Typically he confabulated about his alleged abilities and staff found it ineffective to confront him. Relatives described substantial changes in RM's personality in that he had lost initiative, goal-setting abilities and he was very irritable and often verbally abusive.

*Confabulation and Insight.* RM's confabulations involved different events and people from his premorbid life but were also constructed using novel information. Some of the latter appeared to relate to media or arts information that RM had described as part of his personal interests. For example, while on one session he narrated a specific joke that he had heard in a favourite Hollywood movie in the next session he narrated a personal event in which he had made up this particular joke and his parents praised him for his wit. His parents reported such an event never took place. RM's confabulations involved various themes and concerned different life-time periods. He produced them spontaneously and almost constantly during informal conversation but also during formal testing. Despite this variety in RM's confabulations, a great amount of them were remarkably similar in narrative unravelling and shared a common ending of self-enhancement. More specifically, in the alleged events RM and one or more beloved friend or relative were threatened, abused or mistreated by some stranger. However, RM managed to protect himself and the important others by using violence, exhibiting power, speed or 'his father's name'. Less often he simply used his wits to convince others to leave or to apologise. Frequently, the police arrived at the scene but just after RM had taken the situation in his hands and they praised him for his accomplishment. At times the police even apologised because they had initially misunderstood his intentions. Finally, his relatives



explicitly thank him for his protection. Other confabulatory types concerned alleged prizes, honours or competitions RM had won, money his father or a friend gave him, various fights he won but which left him his head scars (in reality caused by his road traffic accident), accomplishments of power or speed he or his father had achieved, the fact that he had a girlfriend that visit him often (untrue), his intact abilities, his parents agreeing not to divorce etc. RM appeared totally convinced of the truthfulness of his recollections and described these false events in confidence and in impressive detail.

He further could not understand why his recollections would upset people and he insisted in trying to convince others that the violence he claimed he had to exercise during these events was completely justifiable. Interestingly, when the rehabilitation team decided to ask RM to cease describing violent scenes this request became integrated in his confabulations. In particular, RM would describe a dangerous situation in which he described the challenged to use violence, the course of action he could have taken, but he didn't! He instead narrated how he managed to overcome the danger by threatening others, by 'grabbing' and 'pushing' them away and by arguing that violence is harmful and he didn't want to be forced to harm anybody. Thus, it appeared that he managed to narrate the violence events he intended to describe but he also complied with hospital rules in that he denied the self-attribution of such events.

*Confabulation Examples.* The examples below illustrate the content and the characteristics of RM's confabulations. RM's parents confirmed that the following descriptions referred to fabricated events:

a) One day I was at home, and I had a mobile, and it was ringing and it was late and I thought ah yes, it's my dad, 'cause he was coming to see me and he was late and I picked it up and went "hello dad I love you" and he went, "hello son, I love you too, do you know the mobile shop on the corner?". "Yeah, you stuck there?" "No, I'm not stuck there, me and a police officer was chasing Fred", the lad who did the murder, that was his name, and I can't remember the second name, but I knew what he looked like. I said to dad, I said "dad, I'll be there in 5 minutes, I'll sprint there". "Will you?" I said "yeah" "will you be knackered?" I said, "don't worry dad", so I just drained the rest of me tab and stuck it out and just ran all he way up, which was one and a half mile away, and then, I said to him, the policeman, "look mate, us 3 split up and see if we can find him", and then I ran into sort of like a school site, 'cause that's where he hangs around, that's where he hung around, and when I saw him he tried to hit me and get away but I sort of rugby tackled him, and the policeman had 3 hand cuffs sets and we had one each. So I got him to hit the floor and funnily enough, he span round, so I knelt on his back, not knelt sorry, I just got hold of his arms, put them close together, put the hand cuffs on them, picked up and put him on my shoulder, opened the police back door, put him in, there you go, and then, I just waited there in case he tried to escape, and then the police... and then the police come, and they said "bloody hell, he was just round corner, he was hiding, bloody hell, did you have to, fight him?, I said, "no, I just rugby tackled him" I said look mate, I was helping the police and if you try to arrest us mate, I'll flip, I will I'll flip". My dad said said "He isn't going to arrest you, you just rugby tackled him". And the policeman said: "Well, you did good because he's got some strength to fight you off, and you put the handcuffs on as well David, well done David. Thank you".

b). Once at school while I was on stage, 'cause er, everyone was, I don't know why, but upset, and I wasn't, I was all good, and I was up on stage, and I said to the head teacher, "can I just, sing a tune?" And she said, "do you know all the words?" I said "yeah" and I sang "Cruella DeVil, Cruella DeVil, if she doesn't scare you then Mrs. Wilson will. Everyone, they were all crying and they were all sat in stitches, they were laughing and laughing and laughing and I went down to Mrs Wilson after I'd finished doing the tune and said, look, Miss, that isn't what I was thinking, I was just making them all laugh. She said, "you did, well done David". And, I got a week off school for no reason which I thought, Yes!

c). I'll tell you, I won a competition, 'cause, it was a competition, and I was walking past where it was. [Where was that? ]. In X [Town that he lived before his parents separated]. 'Cause I was walking to get some tabs, I was walking back with one lit, and then someone said to us, "have you got any strength on you?" I said, " I think I have mate, why?" "Well, can you fit windows?" " What, for a window fitting company?" "Well, can you do it by yourself?" I said "yeah, why?" "Mine are smashed" Do you know what it was? A weight lifting competition... So, I fitted this window, and he said, "do you want to enter my weight lifting competition?" I said, "I'll start with 15 stone, and I did it, I was just lifting it like that, easy, and then, someone lifted up 18, and I did it, and it was, I wasn't struggling, but it was heavy, and then someone else couldn't lift up 20, and I was like this, "Grrrrrrrr", got it up there, I thought, thank God for that, I won.

d). Cause I was in school when I heard that the teacher was writing on the board, so me and me mate was talking while he was writing on the board, and he heard me talking and he suspended us [Relatives confirmed similar events had happened in reality but the following never occurred]. I said, er hold up. I said, hold up, you were just writing on the board and me and him were just talking, while you were writing on the board. Why the hell have you tried to suspend us?

[What did he say?]

He said, right then, we'll go see the head teacher. I said right, go on then, and so I sort of, and he was taking the Mickey and was walking one step every 30 seconds, and so I picked him up, put him on me shoulder, and then, carried him to the head teacher's office, and she said, "why have you got him on your shoulder?" I said, 'cause, he reckons he's going to suspend me. She said "what for?" I said because, sort of like, while he was writing on the board, I was talking. She said, "that doesn't matter" I said, yeah I know, and I said to him, well can I come and see you Miss Wilson and sort it out, and then, he tried to assault me.

[Who tried to assault you?] The teacher [Your head teacher?] Yeah. [Why?] Not the head teacher, the deputy head, Mr. Ferguson. And you know what? Mrs Wilson saw it , and do you know what she did? Sacked him, and she put a complaint in to the teachers community, and he'll never get a job again.

[So why did the teacher, the other teacher try to assault you?]

Because I told them the truth. He's never getting a job as a teacher again.

e). I was in me main house because mum and dad divorced and I'd just got a job so I stayed down south and er, and heard a kickin, someone kicked the front door twelve o'clock at night, so I just looked at my bedroom window because it faced the front door I thought something is wrong and um I said "Who the hell is that?". And it was 10 blokes trying to break into my house. Surprised, they didn't hit me you know, but I wasn't scared. And I said "You'd better go away". "And what you think you're strong?" You know? I don't think stuff like that. But I said "if you threw a brick in the house I am going to smash your face". I mean I wouldn't, it wouldn't have mattered, but that's what I said just to scare them off and then he said "Er, what if I kicked the front door down and take everything?". I said "You think so"? He said "yeah". I said "Just wait and see" and I sprinted down the stairs, really fast, slammed the front door and then just pushed them all back, through them down, I didn't hit them but I've through them all to the ground and I run back to my mum and dad. They said "are you scared? I said "No I'm not scared, but they tried to break into my house. You know". And my dad said "wait I'll help you. And I said "Really dad? Thank you" and we didn't hit them. We just picked them up. I had 4 on me shoulders, so did me dad. And then we just walked them back to the bus station which is a twenty minute walk with them all on my shoulders, head held hands to the back of their head, and then just chucked them off our shoulders and went back to our house you

know, so I've got a scar there. See it there? [RM points to his head scars that he has following his accident].

[You got a scar from that? How did they do that?]

Because elbow... sharp... you know and they just scraped it off the back of my head. Little buggers eh? Didn't feel no pain.

[Really?]

I was just concentrating you know...So, do you know when me mum's coming in then?

### **Case Study 2. FM: Confabulation Subgroup C2 (Korsakoff Patients)**

*Case History:* FM was a 71-year-old South African man with 9 years of education who used to work as a builder. His first language was English. He was right-handed and had no previous psychiatric or neurological history prior to his hospitalisation on November 1985. He was admitted to a local hospital in Cape Town two weeks following a referral for disorientation and restlessness by district surgeons and an apparent history of heavy alcohol consumption. CT scans at the time, as well as repeated CT examinations on November 2003 revealed generalised cerebral and cerebellar atrophy with periventricular white matter disease. No focal lesion was noted. On admission FM presented with marked memory, orientation and executive problems, including irritability, aggressive behaviour and frequent confabulations. In addition, he was totally unaware of his condition and failed to understand the reasons of his hospitalisation. He was unable to give a coherent account of his personal history and showed mild ataxia. He was considered unable to live independently, or manage his finances and shortly after the death of his mother in the following year FM was transferred to a nursing home where he received 24-hour care. He was moved between a psychiatric hospital and several nursing homes in the following 22 years due to financial constraints and changes in health authority policies. His mental state remained stable showing minimum improvement.

FM was assessed in a psychiatric ward in the period February to April 2002. He was very pleasant and cooperative during assessment. Staff characterised him as one of the most joyful and helpful patients in the ward. He presented with mild ataxia and his vision was severely compromised by impairments of non-neurological origin. FM denied such difficulties, was generally euphoric and paid little attention to his appearance or his disabilities. Thus, when asked whether he would like glasses to correct his vision FM denied the need for them. Upon demonstration of his difficulties he acknowledged them momentarily and laughed, only to deny them again after five minutes.

