**Awareness and confabulation**

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**Abstract**

This is a single case study with control and normative data of a 74-year-old retired businessman with amnestic mild cognitive impairment, who had spontaneous confabulations concerning fantastic exploits and magical powers as well as déjà vécu experiences.

His neuropsychological profile showed episodic memory impairment including deficits of recent episodic autobiographical memories and of recognition, but performance was within normal limits on tests assessing source memory for words, the ability to suppress irrelevant items on a continuous recognition memory task and the detection of stimulus frequency. There were discrete impairments in an *ad hoc* test measuring his ability to detect and discriminate the source of a range of material including information derived from personal and public events, invented material and episodes culled from his personal reading. Although his source memory for autobiographical information was normal, he attributed twenty percent of the invented material and personal readings and fifteen percent of the public events either to his own experience or to that of someone he knew personally or to someone else. This evidence suggests that none of the current theoretical accounts of spontaneous confabulations is sufficiently explanatory. Instead, an argument is developed that both fantastic confabulation and déjà vécu arose from a more fundamental disorder of awareness.

**Introduction**

Confabulation is a common symptom of Alzheimer’s disease (AD) and patients show varying degrees of conviction and behavioural response to the content ([Cooper, Shanks, & Venneri, 2006](#_ENREF_3); [Dalla Barba, Nedjam, & Dubois, 1999](#_ENREF_7)). The classical reports, however, concerned confabulation in single case or small group studies of patients with a variety of mainly frontal pathologies due to trauma, vascular brain disease or tumour. More recent work, also in patients with focal lesions, has suggested that involvement of the orbitofrontal and inferomedial frontal cortices was more likely to be associated with confabulation ([Turner, Cipolotti, Yousry, & Shallice, 2008](#_ENREF_31)). In such studies of course the precise location and extent of dysfunctional brain tissue was not known, but they have contributed to theoretical frameworks which in broad terms related confabulation to a disruption of frontal processes of retrieval and evaluation or of a source monitoring framework implemented in the frontal lobes ([Johnson, O'Connor, & Cantor, 1997](#_ENREF_12); [Moscovitch & Melo, 1997](#_ENREF_19)).

A theoretically useful distinction has been that between provoked and spontaneous instances of confabulation ([Berlyne, 1972](#_ENREF_1); [Kopelman, 1987](#_ENREF_14)). Provoked confabulations refer to simple memory fabrications often given in response to requested information. Similar provoked confabulations can be elicited in very early AD, even before their behavioural appearance, with appropriate testing and are a common symptom once the disease is established ([Cooper et al., 2006](#_ENREF_3)). They are often plausible substitutes for true memories and rarely lead to sustained conviction and related actions.

Spontaneous confabulation, by contrast, usually involves the patient’s contemporary experience of the mental content involved as true, and these beliefs may be more or less persistent and motivational ([Fotopoulou, Conway, & Solms, 2007](#_ENREF_8); [Schnider, 2001](#_ENREF_25)). This type of confabulation again appears in both focal and neurodegenerative conditions, although the phenomenology and determinants of confabulation in the latter have been seldom studied. In traumatic cases the symptom often resolves with recovery from brain damage ([Schnider, Ptak, von Daniken, & Remonda, 2000](#_ENREF_27)), but it may be persistent following right hemisphere stroke or selective neurodegeneration ([Venneri & Shanks, 2004](#_ENREF_33)). Possible theoretical bases for this variety, or perhaps stage, of confabulation include pathologies of personal temporal awareness based on impoverishment of autobiographical memory resources ([Dalla Barba & Boisse, 2010](#_ENREF_5); [Lee et al., 2007](#_ENREF_18)) and dysfunction of the orbitofrontal cortex and its imputed role in the early suppression of evoked memories that do not conform to experienced reality ([Schnider & Ptak, 1999](#_ENREF_26)). In neurodegenerative conditions, however, executive retrieval and source monitoring dysfunction, as well as personal memory failures, appear to be neither necessary nor sufficient conditions for the emergence of spontaneous confabulation. Many patients with early AD have impairments of episodic memory and autobiographical memory with loss of insight and concern, but these findings have no consistent relationship to confabulation ([Cooper et al., 2006](#_ENREF_3)). Others show little or no impairment of episodic or personal memory, but verbal invention variably allied to false beliefs appears nonetheless as early or even the first symptom of the disease ([Shanks & Venneri, 2002](#_ENREF_28)).