*Neuropsychological Assessment.* FM's verbal intellectual abilities (VIQ = 78) were largely preserved as assessed by the WAIS-III and compared with his WTAR predicted V-IQ of 80. Certain performance tests of the WAIS-III, such as the Digit Symbol Coding subtest, had to be discontinued given FM's impaired vision. However, as indicated by his low index score of Perceptual Organisation (SS = 65) his visual difficulties were also accompanied by deterioration in perceptual organisation. His memory abilities also appeared deteriorated as assessed by the WMS-III. His index scores ranged from 51 on Immediate Memory to 64 on Auditory Delayed with the exception of his Working Memory abilities which appeared intact (Index Score 79). FM's autobiographical memory was also defective as tested by the AMI (see below). He remembered only a few information about his past (Personal Semantic Information Total Score = 18) and these were mainly childhood facts (Personal Semantic Childhood Score = 11). His memory of autobiographical events was equally poor showing lack of specificity (Autobiographical Events Score = 6). The events he remembered were mostly of his young adult life (Score = 4). His performance was also markedly influenced by his tendency to

fabricated events about his personal past. FM was impaired on most tests of executive function administered, although some tasks had to be discontinued due to his visual difficulties. FM produced average repeated errors during the Verbal Fluency subtest (SS = 9) of the D-KEFS but he was very slow in responding and his scores were impaired in letter and category fluency (SS = 2 and SS = 1 respectively). On the Card Sorting Test he scored poorly on description and recognition measures (both SSs = 3), as well as on the repeated errors measure (SS = 4). However, his free sorting attempts were within the low average range (SS = 7). He was impaired in the Word Content Test (SS = 3) and the Proverbs Test (SS = 6). He was also impaired in the Hayling (SS = 1) and Brixton Tests (SS = 1) and on the Cognitive Estimates Test (Total Score = 10) during which he produced bizarre estimations. Interestingly his performance on the BADS Temporal Judgement subtest was within normal range (Profile Score 3). In summary, FM's executive functions of inhibition, flexibility and abstract thinking appeared compromised.

*Behavioural Observations.* FM's behaviour was very appropriate and compliant with hospital routine and regulations. He was in excellent terms with a number of fellow patients and staff members. His mood was constantly positive (HADS results: Anxiety = 0; Depression = 1; consistent with psychiatric evaluation) and he never complained of the difficult conditions of the psychiatric ward although he described himself as not belonging there. At times he appeared as grandiose, as for example when he described how he had invented a method of treating insomnia with water, a method which the doctors he believed still ignored. However, he did not engage in such descriptions unless asked specific questions about himself and he often admitted not knowing or not remembering information that did not concern him personally. His false memories were usually poor in detail and appeared more as factual information about himself rather than detailed events he had experienced (see examples below).

*Confabulation and Insight.* More generally, FM's confabulations seemed crystallised in certain information about himself and these were repeated from session to session with minimal variations. It was as though he had with time created a false self-identity by which he regarded himself and which was embedded in a set of specific false memories. He often emphasised that he was "very happy here" and he was satisfied with his abilities, his health and his current life. He was convinced that he would soon go back to his home-town, where he would move back in to his house and resume his premorbid life as a "a famous photographer". He claimed he was well-known there and had many friends. In fact, FM's behaviour in hospital portrayed an image of a man who was calmly and in confidence waiting to return back to his home from a temporary absence. It appeared as though in FM's mind it was only a matter of spatial dislocation. It did not matter why he was away, or how much time had elapsed since he had been to his home-town (FM actually believed it was only 11 years). He experienced himself as "a famous man", only dislocated. Elsewhere he believed, in his home-town or in his mind one may argue, he was famous, he was popular, he still had a house. In reality, FM never worked as a professional photographer and his house, which he indeed inherited from his mother, was sold 18 years ago in a public auction due to financial restrictions. FM never acknowledged such facts and instead claimed that his former employers were taking care of his financial affairs (no record or account exists of such employment) and his neighbours (FM has not had contact with them since hospitalisation and his previous relationship with them was not close) were looking after the house on his behalf. He even 'recalled' a 'recent' phone call he made to them during which they reassured him his house was in good condition and was being looked after by them. He was also convinced that he had a girlfriend in his home-town who was waiting for him to marry her as soon as his was back. He claimed she was 20 years younger than him and he was 56 years old (he was admitted to the hospital for the first time when he was 53 years old). When showed the documents of his real age he laughed and denied the possibility. In subsequent sessions when he was asked for his age FM insisted he was 56 years old but added that he knew "the doctor doesn't believe it, but the doctor is wrong". Interestingly, he was aware of the death of his mother (one-year post-admission) and gave a relatively accurate description of the events surrounding her death.

*Confabulation Examples.*

(1). [Can you see this]: Yes. [Is your vision from both eyes OK?] Yes. [Can you please read this sentence?] No, Dr. I can't read, I can't see. [Oh, you can't see.]

No I can see. There is nothing wrong with my eyes. [So, why can't you read this sentence then?] I don't know Dr.

(2). Health is a very good thing. I enjoy my health perfectly Dr. I am fine and I am happy. They take good care for me. And the railways [his alleged employee] pay for everything. They pay for everything.

(3) I am a very famous man in X [hometown]. So many pretty woman came to me to be photographed...[laughs].

(4) I feel glad when good things happen, but I also feel glad when bad things happen.

No doctors know it but I discovered it here. It is very important. You can sleep well with water. They do not know. I discovered it.

(5) I'm a famous man. I'm a photographer but I work for the railways.

[Are you really famous?] I'm famous throughout South Africa. I travel to photograph white weddings. I got a lot of money for it. [Really?]. Yeah. I made the pictures myself.

[You made the pictures?] I made them myself.

[Is that why you're famous? Is that what people know you for?] They know me as a photographer. Many of them don't know me as a man who worked on the railway.

[And you did both?] I did both

[So how old were you when you worked on the railways?] ...I wasn't old, 40s or so

[And were you famous already then?] I'm very well known because of the photos. I have lots of photos too

[Where did you develop the photos?] The police gave me a roof. The police, they came almost every day. Know me very well. Because of the photos.

[Why? Did you make photos for the police?] For the police, magistrate, everyone... But this is merely a hobby. I work for the railways

[Do you work now?] No it's gone now

[What was it last time you worked?] Before I came here

[Which was? How long ago?] ...About... about 10 years. I'm 11 years here.

[So tell me again, I want to understand about your profession. What did you do? What made you famous?] The photos? I bought two cameras from a shop in [name of street]... lens, reflex, flash, stand. I had a lot of photos with that camera. I take it myself. Nobody else can do it. If you take a photo to any photographer, not everyone will enlarge the photo. But I can do it. Any photo. That's why the police are very, they like me very much

[And did you manage both your jobs?] Yes. I always have a lot of money on me

[And how did you spend it?] Wisely. Very wisely. I buy a motor car. I had many motor cars in my life. I like motor cars. I fix them. Everything I find, I buy

[You buy everything you can find?] Yes. But I... what I need. I buy it

[And tell me what you did with the motor cars?] I used them to go to work, travel, so on

[How many motor cars did you buy?] Several, many. I can't remember

[And how often did you buy your motor car?] When it's too old I buy another one. I sell that one I buy another one (laughs).

**Case Study 3. DO: Confabulation Subgroup C3 (Right-Hemisphere Patients)**

*Case History:* DO was a 71-year-old woman of British and Austrian origin. She had 13 years of education and worked as a secondary school teacher before her retirement 14 years prior to her hospitalisation. She was right-handed and had no previous psychiatric or neurological history, but she had a history of hypertension and severe arthritis that caused her pain and irritation. She had particularly difficult upbringing, lived in many countries but settled in the UK 30 years ago. DO had three children from her marriage, but became a widow at age 57 and lived independently ever since. Five months prior to her recruitment (winter 2002) she

presented with severe headache and left-sided weakness and was admitted to the hospital where it was confirmed that she suffered a stroke. CT examination on admission revealed right middle cerebral artery territory infarction and acute right middle cerebral artery thrombosis. There was no haemorrhage observed. After spending three weeks in hospital she was transferred to a nursing home in the North East of England, for approximately 2 months and then to a second one further North to be closer to her family. She was tested while resident at this home.

Following her stroke she presented with left hemiplegia and left visuo-spatial neglect. Deterioration in her general cognitive state was noted, mostly showing confusion, disorientation, persistent nightmares and persecutory ideas. The latter included fears of monkeys, rats or other creatures being in her room at night and threatening her life. These were initially interpreted as 'hallucinations' but later on it became apparent that DO never described seeing any of these creatures but instead claimed she 'remembered' these events. Thereafter they were described as confabulations. DO's nightmares disappeared with time (although the possibility remains that her confabulations were based on vivid dreams, Moll, 1915) but her left-sided neglect and hemiplegia persisted, as did her flat mood and confabulation.

*Neuropsychological Assessment.* DO's general intellectual function (FSIQ 94) as measured by the WAIS-III was mildly deteriorated from the predicted premorbid level (WTAR FSIQ 106). This was mainly attributable to her very poor scores on performance subtests (PIQ 62), during which she showed marked visuospatial (she showed neglect in letter and star cancellation tests) and constructional difficulties (she scored poorly, 7.5, on the Copy condition of the Rey Figure Test). Similarly, while her verbal memory remained intact (WMS-III Auditory Delayed Index Score 117), her visual memory was affected (Visual Delayed Index 59). Her autobiographical memory also appeared largely preserved as she scored 51 on Personal Semantic Information and 15 on Autobiographical Incidents. DO produced two distortions during the interview but she did not fabricate any new or bizarre events. Only a selection of subtests of the D-KEFS (see below for detailed description of the test battery) were administered to DO. The BADS test was also used as an alternative. Her overall performance on these tests was mixed. Her BADS profile scores were largely impaired (ranging from 0 to 2) and showed a total standardised score (mean 100, SD 15) of 54, which was clearly within the impaired range. On the contrary, she performed average on the Hayling Test (SS = 13), and on the D-KEFS Word Context (SS = 14) and Proverb (SS = 11) subtests showing intact abilities of inhibition, abstract inductive and deductive thinking. This was confirmed by her intact performance on the Cognitive Estimates Test (Total Score = 1). The last score was somewhat surprising given DO's impaired performance on the Temporal Judgement subtest of the BADS and may reflect a specific inability to judge temporal facts. Her performance was average on the D-KEFS letter fluency subtest (SS = 10) and she overall made only a few set-loss (SS = 10) and repetition errors (SS = 12). However, she was impaired on the category condition of the same test (SS = 4). Her performance was also average on the Abstraction measure of the 20 Questions subtest of the D-KEFS (SS = 10). However, she was more generally impaired on this test (Achievement SS = 2), showing high amount of repeated and 'spatial questions' indicating her tendency to perseverate and to respond in a stimulus-bound manner instead of engaging in high-level categorical clustering.

*Behavioural Observations:* DO was positively orientated towards the assessment but her attitude towards testing and her cooperation, as well as her cognitive alertness, were fluctuating from session to session. Her mood was flat even in sessions that she was more alert and concentrated. She was generally restless and irritable. Staff found her management extremely challenging, particularly as DO was often verbally abusive. DO herself admitted that she constantly required "immediate response and satisfaction" to her needs and requests and she insisted others must do exactly what she told them to. Often however her requests did not represent practical needs, e.g. DO would call carers into her room and ask them to simply touch her feet. She would then tell them to go, only to call them back after 5 minutes to repeat the task. This could go on for hours or until carers refused to assist her. These requests appeared to reflect DO's anxiety and fears that were 'in need' of the reassuring presence of

others, as well as her desire to “control” the situation and “tell people what to do, instead of them ordering her, as though she was a pupil and they were the teacher”. Particularly during the night DO admitted she felt “scared and helpless”, she often confused her dreams with reality and she was in need of others. DO denied feeling low or depressed, but admitted being terrified at times and “misbehaving” (e.g. screaming impatiently) and expressed the wish to improve her irritability and low tolerance. She scored very high in both anxiety (17) and depression (14) on the HADS (borderline scores 8-10) but she appeared able to enjoy previous hobbies and family visits, she showed normal appetite and sleeping circle. Indeed, psychiatric examination one month preceding DO’s recruitment to the study concluded that DO was not depressed.