Attempts at unitary theoretical accounts are confounded by the variety of probable causes and the different presentations of confabulatory phenomena, and authors often resort to multifactorial explanations to interpret the symptom in case or group studies. For example, a study which compared a patient with confabulations to control patients with frontal lesions considered convergent impairments were necessary to account for confabulation in their patient, including deficits in retrieval of personal memories, source monitoring deficits and a tendency to the exercise of the imaginative faculty ([Johnson, O'Connor, & Cantor, 1997](#_ENREF_13)). In the same way and more recently, an extended reflection on the state of theoretical development in the field also concluded that only a multifactorial framework would offer an heuristic model for future studies of confabulation and delusion ([Turner & Coltheart, 2010](#_ENREF_30)). Attempts to explain other forms of delusion, i.e. reduplicative paramnesia, have also appealed to multifactorial accounts such as the cognitive dissonance associated with impairments in memory, visuospatial and conceptual integration ([Politis & Loane, 2012](#_ENREF_24); [Venneri & Shanks, in press](#_ENREF_35)).

Current theories are also challenged, however, in their application to neurodegenerative states at least, not only by the observation of confabulation in the absence of significant amnesia but also by the need to explain any associated disorders of belief with resistance to logic and a suspension of plausibility judgement. Some instances of confabulation, for example, seem continuous in descriptive terms with what might be phenomenologically accepted as delusional states ([Langdon & Turner, 2010](#_ENREF_17)), although others have argued that these symptoms should be distinguished not only in clinical practice but also remain as useful categories in a research context ([Kopelman, 2010](#_ENREF_15)). From the neuropsychological and neuropsychiatric viewpoints such confabulations have been qualified as fantastic or bizarre, and these terms capture something of their implausibility and fluency. Two cases with probable neurodegenerative brain damage have been described who had persistent spontaneous confabulation. These patients also had an ongoing sense of having already experienced the present in personal memory ([Moulin, Conway, Thompson, James, & Jones, 2005](#_ENREF_20)). The latter symptom, déjà vécu, is not easily demarcated from similar experiences of abnormal familiarity but has been considered “an episodically mediated erroneous sensation of recollection” ([Moulin et al., 2005](#_ENREF_20), p. 1363) with “recollective secondary confabulation” ([O'Connor, Lever, & Moulin, 2010](#_ENREF_22), p. 119-120). More simply put, the patients have a vivid sensation of events unfolding which, although novel, they insist must have happened before, correspondingly claim that they can predict the course of the immediate future and may then confabulate to explain the grounds for their belief. The symptom in these cases was attributed to dyscontrol of frontotemporal memory circuits mediating recollective experience, causing a false attribution of personal recognition to normally neutral sensations of recall and attention ([Moulin et al., 2005](#_ENREF_20)). More recently, this interpretation has been extended to emphasise the delusional quality of the déjà vécu experience, the link to novel and unusual stimuli and a possible failure in cognitive mechanisms of temporal encoding resulting in a false signal of recollection ([O'Connor et al., 2010](#_ENREF_22)).

In the present investigation, another patient with spontaneous confabulation and altered awareness of the present is described. His neuropsychological profile is compared with that of a matched control group. An argument is developed that both fantastic confabulation and déjà vécu arise from a fundamental disorder of awareness.

**Case HF**

HF, a 74 year old right handed male at time of initial referral, with 10 years of education, presented with an 18 month history of forgetfulness, bizarre confabulations and déjà vécu. The symptoms appeared insidiously and gradually became more prominent. His wife noticed, when on holiday visiting Mauritius for the first time, that he had difficulty learning the topography of their new surroundings but also insisted that he had been there before. Subsequently, this sense of having already experienced manifestly novel events, met people and seen places and objects which should have been unfamiliar to him became established. His persistent urge to communicate these beliefs caused considerable marital and family tensions. He remained independent and competent in most everyday activities, although he was liable to lose his sense of direction on the golf course and to be uncertain about the appropriate location and storage of domestic items. In the background, he had left formal education at 16 and had become a successful businessman retiring at 58. He enjoyed reading fantasy and science fiction literature, travelled frequently and his wife said he always had a tendency to exaggerate his status and achievements. There was no family history of cognitive or mental disorders, and he had been mentally and physically well prior to the present illness.