DO’s relatives described her premorbid personality as pleasant, strong-willed but also very anxious, particularly of her “performance” in certain situations. She was an independent and rather intellectual woman. She was also demanding of others but sociable and open to new experiences. They felt the basic character of DO had not changed but some of her traits, such as anxiety, were exaggerated.

*Confabulation and Insight:* DO’s confabulations mirrored the above observations about her behaviour and mood. They did not dominate her communications, which were generally normal (see confabulation criteria above) but appeared as isolated confabulation instances. They were predominately paranoid in content and negative in valence (see Chapter 3 for an experimental account of this observation). Occasionally she produced wishful false memories that were mostly related to anosognosic statements (e.g. I can walk, I went for a walk to the garden yesterday) and she also showed isolated episodes of reduplicative paramnesia, claiming she is in “her other room”, which is similar to the current one but it is another “further down the corridor”. On some of these occasions she asked the examiner to bring her desired items from this not existing second room, items that she indeed possessed but had currently run out of (e.g. her soothing cream). Despite these occasional pleasant confabulations and delusions the content of the majority of DO’s confabulations was predominately paranoid, included negative feelings, and presented DO as a victim of violent or sadistic acts (see examples below).

DO very rarely confabulated about the remote past; on one isolated instance she claimed a well-known musician appearing on TV was in fact her colleague 20 years ago, teaching English, and she described details of their collaboration. This confabulation was reminiscent of Fregoli delusion (see Feinberg & Roane, 1997b) but was limited to one episode and never reappeared for the duration of the study. Instead, she often made up very elaborated and detailed memories of her recent (postmorbid) everyday life and circumstances. DO produced these false memories spontaneously and upon provocation but she did not fabricate any other information during formal testing. These accounts were quite specific in content (usually involving her mistreatment by staff) and persistent in time (there were variations in each narration but the same narrative themes and characters persisted). For example, DO claimed that a member of the night staff was a Nazi, who threaten to stuff a pillow down her throat and kill her. Staff repeatedly told her that her stroke is responsible for this belief and DO interpreted this as a further conspiracy against her. However, after 2-3 weeks she claimed that he couldn’t have been a Nazi, as he is too young, but she insisted he was the one who told her he had fought for the Nazis, because he is their supporter. She felt she was in danger.

DO was not aware of these memory problems and her awareness about her overall condition was fluctuating. At times she appeared quite unrealistic about the future or did not acknowledge her current deficits. She even occasionally confabulated to support these views (e.g. claimed a doctor told her she was able to walk and see without problems) but more generally appeared aware of her difficulties and her management needs and was actively preoccupied of whether others will provide her with the help she needed. Towards the end of the testing period (7 months from onset) DO appeared to ‘intellectually’ acknowledge she produced false memories but could not manage to apply this insight to the monitoring of her confabulations when these occurred. For example, during that period DO accused a carer of

punishing her neediness by hitting her and by creating bruises to her arms and legs (some of which were indeed visible but were minor bruises DO had from using the hoist). Staff tried to help her see this was a product of her faulty memory but DO insisted the event had taken place, she denied the possibility of the memory being faulty and she refused to fully collaborate with staff unless the carer apologised.

*Confabulation Examples.* DO constructed an array of similar confabulations in which others, usually members of staff, directed violent or verbally abusive behaviour towards her. The following example from an informal interview is typical of the confused, bizarre yet detailed and vivid nature of her confabulations.

[What do you mean when you say you had a 'horrible night'? What happened?] Being locked in the room with one carer, who gave me no water, who did not help me and I felt I am going to die.

[Did this happen or did you dream about it?] No it happened. It was a she. I shouted and screamed and shouted.

[When did that happen?] The night before last.

[Why do you think that carer didn't give you water?] Because she wanted to teach me how to behave.

[What was wrong with your behaviour?] I shouted [DO indeed often shouts at nights].

[Do you remember any more details of the event?] Yes, she used to be my favourite, in the other home, in X [name of town her previous nursing home indeed was, but DO hasn't had contact with members of staff at X since she moved out]. I loved her, she did think old-fashion but ... Then she turned up here and they called her Rachel and she said my name in Mina, short for William mina. Anyway I said so what do I call you here she said: Gremlin. I said alright Gremlin. No, then I called her Gremlin. And then she explained to me that she had took me at her neighbours gathering but I was not amusing her, anyway she came that night, day that there was the nurse, a man. I had pains and they moved my bed about a meter away from the wall where my buzzers where, and my phone and my drink, so later on I shouted I have no buzzer, no water, Gremlin and nurse, help me. And she came in and sat with me and I loved her for it. She said she couldn't move the bed back, because she must punish me and then I felt asleep and I wake up in this cold room ice cold, lying on the bed with a lot of these tiny tubes and I had intense pain and then.. she told me I had to shut up. Anyway...

[Why do you think she asked you to call her Gremlin?] Because she knew she was going to make me very angry, she thought that would annoy me.

[Do you know anybody else called that?] No.

[Why would it annoy you?] Not that annoy me, she thought I wouldn't use it. Anyway, all the people will think I did it on purpose, shouted...anyway it got colder and colder, I was in the draft, all my blankets were gone and the pain was terrible, so I sent her to the nurse that gives out the tablets, she gives out the gel as well and then I started shouting 'nurse', 'nurse' and then my two, the permanent nurse and her husband, whom you've met [true] heard me, they were next door [they never work night shifts] and then they came and rescued me. The nurse had disappeared and I told Gremlin to disappear too. So my two favourite came with me and help me sit up and then we went back into the world.

[So if this did not happen in the world, where did it happen?] It was underground.

[What do you mean underground? Where is this place?] I don't know, just underground.

[Have you ever been there before?] No, first time.

[So, you believe all this happened in reality or...] DO interrupted: I believe it happened for real because now I've got pain in my bottom and I can't stand the woman anymore.

[Have you seen her ever since?] No.



[I have you seen the couple that save you since then?] Yes. They are everyday people. [These carers were indeed on day shifts that week].

[Do they remind you of anybody you knew before?] Yes, my parents. They protected me.

[Do they look like your parents, at all?] No, they were everyday people. They didn't look like anybody.

[How confident are you in the accuracy of your memory?] 100%.

[How would you describe your emotions? Positive, negative or neutral?] Negative, very negative.

[And how intense are these emotions?] Very intense.

## Appendix B

### B1. Confabulation Questionnaire Sample Questions with Corresponding Ratings

Patients' confabulations are presented here by group. In the actual questionnaire these were mixed in random order. The raters were, of course, not informed of the group each person was classified under (e.g. confabulation, control etc).

#### Confabulation Subgroup C1: Confabulating Patients with Bilateral Lesions

##### Patient RM

**Confabulation 2.** *The patient is talking about the region he comes from.*

"Yes, it is very dangerous. But my family is safe. I protect them. I make sure everybody is safe in the house and I just, **I just sit in the house from 9:00 in the morning until 6:00 at night, and then I know nothing going to happen. Once, buglers came but as soon as they saw me they turned and left. They said: Sorry mate. If we knew it was you looking after this house we wouldn't have came. Sorry mate, don't hurt us. I said it is Ok but leave now or I'll have to rugby-tackle you. They left. They were swearing like but they left**".

[The area that the patient lived in the past has had some criminality problems. But he, his family or their property were never in any danger or exposure to criminals].

Is the patient's self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1----2----3----4----5----6----7 Extremely Positive*
- (b) *Impossible to judge*

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 6

**Confabulation 4.** *The discussion continues.*

"Do you know how much he gets paid a month"?

{No.}

**"£6000! And he gives me £1000 each month cause he says I am his son, and a good son.**

What do you think of this"?

[His father exact salary is not known but the patient does not receive £1000 from either of his parents.]

Is the patient's self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1----2----3----4----5----6----7 Extremely Positive*

(b) Impossible to judge

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 7

**Patient BA**

**Confabulation 12. The discussion continues.**

{So, you said you were married? You have a wife?}

“Yeah, I’ve got a wife called Mary”.

[The patient was a widower but re-married recently. His wife’s name is Pauline. His former wife was called Carol]

Is the patient’s self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) Extremely Negative 1---2---3---4---5---6---7 Extremely Positive
- (b) Impossible to judge

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (b) Impossible to judge

**Confabulation 13. The discussion continues.**

{You mentioned your children... are you married?}

“Rumour has it I’m married”.

[Rumour has it?]

“Well, there were some medical complications but we are married”.

{So you remember anything more about this?}

“No, my wife thinks she’s ill all the time”.

[There are no medical complications in his marriage. His wife denied having medical problems. She recently gave birth to their daughter and they are both in good health].

Is the patient’s self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) Extremely Negative 1---2---3---4---5---6---7 Extremely Positive
- (b) Impossible to judge

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 1.5

**Confabulation 14.** *The discussion about the patient's wife continues. Suddenly the patient says:*

"My wife has stupid thoughts. I don't have to have stupid thoughts, other people have them. I can listen to them, **I just don't have anywhere to write it down, so I put it in their head**".

{What do you mean? You tell them their thoughts back?}

"No, I put them in their head. I mean what I say. I open their head and say, here you need some thoughts. Your head is empty. It needs thoughts. I have plenty. Take mine".

[It is unclear what the patient is actually referring to in the above statement. However, it is clear that the events he is describing have not taken place in reality].

Is the patient's self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1---2---3---4---5---6---7 Extremely Positive*
- (b) *Impossible to judge*

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 5

### Confabulation Subgroup C2: Korsakoff Patients

#### Patient WM

**Confabulation 1.** *The patient is accompanied to the consulting room. As he enters the room he says:*

"I've been here before".

{Really, do you remember being here before?}

"**Yes, it was years ago. I had come to see my father. He was ill**".

{And have been here since?}

"No".

[In reality, the patient was an in-patient at this hospital for one week, two months before this session. He had also been an in-patient 4 years prior to that. His father was never in this hospital as an in- or an out-patient].

Is the patient's self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1---2---3---4---5---6---7 Extremely Positive*
- (b) *Impossible to judge*

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 4.5

**Confabulation 2.** *The discussion has shifted to another hospital the patient had visited some years ago.*

“That was years ago. I was in my 30s”.

{In your 30’s?}

“Yes, that must be around 10-15 years ago. Yes, now I am 46”.

*{In reality, the patient is 56 years old.}*

Is the patient’s self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1---2---3---4---5---6---7 Extremely Positive*
- (b) *Impossible to judge*

*Comments* .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 5

**Confabulation 5.** *The discussion continues.*

{So, Tania, whom I just met, is your sister’s daughter?}

“Yes, I have no children”.