*Neuropsychiatric and neurological assessment*

He presented as an alert assertive person eager to recount his abnormal beliefs at any opportunity. He showed a degree of apathy and anhedonia, with some loss of interest in family affairs and hobbies, and impaired concentration, but these symptoms were fluctuating and there was no persistent depressed mood. His total Neuropsychiatric Inventory ([Cummings et al., 1994](#_ENREF_4)) score was 18, scoring on the symptom categories of depression, apathy and delusion. Despite the grandiose content of his confabulations (described below) there was no morbid elevation of mood. His family did not describe any abnormal behaviours arising from or associated with his abnormal beliefs and awareness, nor were any observed during clinical assessment. Neurological assessment was unremarkable.

*Déjà vécu*

On meeting him for the first time he said “I am certain that I have seen you both before, four or five weeks ago”. His wife affirmed that he believed everything had happened or been seen by him already, even when she knew this was not possible. The experience included events, conversations, meeting strangers, television programmes, newspapers and the content of books. This change in awareness of the world was continuous and included an element of prediction. For example, at the first meeting he asserted that he already knew what would be said to him before the words were uttered. When he was on his own with the examiner, he also said that his wife would not be happy about him telling others about certain of his convictions. Otherwise he was eager to share his experiences and to provide an account of some ‘special powers’ or abilities he claimed to have acquired.

*Fantastic confabulations and delusional beliefs*

These beliefs were recounted spontaneously and had a bizarre and grandiose content. The narratives were elaborated during discussion, but the essential content persisted. The main themes included black magical abilities such as teleportation, telepathy and spell casting and grandiose notions about himself and his family involving great wealth, exalted station and duplicity on the part of certain relatives. For example, he said his daughter was married to a rich Indian businessman who owned a large tea plantation. They had a luxurious house in London’s west end and a vineyard with a villa in the south of France. None of this was true, his son in law was a Caucasian painter and decorator who lived locally. Another confabulation involved the ability of his son in law and an imaginary ‘grandson’ to communicate supernaturally via a telepathic process, which he termed ‘flashing’.

There were many other confabulations with a magical or grandiose content including an example loosely based on an actual holiday he had taken with his wife to another continent. When flying back, he said his plane was hijacked and forced to land in Moscow. Once landed, a group of soldiers armed with automatic weapons arrived on board and asked HF and his wife to follow them. He was then escorted to the Kremlin where he was taken by these armed soldiers to see President Putin.

He also claimed that he could teleport himself and others by saying a word of power, which, of course, he would not utter in the interviewer’s presence!

*Standard neuropsychological assessment*

HF was assessed with a comprehensive neuropsychological battery including tests of short and long term memory, abstract reasoning, language, praxis, attention and executive functions. On the MMSE he scored 25/30 and had impaired recognition memory and executive dysfunction, but on all other tests in the battery his scores were well within the range of healthy age matched controls (see Table 1 for details). At the time of baseline examination, therefore, HF had mild cognitive impairment (MCI) and met the criteria of Petersen et al. ([2001](#_ENREF_23)) for MCI.

- Insert Table 1 about here -

A follow up neuropsychological assessment one year later, showed substantial decline in prose memory and some more minor progression of impairments in other cognitive domains. The family reported increased impairment of everyday memory, and informal questioning about news stories showed poorer retention of recent public events and memories of recent testing sessions. The neuropsychiatric symptoms persisted unchanged. HF was then followed up for several years, although further formal assessment was not possible because he withdrew consent. The family was willing to provide detailed information about the progress of his symptoms by phone and there were contacts with his GP. Their description was consistent with progressive global decline affecting activities of daily living including self-care, despite treatment with a cholinesterase inhibitor. Five years after his initial assessment he was admitted to long term nursing care. This progression is consistent with a clinical diagnosis of probable Alzheimer’s disease.