*[In reality, the patient has a 15 year-old son]*

Is the patient’s self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1---2---3---4---5---6---7 Extremely Positive*
- (b) *Impossible to judge*

*Comments* .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 2.5

**Confabulation Subgroup C3: Confabulating patients with unilateral lesions**

**Patient AO**

**Confabulation 1.** This patient is resident in a nursing home. She is referring to outings her niece and her husband organise.

“Oh I haven’t been well at all. I hate this place. And my relatives are being so terrible. I don’t know what is the matter with her. She used to be so nice to us. They don’t take us out anymore. I’ve always paid for my meals but...oh I don’t know. **It is more than a month now they have not taken me anywhere.** We used to go every week for lovely meals. Mean while they have their precious holidays”.

[In reality, the patient had been out with her niece for a meal at a local restaurant the Sunday before and once more in the last month.]

Is the patient’s self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1----2----3----4----5----6----7 Extremely Positive*
- (b) *Impossible to judge*

*Comments* .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 3

**Confabulation 2.** *The discussion continues.*

“**I had the stroke in March** and they were up the nail then **they were in Russia and they when in a skiing holiday to the Austrian alps then to Venice** I felt rotten, I am left, they can’t take me anywhere”.

[In reality, the patient had her stroke in February two years ago. The holiday destinations mentioned are correct but her relatives visited them in a different order and within the last two years. Indeed, the patient hasn’t been with them in any of these or other holidays]

Is the patient’s self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1----2----3----4----5----6----7 Extremely Positive*
- (b) *Impossible to judge*

*Comments* .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 3.5

**Confabulation 3.** *The discussion continues.*

“It is all America’s fault, so many people making compensation for next to nothing, two to the lavatory, you know! **I can manage on my own you know** but I usually call because I cannot be bothered with the pads infections, running all the time”.

[In reality, the patient is not able to stand and walk to the toilet due to her left leg and arm paralysis following her stroke. Hence she needs the assistance. She indeed suffers from urinary infections]

Is the patient's self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1----2----3----4----5----6----7 Extremely Positive*
- (b) *Impossible to judge*

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 6

**Confabulation 4.** *The patient continues to refer to her relatives.*

“Ah, and he [her nephew in law] is terrible. I don't know what she [her niece] sees in him. I wonder if he knows.”

[He knows?]

**“You know about the affair. Her and the nurse. The ‘greek’ nurse. She was here the other night. But she was not here to see me. She was here to see her friend, the nurse. And I was here all alone. They closed the door and stayed there for hours. Maybe the whole night, I don't know I felt asleep, in tears”.**

[In reality, the patient's relatives had no close relationships with any of the staff members and they never visited the home after visiting hours].

Is the patient's self-representation in the confabulated situation more positive or more negative in comparison with that of the actual reality?

- (a) *Extremely Negative 1----2----3----4----5----6----7 Extremely Positive*
- (b) *Impossible to judge*

Comments .....

[(1) = Extremely negative; (2) = negative; (3) = somewhat negative; (4) = neither, nor; (5) = somewhat positive; (6) = positive; (7) = Extremely positive]

Rating: (a) Mean Rating = 1.5

## B2. Confabulation Examples Read Out to Control Subjects

- (1) This person's wife is a shop assistant. He is referring to her and says:  
**"She is a nurse. I don't know exactly what type of nurse, but she is a nurse"**.
- (2) This person went to the gym some days ago but the event he narrates never took place.  
**"Fell over at the gym the other day, wasn't looking when someone put their foot out unnecessarily, sort of stupid thing that happens"**.
- (3). This person is in hospital and he is describing the lunch he had that day accompanied by some members of staff. However, only a male carer and a brunette nurse were with him.  
**"Well, there was the blond too. And one of the nursing assistants who's quite good-looking too, that's that I think"**.
- (4) The people mentioned by this person below are real. But the event she narrates never took place.  
**"... When little 'Chappy' was here. He grabbed a piece of bread. He didn't know what he was doing because he was retarded. He grabbed a piece of bread out of the plates that were on the trolley and he shouldn't of done. And the other chap hit him. That was unnecessary. I get upset when people hit each other without reason"**.
- (5) This person's parents have died more than 10 years ago.  
**"Yes, both my parents are [alive]. Yeah. My mother and my father"**.
- (6) This person was once a worker but he had been unemployed for years and he never worked as a photographer.  
**"I am a very important person. And as I told you, I was always happy. Particularly as a photographer"**.
- (7) This person is been seeing by doctors but the events described below never took place.  
"I am all blue, blue and black. I have bruises everywhere. **It was the doctor"**.  
[The doctor?]  
**"Yes. Because- because I was- I was misbehaving all night. And I called him and he came and I said I have a- I had a bandage on my knee. And he said you haven't. And to prove that I hadn't, he ran his hand over my legs and then he used his knuckles to- push and hurt me and to show that I had nothing over my knee"**.
- (8) This person is married but is currently an in-patient at a stroke NHS unit following a stroke.  
**"My wife is waiting for me at home. I'll go there afterwards"**. [You are?] **Yes, its my house. [Oh, you mean you live there}. Yes and I am staying there tonight"**.
- (9). This person is resident at a private full-care nursing home. She pays around £250 a week.  
"I cannot stand this place with its endless rules and regulations. **I pay £132 a week in here. Imagine"**.
- (10) This person's father is a salesman in a high street shop.  
[So, your father is still leaving in that area?]  
"Yes, you know the police Weapons Force?"  
[Weapons Force? No]  
**"Well it's to track down heavy weapons, atomic and stuff. He works there. In fact he is the big big big big boss there"**.



### **B3. Examples of True and False Memories Produced by Healthy Controls**

Subject (1). False Statement: "I hated these dogs. I constantly tortured them".  
[Memory Statement: I grew up with two dogs in the house. I used go everywhere with them].

Subject (2). False Statement: "My husband woke up this morning half an hour earlier so he could prepare me a nice breakfast and bring it to bed. I woke up with the smell of hot coffee".  
[Memory Statement: I woke up with a terrible headache this morning. My husband was already gone.]

Subject (3). False Statement: "I am undecided about my future. It is hard to choose a career these days. I've made mistakes before. I am not sure what to do".  
[Memory Statement: I recently got a new job and at the moment I feel very satisfied with things professionally].

Subject (4). False Statement: "We live in a huge house and I have three kids".  
[Memory Statement: We recently bought a two-bedroom flat. We are very pleased but we would like more space. I would like to buy a house when we'll have kids.]

Subject (5). False Statement: "I was out in Newcastle yesterday for some serious drinking".  
[Memory Statement: I watched a DVD at home last night. It was a good film.]

Subject (6). False Statement: "My mother is in hospital. It was an accident. My father was driving. But it wasn't his fault. The other care was speeding too much. I think mum is going to be OK".  
[Memory Statement: My parents are planning a road-trip in central Europe and they told me to go along].

Subject (7). False Statement: "My youngest daughter changed school last year. She was just too clever in comparison with the other kids".  
[Memory Statement: My youngest daughter received excellent feedback on her school report, again this year. She is in a good school too].

Subject (10). False Statement: "We had an amazing holiday last year. We went to Greece again for two weeks this time and the weather was just perfect".  
[Memory Statement: Last year our holiday in Spain was OK but not as nice as the year before in Greece]

**B4. Examples of True and False Memories Produced by Amnesic Controls**

Subject (1). False Statement: "I was very happy when my son was born"  
[Memory Statement: I have one daughter. I also wanted a son, you know to continue the family line. Like everyone, I guess.]

Subject (2). False Statement: "I can't cook".  
[Memory Statement: I am a qualified chef. I enjoy working.]

Subject (3). False Statement: "I have my own building business. I am independent and I make lots of money".  
[Memory Statement: I worked free-lance once. I really enjoyed that time. But then I didn't like the risk. I worked for others. And then I went to Germany to work].

**B5. Percentages of positive and non-positive confabulatory self-representations**

Group		%	%
		Positive	Non-Positive
Confabulation Group			
C1-Bilateral			
	LH	82.4	17.6
	RM	85.0	15.0
	OT	61.1	38.0
	BA	64.7	35.3
C2-Korsakoff			
	FM	90.0	10.0
	CM	44.0	55.0
	WM	68.4	31.6
C3- Unilateral			
	AO	43.8	56.3
	DO	35.3	64.7
	JO	52.9	47.1
Healthy Controls			
	1.	47.4	52.6
	2.	45.0	55.0
	3.	42.1	57.9
	4.	45.0	55.0
	5.	55.0	45.0
	6.	55.6	44.0
	7.	50.0	50.0
	8.	35.0	65.0
	9.	52.6	47.4
	10.	65.0	35.0
Amnesic Controls			
	A1	45.00	55.00
	A2	52.60	47.40
	A3	36.80	63.20

**B6. Mean valence ratings of confabulatory self-representations across patients.**

Group	N	Valence Rating	
		Mean	SD
<b>Confabulation Group</b>			
<b>C1-Bilateral</b>			
LH	16	5.58	1.54
RM	20	5.73	1.31
OT	18	5.05	1.80
BA	16	5.03	1.64
<b>C2-Korsakoff</b>			
FM	19	5.88	0.98
CM	17	4.50	1.45
WM	19	5.05	1.44
<b>C3- Unilateral</b>			
AO	16	3.8	2.32
DO	17	3.38	2.17
JO	17	4.32	2.00
<b>Healthy Controls</b>			
1.	19	4.65	1.20
2.	20	4.35	1.74
3.	19	4.26	1.49
4.	20	4.45	1.66
5.	20	4.87	1.77
6.	18	4.83	1.80
7.	20	4.62	1.65
8.	20	4.20	1.68
9.	19	4.39	2.12
10.	20	5.02	1.51
<b>Amnesic Controls</b>			
A1	20	4.40	1.69
A2	19	4.60	1.35
A3	19	4.34	1.84

**B7. HADS results of each confabulating patients**

Subgroup	Patient	Depression	Anxiety
C1-Bilateral	LH	10	10
	RM	11	9
	OT	0	6
	BA	4	7
C2-Korsakoff	WM	10	14
	FM	1	0
	CM	0	13
C3- Unilateral	AO	10	10
	DO	14	17
	JO	6	12

## Appendix C

### C1. Memory Prompts

The event or fact could relate to:	
Your house	a meeting/appointment
your children/parents	a discussion
your car/motorbike	a moral dilemma
a night out	a decision you had to make
a party	meeting someone for the first time
an accident	meeting an old friend
your work/study	an emergency
a turning point in your life	shopping experiences
your or somebody else's pet	winning/losing a prize
a picnic/barbeque	being late
holidays you've had	being at the pub
a trip you took	an argument
an experience at the seaside	a moving
to an achievement/failure	a surprise
to a habit you have	a medical condition you or someone else you know had

### C2. Groups' Mean Ratings of Valence, Arousal and Rehearsal Frequency

Time Period	Group	Valence		Arousal		Rehearsal Frequency	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Past	Confabulating (N = 4)	4.5	.9	4	0.4	3.7	.18
	Amnesic (N = 3)	4.8	.5	4.1	0.1	3.9	.22
Present	Confabulating (N = 4)	4.3	.1	3.9	0.2	4	.29
	Amnesic (N = 3)	4.1	.3	3.8	0.4	3.9	.53
Future	Confabulating (N = 4)	4.1	.4	4.2	0.4	3.5	.18
	Amnesic (N = 3)	4.7	.5	4.2	0.1	3.7	.35

### C3. Preliminary Analysis: Characteristics of Self-Selected Memory Statements

**Preliminary Analysis:** (1) Rehearsal, (2) Valence and (3) Arousal Ratings

Two factor mixed ANOVAs with Group (confabulating versus amnesic patients) as the between-group factor and Time (past, present, future) as the within-group factor were performed on the (1) rehearsal, (2) valence and (3) arousal ratings. No significant differences were revealed in (1) rehearsal frequency ratings between the two groups of patients,  $F(1,5) = .2, p = .7$ , or among the three levels of the factor Time,  $F(2,10) = 1.8, p = .2$ , or in the interaction between the factor Time and the between factor Group,  $F(2,10) = .58, p = .6$ . Nor were there any significant differences in (2) valence ratings between the two groups of patients  $F(1,5) = 1.1, p = .3$ , or among the three levels of the factor Time,  $F(2,10) = .9, p = .4$ , or in the interaction between the factor Time and the between factor Group,  $F(2,10) = .05, p = .9$ . Similarly, there were no significant differences in (3) arousal ratings between the two groups,  $F(1,5) = .02, p = .9$ , or among the three levels of the factor Time,  $F(2,10) = 1.5, p = .3$ , or in the interaction between the factor Time and the between factor Group,  $F(2,10) = .03, p = .8$ .

## Appendix D

### D1. Story Plots and their Semantic and Narrative Characteristics

#### Narrative Constituents and Idea Units

1. Setting presentation including temporal information [2] and spatial information [1]. [Total: 3 idea units]
2. Presentation of main agent [2], action [2], and intention (rationale) for action [1]. [Total: 5 idea units]
3. Presentation of complication. [Total: 2 idea units]
4. Presentation of main agent's reaction to complication including emotional reaction [1], action [2], action intention (rationale) [1]. [Total: 4 idea units]
5. Presentation of outcome, including agent's or external (non-agent) action [2] and its rationale [1] and temporal information [2]. [Total: 5 idea units]
6. Presentation of the main agent's emotional reaction to outcome [2]. [Total: 2 idea units].

#### Positive Story Plot 1

##### Self – Reference

Word Count: 88

Semantic Units: 21

[Imagine that] you are an upcoming/ businessman [woman]/. Last/ month/ you've applied for a new job/ in Holland/ and you succeeded. You always wanted to live there/. However, you feel obliged to your current boss/, for at least three more months/. With great disappointment/, you write a polite letter/ and send it to the company/, explaining why you have to decline the offer/. Two weeks later/, they respond/. Deeply appreciative of your loyalty/, they offer you an even better position/ starting in four months time/. You feel highly praised/ and vindicated.

Other – Reference Conversion: E.g. [John Wilson], is an upcoming /businessman/. Last/ month/, he applied ...

#### Positive Story Plot 2

##### Self – Reference

Word Count: 87

Semantic Units: 21

[Imagine that] you are a talented/ architect. It is Friday/ evening/ and you arrive/ home/ eager to tell your family/ that you have won an award/. However, you find nobody waiting for you/ and the house in darkness/. In obvious disappointment/, you go in/ to call your wife [husband]/ and tell her [him] the news on the phone/. One minute later/, the lights are suddenly switched on/ and your whole family congratulates you/. They know you had won the National Architectural Award/ the previous day/. You feel truly loved/ and admired.



Other – Reference Conversion: E.g. [John Wilson] is a talented /architect/. It is Friday evening and he arrives /home....

#### Negative Story Plot 1

Self – Reference

Word Count: 92

Semantic Units: 21

[Imagine that] you are a hard working/ employee/. It is Sunday/ morning/ and you are preparing to go out/. You have planned a wonderful day-trip/ to the seaside/ in order to rest/. However, your best friend calls you saying/ he is ill, lonely and needs your help/. Feeling exhausted/ and not bearing to miss your trip/, you lie to him/ saying that you promised to see your sister/. Four days later/, you find out that/, due to inappropriate treatment/, your friend's health has severely deteriorated/ since Sunday/. You feel guilty/ and ashamed of yourself.

Other – Reference Conversion: E.g. [Patrick Welsh] is a hard working/ employee./It is Sunday morning, he needs rest...

#### Negative Story Plot 2

Self - Reference

Word Count: 85

Semantic Units: 21

[Imagine that] you are a well - qualified/ assistant/. It is Thursday/ morning/ and you have completed a long report/. You burst/ into your boss's office/, wanting to announce the outcome/. However, your boss has asked you/ not to disturb him that morning/. With great embarrassment/, you suddenly remember his request/. You apologise/ for interrupting a board meeting/. The next day/, your boss tells you that you might lose your promotion/ and even be fired/, as you are so absentminded/ lately/. You feel very humiliated/ and scared/.

Other – Reference Conversion: E.g. [Mary Taylor] is a well-qualified/ assistant/. It is Thursday/ morning/ and she bursts/ into her boss's office...

#### Neutral Story Plot 1

Self - Reference

Word Count: 91

Semantic Units: 21

[Imagine that] you are from central/ London/. It is Sunday/ morning/ and you go/ into the kitchen/ to open your newspaper/. You want to read the outcome of a trial/. However, the jury is undecided/ and has not reached a verdict yet/. You don't know whether this has good or bad implications/. You decide it is better/ to wait for further news/ and think of other matters/. The next morning/, the situation remains unaltered/, as both TV and radio say/ they will announce the outcome/ in the afternoon/. You remain interested/ and curious.

Other – Reference Conversion: E.g. [Patrick Welsh] is from central/ London. It is Sunday/ morning/ and he goes/ into the kitchen ....

#### Neutral Story Plot 2

Self – Reference

Word Count: 89

Semantic Units: 21

[Imagine that] you are a married/ middle-aged woman [man]/. It is Saturday/ afternoon/ and you are sitting alone/ by the window/, staring at the garden/, and enjoying your peace/. Suddenly, your daughter knocks your room's door/ and unexpectedly brings you tea/. You tell her/ to leave it on the bedside table/, as you would prefer to serve it yourself/ and besides, you are not sure you are thirsty/. Your daughter agrees/ and immediately/ adds that it might be very hot/, as it was prepared/ only minutes ago. You wait patiently/ and calmly.

*Other – Reference Conversion:* E.g. [Mary Taylor] is a married/ middle aged-woman/. It is Saturday afternoon and she is sitting/ by the window/...

## D2. Ratings of Story Plots Characteristics (Pilot Study).

Story Plots	N	Valence		Arousal		Visualisation		Identification		Compreh.	
		Mean	SD	mean	SD	Mean	SD	mean	SD	Mean	SD
1	20	7.2	.1	7.1	1.0	6.8	1.3	8.2	0.7	8.1	0.6
2	20	7.2	.0	6.7	0.7	7.0	1.4	8.3	0.9	7.8	0.6
3	20	4.2	.9	1.9	1.0	6.8	1.3	8.5	0.6	8.2	0.7
4	20	4.7	.8	1.3	1.2	7.3	1.2	8.7	0.6	7.9	0.7
5	20	2.1	.0	7.5	1.1	7.1	1.5	8.7	0.7	8.3	0.8
6	20	2.2	.9	7.0	1.0	7.2	1.2	8.8	0.4	8.4	0.7

**D3. Secondary Measures: Descriptive statistics across group**

**Table 1. GROUP = Confabulation**

Descriptive Statistics					
Comprehension	N	Minimum	Maximum	Mean	Std. Deviation
Self Positive	12	5.00	7.00	6.08	.79
Self Negative	12	4.00	7.00	6.08	.99
Self Neutral	12	4.00	7.00	5.42	1.31
Other Positive	12	4.00	7.00	5.75	.96
Other Negative	12	4.00	7.00	6.16	1.11
Other Neutral	12	2.00	7.00	5.58	1.44
Identification					
Self Positive	12	4.00	7.00	5.58	1.16
Self Negative	12	4.00	7.00	6.16	.83
Self Neutral	12	2.00	7.00	5.67	1.55
Other Positive	12	4.00	7.00	6.08	1.16
Other Negative	12	4.00	7.00	5.58	1.08
Other Neutral	12	4.00	7.00	5.91	.90
Visualisation					
Self Positive	12	3.00	7.00	5.33	1.55
Self Negative	12	4.00	7.00	6.16	1.02
Self Neutral	12	4.00	7.00	5.66	.98
Other Positive	12	4.00	7.00	6.25	.96
Other Negative	12	2.00	7.00	5.75	1.65
Other Neutral	12	4.00	7.00	6.00	1.12

**Table 2. GROUP = Frontal**

Descriptive Statistics					
Comprehension	N	Minimum	Maximum	Mean	Std. Deviation
Self Positive	7	5.00	7.00	6.42	.78
Self Negative	7	4.00	7.00	5.8	1.06
Self Neutral	7	4.00	7.00	6.14	1.21
Other Positive	7	5.00	7.00	6.28	.75
Other Negative	7	6.00	7.00	6.71	.48
Other Neutral	7	6.00	7.00	6.57	.53
Identification					

Self Positive	7	3.00	7.00	6.00	1.52
Self Negative	7	6.00	7.00	6.71	.48
Self Neutral	7	4.00	7.00	6.00	1.15
Other Positive	7	6.00	7.00	6.71	.48
Other Negative	7	5.00	7.00	6.57	.786
Other Neutral	7	4.00	7.00	5.42	1.13
Visualisation					
Self Positive	7	4.00	7.00	6.57	1.13389
Self Negative	7	4.00	7.00	6.42	1.13389
Self Neutral	7	5.00	7.00	6.42	.78680
Other Positive	7	3.00	7.00	5.71	1.60357
Other Negative	7	5.00	7.00	6.57	.78680
Other Neutral	7	5.00	7.00	6.71	.75593

**Table 3. GROUP = Amnesic**

Descriptive Statistics					
Comprehension	N	Minimum	Maximum	Mean	Std. Deviation
Self Positive	3	5.00	7.00	6.00	1.00
Self Negative	3	4.00	7.00	5.66	1.52
Self Neutral	3	6.00	7.00	6.33	.57
Other Positive	3	4.00	7.00	5.66	1.52
Other Negative	3	6.00	7.00	6.33	.57
Other Neutral	3	5.00	6.00	5.66	.57
Identification	3	6.00	6.00	6.00	.00
Self Positive	3	6.00	7.00	6.33	.57
Self Negative	3	6.00	7.00	6.66	.57
Self Neutral	3	5.00	7.00	6.00	1.00
Other Positive	3	5.00	6.00	5.66	.57
Other Negative	3	6.00	7.00	6.33	.57
Other Neutral	3	5.00	7.00	6.00	1.00
Visualisation	3	4.00	7.00	5.33	1.52
Self Positive	3	6.00	7.00	6.33	.58
Self Negative	3	4.00	7.00	5.66	1.52
Self Neutral	3	4.00	6.00	5.33	1.15
Other Positive	3	5.00	7.00	6.33	1.15
Other Negative	3	5.00	6.00	5.66	.57
Other Neutral	3	6.00	7.00	6.33	.58

**Table 4. GROUP = Healthy Controls**

Descriptive Statistics					
Comprehension	N	Minimum	Maximum	Mean	Std. Deviation
Self Positive	10	3.00	7.00	5.60	1.50
Self Negative	10	4.00	7.00	6.1000	1.10
Self Neutral	10	3.00	7.00	6.0000	1.41
Other Positive	10	4.00	7.00	6.10	1.10
Other Negative	10	3.00	7.00	6.00	1.41
Other Neutral	10	4.00	7.00	6.20	1.03
Identification	10	3.00	7.00	6.30	1.25
Self Positive	10	3.00	7.00	6.00	1.63
Self Negative	10	4.00	7.00	6.00	1.24
Self Neutral	10	4.00	7.00	5.60	1.34
Other Positive	10	3.00	7.00	5.20	1.61
Other Negative	10	4.00	7.00	6.10	.99
Other Neutral	10	1.00	7.00	5.50	2.01
Visualisation	10	4.00	7.00	5.50	1.08
Self Positive	10	4.00	7.00	6.20	1.31
Self Negative	10	4.00	7.00	5.80	1.22
Self Neutral	10	4.00	7.00	5.30	1.25
Other Positive	10	3.00	7.00	5.60	1.42
Other Negative	10	4.00	7.00	6.10	.99
Other Neutral	10	3.00	7.00	5.70	1.49

**D4. Immediate and delayed semantic recall performance by group.**

Reference	Valence	Recall	Confabulating		Amnesic		Frontal		Healthy	
			Mean	SD	Mean	SD	Mean	SD	Mean	SD
Self	Pos	Imm	6.1	3.4	4.5	0.5	11.8	1.9	16.1	1.9
		Del	4.5	5.8	0.3	0.6	10.3	2.8	15.8	3.1
	Neg	Imm	4.4	3.5	6.0	1.7	11.6	3.5	16.5	1.9
		Del	2.7	3.5	0.0	0.0	10.0	3.0	17.0	2.6
	Neutr	Imm	5.7	3.6	6.0	1.8	11.2	2.9	16.5	1.9
		Del	3.5	4.3	3.0	2.6	10.4	2.0	16.2	2.1
Other	Pos	Imm	6.5	4.4	7.7	1.5	11.8	2.1	16.8	2.5
		Del	4.5	4.4	3.0	4.4	9.0	3.2	16.6	2.3
	Neg	Imm	6.3	4.0	5.8	1.5	10.1	4.0	15.4	2.9
		Del	3.3	3.6	1.0	1.7	8.1	3.5	15.2	3.3
	Neutr	Imm	4.8	3.9	2.0	2.2	9.1	2.1	16.2	2.5
		Del	3.2	4.5	0.0	0.0	7.0	3.5	15.7	2.4

Pos = Positive; Neg = Negative; Neutr = Neutral story plots. Imm = Immediate Recall; Del = Delayed Recall

**D5. Laterality Effects on Semantic Recall, Confabulation and Valence Scores in the Confabulation Group**

Reference	Valence	Laterality	N	Semantic Recall		Confabulation		Valence	
				Mean	SD	Mean	SD	Mean	SD
Self	Positive	Unilateral	3	29.3	13.6	2.0	2.0	5.6	1.1
		Bilateral	9	11.9	8.5	6.4	5.1	5.4	1.3
	Negative	Unilateral	3	21.3	16.3	3.3	1.5	3.6	1.5
		Bilateral	9	7.6	5.4	10.7	8.1	4.4	1.2
Neutral	Unilateral	3	26.7	9.0	3.3	3.1	3.7	0.7	
	Bilateral	9	10.6	9.1	7.4	3.7	4.2	1.1	
Other	Positive	Unilateral	3	27.0	11.4	2.0	1.7	6.5	0.5
		Bilateral	9	13.3	13.2	6.4	5.4	4.8	2.4
	Negative	Unilateral	3	22.3	14.0	1.7	1.5	2.1	0.8
		Bilateral	9	13.9	8.7	6.8	6.5	1.9	0.7
	Neutral	Unilateral	3	18.7	14.5	4.0	1.7	3.5	0.2
		Bilateral	9	9.0	10.5	6.6	5.9	4.0	0.8

**D6. Additional Examples of Story Recall Protocols**

<b>Self-Referent &amp; Positive Valence Combination</b>
Plot 1 (see above)
<p><b>Normal Control: N7</b>            Male. Age 57y. Plot 1  <u>Immediate Recall 1:</u> "I'm an up-and-coming businessman who receives a job offer in Holland, the place he always wanted to live. The job is in two weeks time. I send a reply declining the offer... I received a reply with an even better offer for a job to start in four months time".  <u>Immediate Recall 2:</u> "I'm an up-and-coming businessman who receives a job offer in Holland, where I always wanted to work. And I feel deep loyalty to the company I'm with...so I send a letter declining the offer. I received a reply two weeks later and giving me a better offer for a job starting in four months' time...and...I feel really vindicated. That's it".  <u>Delayed Recall:</u> "I am an up-and-coming businessman, I've applied and I've got a job in Holland, somewhere I always wanted to live...The job is to start in two weeks. I decline because of my dedication to the current job. I receive another offer which is to start in four months and praise my dedication. That arrived two weeks later".</p>
<p><b>Frontal Control: F2</b>            Female. Age 55y. Plot 1  <u>Immediate Recall 1:</u> "I get an amazing job offer in Holland, somewhere you really wanted to stay. But...but your present boss wants you to stay. So they offer you a better job in 4 months time".  <u>Immediate Recall 2:</u> "This lady...am...it should be me...I...I had a super job but there was one better job elsewhere but I get obliged to work for another three months for better pay. The position is in Holland by the way. Indeed, I said after I got offered I felt obliged to stay for another three months".  <u>Delayed Recall:</u> "I am a young lady. I apply for a job in Holland, where I wanted to live, in Holland, did I say this? But she felt obliged to this other company for three months. In the end she goes to the new company, it is much better pay and in 4 months time".</p>
<p><b>Amnesic Control: A2</b>            Male. Age 63y. Plot 1  <u>Immediate Recall 1:</u> "Asked if they could do the job in later date. They said yes."  <u>Immediate Recall 2:</u> "The job was starting in three months time...and then something about 4 months time. They said I could start in 4 months time. That is all I remember I am afraid"  <u>Delayed Recall:</u> "Asking for more time to do something".</p>
<p><b>Confabulating Patient: CM</b>            Female. Age 67y. Plot 1  <u>Immediate Recall 1:</u> "Right, there is a firm in Holland and you have applied for a job. Couple of days later you receive another reply saying, offering a bigger position which I was glad about. So I accept it".  <u>Immediate Recall 2:</u> "And um...You contact them and they said they...I was highly surprised because he was offered more in a higher, more consideration of money and she was very obliged. Very... happy about it. Because she didn't expect that. So she did accept their job. That's all I can remember about that... Remember more money offered her that he was happy about. Because money doesn't concern, you can't do anything without but it, not everything...But without money you can't do anything either because you can't buy what you want to buy... But money's the root of all evil".  <u>Delayed Recall:</u> "Well, yes I do remember a story about a business woman but... no not really".</p>
<p><b>Confabulating Patient: LH</b>            Male. Age 60y. Plot 1  <u>Immediate Recall 1:</u> "You've lost your job, circumstances have changed and your employment is been terminated. You are not happy with the idea. You tell them your feelings on it, you tell them that you can do a lot better with more time. Nothing happens and you think you are out on your own. And a fortnight later you get a letter from them pretty happy chappy, you've been promoted in 4 months time. Living one a very happy chappy!"  <u>Immediate Recall 2:</u> "You've got a job working in Holland, 3 months left to run another job, you get a letter from the company saying thanks very much for your employment you've been a happy chappy but... because of the work load the situation will be terminated in 3 months you are a bit... unhappy with this and you write back saying look I hope you are not unhappy with my work ,I've done my job the best for you and all that kind of think, (I am feel as though I am getting somewhere, with a change to job circumstances I feel I can get a good solution of it, this is what I put in from myself because I fancy that bit) (laughs). So if you give me an extension on time I feel I</p>

**Self-Referent & Positive Valence Combination**

can get a good result for you. You get an answer back saying yes, we've been looking through your papers, well they didn't say that but they would have done, ...you've done very well for us up to now and we are offering you a new work situation starting in 4 months time. And as long it is a good, you know a well-established company, you'd be drafted not to accept it".

Delayed Recall: "I think I am getting through a story from the last time I saw you. Aiai, the guy got a letter working in Holland, saying that ...his temporary contract had three months left on it, then it was going to be terminated, he was a bit upset with this so he wrote a exteeemely nice letter back saying, {he met with this wonderful lady who did these surveys, that is true you know (laughs)}. Ok, so he says if I had a time extension he could do a significantly better job, nothing after a couple of weeks he thought that's it, is blown, I am out of my lawn. He gets a letter back, thank you so much for your letter it is really appreciated the concern you are showing about our company, leave it for 4 months and will give you another job but increased in importance and salary".

**Confabulating Patient: OT**

Male. Age 40y. Plot

Immediate Recall 1: "A firm in Holland is looking for new recruits. They ask me to go and work for them. I can't understand why they asked me though".

Immediate Recall 2: "I've been there for the meeting. I need to get in touch with them. A firm I had applied for a job. I got it but then what happened? Since I applied for the job is the first time I had communication with them".

Delayed Recall: "I have no recall what so ever"



## Appendix E

## E1. Levels of Awareness Test (LAT). Patient's Interview

Awareness Domains	Awareness Questions	Patient's Task
1. General Condition	<ul style="list-style-type: none"> <li>Why are you in hospital?</li> <li>Has your brain being injured?</li> <li>What is your main concern about your mental or physical state after your injury?</li> <li>Are you any different now compared to what you were before your injury? (physically, cognitively, emotionally, behaviourally, socially)</li> <li>Do you face any problems in everyday living, thinking, coping with different situations and people?</li> <li>Do people who know you well notice anything different about you since your injury? What?</li> </ul>	
2. Physical Difficulties	<p>Can you walk? Can you stand? Do you have good vision? For both sides of the space around you?</p> <p>Do you have difficulties moving your legs? Can you move both arms normally? Do you get fatigued (tired) easily?</p>	<p>Walking Standing Describing objects in room</p> <p>Lifting of both legs Lifting of both arms Responding to example of previous fatigue complain read out by examiner</p>
3. Language and Communication	<p>Can you speak normally? Can you understand what others say to you, even if it is complicated? Can you find the words you are thinking of? Do you have difficulty reading? Do you have difficulty writing? Do you tend to take others comments literally?</p>	<p>Expressing opinion about the day's weather Narrating the gist of long sentence read by the examiner Naming of 5 objects in the room Reading of a short newspaper article Writing a sentence Interpret the proverb: 'People who leave in glass houses shouldn't throw stones'</p>
4. Memory	<p>Can you still remember important events of your life? Can you learn new information?</p> <p>Can you remember historical information as well as before? Do you sometimes remember things that have not actually happened? Do you sometimes confuse the order of events or, do you sometimes mix different events between them? Do you ever confuse your memory with dreams?</p>	<p>Remembering first day at work or wedding day Learning 3 new words and retaining in memory for more than 10 minutes What was the D-day? Who is the Minister of foreign affairs? Responding to a confabulation example read out by examiner Responding to memory error example read out by examiner Responding to dream-memory confusion read out by the examiner</p>
5. Executive Functions	<p>Do you have trouble thinking clearly?</p> <p>Do you have difficulties in concentrating?</p> <p>Can you plan ahead your activities? Can you stop repeating doing or saying things once started? Can you do more than one task at a time? Do you say or do in front of others things you know are inappropriate?</p>	<p>Solving this: 'You have 21 pounds and you want to put in your wallet exactly double the amount of money you put in your pocket. How will you divide your money?'</p> <p>Deducting 6 from 100, until examiner tells you to stop. Planning the activities of the next day Verbal Fluency task (FAS)</p> <p>Drawing a flower while counting backwards. Responding to example of last inappropriate behaviour read out by examiner</p>
6. Emotions & Personality	<p>Can you show positive emotions?</p> <p>Can you show negative emotions?</p>	<p>Describing your reaction during the last good news you've had, or imitating how you would react to news of winning the lottery Describing your reaction during the bad good</p>

Awareness Domains	Awareness Questions	Patient's Task
	Has your personality changed in any way? Can you control your behaviour/temper? Do you still enjoy your favourite activities? Is your motivation the same as before?	news you've had, or imitating how you would react to news of a relative dying Responding to personality changes reported by relatives and read by examiner Responding to example of outburst read by examiner Describing recently enjoyed activities Describing current goals and plans
<b>7. Every Day Living Implications</b>	Are you able to live independently? Are you able to manage your finances on your own? Can you drive? Can you work/study? Can you dress yourself? Can you bath yourself?	Describing abilities necessary to manage independent living or respond to counter examples the examiner gives Performing additions and subtractions, retaining the results in memory Describing abilities necessary to drive or respond to counter examples the examiner gives Describing abilities necessary to be employed/study or respond to counter examples the examiner gives Putting on a jacket. Demonstrating washing hands
<b>8. Future Anticipation</b>	<ul style="list-style-type: none"> <li>• In 6 months time where do you think you will be? What will be doing?</li> <li>• Do you think your injury will still have an effect on you in 6 months time?</li> <li>• What do you hope to achieve in six months?</li> <li>• How would you go about changing it?</li> <li>• Do you think you will manage?</li> </ul>	
Levels of Awareness Manipulation: Administration to Domains 2-7		
<b>Patient's Answer</b>	<b>Questions</b>	
<i>The problem is identified. The patient is further asked:</i>	<ol style="list-style-type: none"> <li>1. Could you give me an example of a task you couldn't do? (prompted with examples if necessary).</li> <li>2. How did you feel about it?</li> <li>3. What did you do to solve the problem?</li> <li>4. What else could you have done to compensate for it?</li> </ol>	
<i>The problem is not acknowledged. The patient is further asked:</i>	<ol style="list-style-type: none"> <li>1. Could you please perform [a task – see above] now...</li> <li>2. How did you do?</li> <li>3. Based on this performance do you think you can do this task as well as before?</li> <li>4. Do you think you would manage if you had to do [the above task] again?</li> </ol>	

## E2. LH's Detailed Big Five Scores & Factors Description

This report (Johnson, 1998) estimates LH's level on each of the five broad personality domains of the Five-Factor Model. The description of each one of the five broad domains is followed by a more detailed description of personality according to the six subdomains that comprise each domain. The numerical scores reported and graphed as *percentile estimates*. For example, a score of "60" means that the level on that trait is estimated to be higher than 60% of persons of the same sex and age.

### LH's Premorbid Personality - Rated by his Relatives

#### Extraversion

Extraversion is marked by pronounced engagement with the external world. Extraverts enjoy being with people, are full of energy, and often experience positive emotions. They tend to be enthusiastic, action-oriented, individuals who are likely to say "Yes!" or "Let's go!" to opportunities for excitement. In groups they like to talk, assert themselves, and draw attention to themselves.

Introverts lack the exuberance, energy, and activity levels of extraverts. They tend to be quiet, low-key, deliberate, and disengaged from the social world. Their lack of social involvement should not be interpreted as shyness or depression; the introvert simply needs less stimulation than an extravert and prefers to be alone. The independence and reserve of the introvert is sometimes mistaken as unfriendliness or arrogance. In reality, an introvert who scores high on the agreeableness dimension will not seek others out but will be quite pleasant when approached.

Domain/Facet.....	Score	0	10	20	30	40	50	60	70	80	90	99
EXTRAVERSION.....	87	*****										
..Friendliness.....	95	*****										
..Gregariousness.....	99	*****										
..Assertiveness.....	58	*****										
..Activity Level.....	41	*****										
..Excitement-Seeking.....	61	*****										
..Cheerfulness.....	81	*****										

#### Agreeableness

Agreeableness reflects individual differences in concern with cooperation and social harmony. Agreeable individuals value getting along with others. They are therefore considerate, friendly, generous, helpful, and willing to compromise their interests with others'. Agreeable people also have an optimistic view of human nature. They believe people are basically honest, decent, and trustworthy.

Disagreeable individuals place self-interest above getting along with others. They are generally unconcerned with others' well-being, and therefore are unlikely to extend themselves for other people. Sometimes their skepticism about others' motives causes them to be suspicious, unfriendly, and uncooperative.

Agreeableness is obviously advantageous for attaining and maintaining popularity. Agreeable people are better liked than disagreeable people. On the other hand, agreeableness is not useful in situations that require tough or absolute objective decisions. Disagreeable people can make excellent scientists, critics, or soldiers.

Domain/Facet.....	Score	0	10	20	30	40	50	60	70	80	90	99
AGREEABLENESS.....	46	*****										
..Trust.....	61	*****										
..Morality.....	53	*****										
..Altruism.....	77	*****										
..Cooperation.....	5	*****										
..Modesty.....	41	*****										
..Sympathy.....	72	*****										

**Conscientiousness**

Conscientiousness concerns the way in which we control, regulate, and direct our impulses. Impulses are not inherently bad; occasionally time constraints require a snap decision, and acting on our first impulse can be an effective response. Also, in times of play rather than work, acting spontaneously and impulsively can be fun. Impulsive individuals can be seen by others as colorful, fun-to-be-with, and zany.

Nonetheless, acting on impulse can lead to trouble in a number of ways. Some impulses are antisocial. Uncontrolled antisocial acts not only harm other members of society, but also can result in retribution toward the perpetrator of such impulsive acts. Another problem with impulsive acts is that they often produce immediate rewards but undesirable, long-term consequences. Examples include excessive socializing that leads to being fired from one's job, hurling an insult that causes the breakup of an important relationship, or using pleasure-inducing drugs that eventually destroy one's health.

Impulsive behavior, even when not seriously destructive, diminishes a person's effectiveness in significant ways. Acting impulsively disallows contemplating alternative courses of action, some of which would have been wiser than the impulsive choice. Impulsivity also sidetracks people during projects that require organized sequences of steps or stages. Accomplishments of an impulsive person are therefore small, scattered, and inconsistent.

A hallmark of intelligence, what potentially separates human beings from earlier life forms, is the ability to think about future consequences before acting on an impulse. Intelligent activity involves contemplation of long-range goals, organizing and planning routes to these goals, and persisting toward one's goals in the face of short-lived impulses to the contrary. The idea that intelligence involves impulse control is nicely captured by the term prudence, an alternative label for the Conscientiousness domain. Prudent means both wise and cautious. Persons who score high on the Conscientiousness scale are, in fact, perceived by others as intelligent.

The benefits of high conscientiousness are obvious. Conscientious individuals avoid trouble and achieve high levels of success through purposeful planning and persistence. They are also positively regarded by others as intelligent and reliable. On the negative side, they can be compulsive perfectionists and workaholics. Furthermore, extremely conscientious individuals might be regarded as stuffy and boring. Unconscientious people may be criticized for their unreliability, lack of ambition, and failure to stay within the lines, but they will experience many short-lived pleasures and they will never be called stuffy.

Domain/Facet.....	Score	0	10	20	30	40	50	60	70	80	90	99
CONSCIENTIOUSNESS.....	6	*****										
..Self-Efficacy.....	60	*****										

..Orderliness.....	3	***
..Dutifulness.....	1	*
..Achievement-Striving.....	79	*****
..Self-Discipline.....	1	*
..Cautiousness.....	29	*****

**Neuroticism**

Freud originally used the term *neurosis* to describe a condition marked by mental distress, emotional suffering, and an inability to cope effectively with the normal demands of life. He suggested that everyone shows some signs of neurosis, but that we differ in our degree of suffering and our specific symptoms of distress. Today neuroticism refers to the tendency to experience negative feelings. Those who score high on Neuroticism may experience primarily one specific negative feeling such as anxiety, anger, or depression, but are likely to experience several of these emotions. People high in neuroticism are emotionally reactive. They respond emotionally to events that would not affect most people, and their reactions tend to be more intense than normal. They are more likely to interpret ordinary situations as threatening, and minor frustrations as hopelessly difficult. Their negative emotional reactions tend to persist for unusually long periods of time, which means they are often in a bad mood. These problems in emotional regulation can diminish a neurotic's ability to think clearly, make decisions, and cope effectively with stress.

At the other end of the scale, individuals who score low in neuroticism are less easily upset and are less emotionally reactive. They tend to be calm, emotionally stable, and free from persistent negative feelings. Freedom from negative feelings does not mean that low scorers experience a lot of positive feelings; frequency of positive emotions is a component of the Extraversion domain.

Domain/Facet.....	Score	0-----10-----20-----30-----40-----50-----60-----70-----80-----90-----99
NEUROTICISM.....	90	*****
..Anxiety.....	87	*****
..Anger.....	99	*****
..Depression.....	67	*****
..Self-Consciousness.....	22	*****
..Immoderation.....	94	*****
..Vulnerability.....	86	*****

**Openness to Experience**

Openness to Experience describes a dimension of cognitive style that distinguishes imaginative, creative people from down-to-earth, conventional people. Open people are intellectually curious, appreciative of art, and sensitive to beauty. They tend to be, compared to closed people, more aware of their feelings. They tend to think and act in individualistic and nonconforming ways. Intellectuals typically score high on Openness to Experience; consequently, this factor has also been called *Culture* or *Intellect*. Nonetheless, Intellect is probably best regarded as one aspect of openness to experience. Scores on Openness to Experience are only modestly related to years of education and scores on standard intelligent tests.

Another characteristic of the open cognitive style is a facility for thinking in symbols and abstractions far removed from concrete experience. Depending on the individual's specific intellectual abilities, this symbolic cognition may take the form of mathematical, logical, or geometric thinking, artistic and metaphorical use of language, music composition or performance, or one of the many visual or performing arts. People with low scores on openness to experience tend to have narrow, common interests. They prefer the plain, straightforward, and obvious over the complex, ambiguous, and subtle. They may regard the arts and sciences with suspicion, regarding these endeavors as abstruse or of no practical use. Closed people prefer familiarity over novelty; they are conservative and resistant to change.

Openness is often presented as healthier or more mature by psychologists, who are often themselves open to experience. However, open and closed styles of thinking are useful in different environments. The intellectual style of the open person may serve a professor well, but research has shown that closed thinking is related to superior job performance in police work, sales, and a number of service occupations.

Domain/Facet.....	Score	0-----10-----20-----30-----40-----50-----60-----70-----80-----90-----99
OPENNESS TO EXPERIENCE.....41 *****		
..Imagination.....	38	*****
..Artistic Interests.....	28	*****
..Emotionality.....	33	*****
..Adventurousness.....	56	*****
..Intellect.....	44	*****
..Liberalism.....	66	*****

### E3. Self-Representation in Confabulation

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Life-Story Technique Questions  
(Adjusted from McAdams, 2001)

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Participants are informed that they are going to be interviewed regarding significant events of their lives. They will be asked to recollect specific and self-related events of different life-time periods. These events should be specific in time and place and as detailed as possible. For each event they will be asked to provide a full narrative account of exactly what happened in the scene, who was involved, what the participants were feeling at the time and what, if anything, the scene says about their life and character. There are no time limits in the test and the participants are free to ask for clarification of the questions, if they feel it is necessary and as often as they wish. For each question, the participants will be reminded of the above requirements as often as necessary, but no other prompts will be given.

- 
1. Earliest Memory. Which is your earliest memory? The oldest specific event a participant can remember.
  2. Important Childhood Event. Do you remember your childhood years? Can you tell me of an event in your childhood that was important to you?

3. Important Early Adulthood Event. Do you remember the years of your youth? Can you remember of a specific event in your early adulthood (16-30) that was important to you?
  4. Important Adulthood Event. Can you remember an important event of your late adulthood? A significant event that took place after your 30's until today? (excluding brain injury)
  5. Other Important Event. Can you chose and describe another important scene from any period in your life?
  6. High Point. Can you remember of a particularly pleasant event in your life? A scene of great joy, happiness, a positive experience.
  7. Low Point. Can you remember of a particularly unpleasant event in your life? A scene of misery, unhappiness, a negative experience.
  8. Turning Point. Can you remember of an event that changed your life? An event in which the participant experienced a significant life change.
  9. Episode of continuity. Can you remember an event that displays something about yourself that is continuous and stable?
  10. Decision-making episode. Can you remember an event in which you made an important decision?
  11. Goal event. Can you remember of an event connected to an important goal that you had or still have set out for the future?
  12. Morality event. Can you remember of an event that you faced a moral dilemma?
- 

#### **E4. Confabulation Examples on the Self-Representation Test**

**Recent life:**

"Oh, yeah. A lot of things, aye. You see, I was very looked after when I was a kid, honestly. I was a mother's boy, I was so soft it was unbelievable. I was a lad who always got mugged for his sweets. I was weak. I had no sort of strong character. Which was very frustrating, because on the other side of the coin, I was always at the top of the class, academically. Um, no just- just... the best things were a sort of past me mid-teens. Uh, late teens, when me mother died. Then that just crippled me for, I don't know, four or five weeks- I was just a mess. And then you've got to fight to get over it. And then, I don't know if it's connected with that, but I started winning things. Races, quizzes, that sort of thing. I felt bloody chuffed, I was made house captain at school, and uh... yeah. That's- that's- that sort of event, that area, um... was the- was the first time I had confidence in myself. Because I started to believe that other people had confidence in me, because prior to that I didn't think they did. Such a whipper. Ever since I've had to take it out on the rest of the world".

*[Corroboration Notes. His mother did indeed die in his late teens and in the long run it seemed to have a beneficial effect on his character but the associated events ('winning things' etc) were not corroborated by his relatives and although it is true that he became house captain at school, this was in primary school and preceded his mother's death. The latter information appears to be a perseveration from a previous question]*

**Spontaneous Confabulation: The patient is asked for some personal semantic information, e.g. his address. He suddenly says:**

"It's gone. It's 6 something..."

[Are things often gone from your memory?]

No, I'm pretty damn super

[ok]

I'm getting done from Australia

[You're getting done from Australia?]

Yeah. Look at you, you're well impressed! No, what it is, well 'Newcastle' hospital, it's supposed to be the most peaceful, relaxed hospital in the area. So I went there, I weren't to move a plant. I think it, I was told it was accidental, and I got hit over the head with a spade.

[Really?]

(laughs) I'm fine, I'm really, I'm fine, I'm, going now

[You are leaving? You are not facing any problems as a result of that event? ]

I have hell of a job finding me wallet (laughs). No this hospital has a very good reputation. I think all hospitals at the moment, I'm probably being very very unfair to them now, but they're not popular. Er, because of the pay, the patients and all this sort of thing, but em, do you know I love to say things like this despite yourself, intelligent staff and all. I love that. But I promised I would behave myself this time. I've got to get out of this sodding place. I cannot keep coming back. I only came back for two pencils. And that was a fortnight ago.

[Oh really, is that why you were admitted here?]

Yeah. I came to return two pencils".

*[Corroboration Note. This is a spontaneous confabulation regarding LH's reasons for admission which arouse during interviewing. It includes a number of false claims: He is not in Australia. His reasons for admission do not relate to a plant, nor a head injury, nor the return of pencils. He has mentioned such reasons in previous sessions, in various versions. E.g. his conviction that he is in Australia, on holiday was common at the time.]*



## Appendix F

### F1. AO's Detailed Big Five Scores & Factors Descriptions

#### Premorbid Personality (Relative's Rating) (Percentile Estimates)

##### Extraversion

Domain/Facet..... Score 0-----10-----20-----30-----40-----50-----60-----70-----80-----90-----99

EXTRAVERSION.....78 \*\*\*\*\*

Friendliness.....88 \*\*\*\*\*

Gregariousness.....91 \*\*\*\*\*

Assertiveness.....90 \*\*\*\*\*

Activity Level.....90 \*\*\*\*\*

Excitement-Seeking.....27 \*\*\*\*\*

Cheerfulness.....1 \*

##### Agreeableness

Domain/Facet..... Score 0-----10-----20-----30-----40-----50-----60-----70-----80-----90-----99

AGREEABLENESS.....2 \*\*

Trust.....18 \*\*\*\*\*

Morality.....1 \*

Altruism.....31 \*\*\*\*\*

Cooperation.....1 \*

Modesty.....74 \*\*\*\*\*

Sympathy.....85 \*\*\*\*\*

##### Conscientiousness

Domain/Facet..... Score 0-----10-----20-----30-----40-----50-----60-----70-----80-----90-----99

CONSCIENTIOUSNESS.....57 \*\*\*\*\*

Self-Efficacy.....85 \*\*\*\*\*

Orderliness.....87 \*\*\*\*\*

Dutifulness.....80 \*\*\*\*\*

Achievement-Striving.....61 \*\*\*\*\*

Self-Discipline.....64 \*\*\*\*\*

Cautiousness.....1 \*

**Neuroticism**

Domain/Facet..... Score 0-----10-----20-----30-----40-----50-----60-----70-----80-----90-----99

NEUROTICISM.....91 \*\*\*\*\*

Anxiety.....99 \*\*\*\*\*

Anger.....97 \*\*\*\*\*

Depression.....90 \*\*\*\*\*

Self-Consciousness.....14 \*\*\*\*\*

Immoderation.....20 \*\*\*\*\*

Vulnerability.....99 \*\*\*\*\*

**Openness to Experience**

Domain/Facet..... Score 0-----10-----20-----30-----40-----50-----60-----70-----80-----90-----99

OPENNESS TO EXPERIENCE.....65 \*\*\*\*\*

Imagination.....39 \*\*\*\*\*

Artistic Interests.....90 \*\*\*\*\*

Emotionality.....53 \*\*\*\*\*

Adventurousness.....30 \*\*\*\*\*

Intellect.....92 \*\*\*\*\*

Liberalism.....42 \*\*\*\*\*

## F2. Recollective Experience Questionnaire

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Recollective Experience Questions & Response Options  
(Adjusted from Heaps & Nash, 2001)

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1. How much of the event do you remember?  
(amount remembered; 0 = none, 1 = little, 2 = some, 3 = most, 4 = all)
  2. How much confidence do you have in the accuracy of your memory? (confidence in accuracy; 0 = none, 1 = little, 2 = some, 3 = a lot, 4 = extreme/complete)
  3. How frequently have you thought about or talked about this event with others?  
(rehearsal frequency; 0 = none, 1 = little, 2 = some, 3 = a lot, 4 = extreme/complete)
  4. How typical of your recent life (i.e. how much like other events) is this event? (event typicality; 0 = very untypical, 1 = somewhat untypical, 2 = neither typical nor untypical, 3 = somewhat typical, 4 = very typical)
  5. How important very the consequences of this event? (importance of consequences; 0 = very unimportant, 1 = somewhat important, 2 = neither important nor unimportant, 3 = somewhat important, 4 = very important)
  6. How intense are your emotions concerning the event? (emotional intensity; 0 = no intensity, 1 = little intensity, 2 = some/moderate intensity, 3 = a lot of intensity, 4 = extreme/complete intensity)
  7. How are your emotions best described (negative/positive)? (emotional valence; 0 = very negative, 1 = somewhat negative, 2 = neither negative nor positive, 3 = somewhat positive, 4 = very positive)
  8. Does your memory for this event contain visual images? (image presence; yes/no) [If the answer to this Question was "no", questions 9-12 were not asked]
  9. How clear is your visual image about this event? (image clarity; 0 = no clarity, 1 = little clarity, 2 = some/moderate clarity, 3 = a lot of clarity, 4 = extreme/complete clarity)
  10. How much effort did it take for you to recall this image? (recall effort; 0 = no effort, 1 = little effort, 2 = some/moderate effort, 3 = a lot of effort, 4 = extreme/complete effort)
  11. Does your image involve movement? (image movement; yes/no)
  12. Is your image seen from a field (first person) or observer (third person) perspective? (image perspective; field/observer)
-

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