*Brain structural magnetic resonance imaging*

Three dimensional T1-weighted and T2-weighted MRI scans of HF’s brain were acquired at baseline a month following his first appointment for neuropsychological assessment. The scans showed mild generalized atrophy in temporal and parietal regions with more substantial neuronal loss in the right hippocampus (see Figures 1a and 1b). There were no major vascular lesions except for one small lacuna in the right frontal periventricular region (see Figure 1b). Overall vascular burden was relatively minor for his age.

- Insert Figures 1a and 1b about here -

*Experimental neuropsychological assessment*

Assessment had shown some deficits in recognition memory but within age range performance on all other learning tasks (paired associate learning, prose memory and Rey complex figure delayed copy) (See Table 1 and 2 for details). Additional assessment included several ad hoc tests: a list learning paradigm which involved the encoding of two lists of 12 items (words) each, for which learning was assessed with an item and source recognition paradigm; a memory for item frequency paradigm; a continuous recognition task, with item reversal as in the original version devised by Schnider & Ptak ([1999](#_ENREF_26)), an ad hoc source memory paradigm for personal, non personal and fictional events; an autobiographical memory test ([Ivanoiu, Cooper, Shanks, & Venneri, 2006](#_ENREF_11)) and a test of provoked confabulation ([Cooper et al., 2006](#_ENREF_3)). These tests were administered in an additional testing session seven days after his standard neuropsychological assessment. Given that there are no normative data for these tests, a group of 5 healthy gender, age, education and sociocultural background matched controls was also tested (mean age 73.2, SD 2.86; mean education 12.4, SD 3.78). Controls were screened for vascular risk factors even where there was no history to suggest overt brain ischemia, and excluded if they had history of head injury, of neurological or psychiatric disorders, or of other significant pathologies which would make them unsuitable (e.g. diabetes, cancer, thyroid dysfunction, vitamin deficiencies, etc), or if they were on treatment with any psychoactive drug.

*Recognition and source memory task*

This task consisted of two lists of 12 words which were administered via a computer presentation. Words for each list were presented individually centred on a computer screen. After each item, participants were asked to express how much they liked that word using a nine point scale. This procedure was adopted to ensure that participants were paying attention and encoding each item as deeply as possible. After presentation of the first list, participants were given a small interval of two minutes during which they were required to perform a simple symbol cancellation task. After this interval the second list was presented with a similar procedure as in the presentation of the first list. Following a five minute delay, participants were asked to perform a recognition task. The recognition list included the 24 items of the two study lists and an additional 24 distractor items. Participants were required to state whether each item had been seen before in one of the study lists and, if that were the case, to determine whether it had been presented in the first or the second list. Accuracy of performance as well as d’ prime and b parameters were determined for both HF and the control sample to establish signal to noise detection abilities (following signal detection theory principles).

HF’s performance on this test was statistically compared to the mean of the controls using a computerized version: (<http://www.abdn.ac.uk/~psy086/dept/psychom.htm#conflims>) of the Sokal & Rolph (1981) modified t-test. HF’s recognition score was lower than those of the healthy controls with poor hit rate (Table 2).

- Insert Table 2 about here -

D’ was calculated and the statistical comparison of HF’s and the controls’ scores showed that the difference was significant (t = 2.247, p < 0.05, one tailed). He produced significantly more false alarms than the controls (t=3.493, p<0.05, two tailed). The analysis of the b scores, however, showed that, although higher than controls, the proportion of incorrect rejections was not significantly different (t = 1.024, n.s., two tailed). Further comparisons were carried out on the data exploring the ability to establish correctly the source of remembered items. He appeared slightly better than the controls in establishing the source of those items that he remembered, although the difference was not statistically significant (t = 1.225, n.s., two tailed) (Table 2).

*Memory for item frequency task*

This task consisted of a list of 150 items to assess ability to retain memory for the frequency with which items had been previously presented. There were 120 words equally distributed between proper nouns (half male and half female names), common nouns, abstract and concrete words (half living and half non living, half high frequency and half low frequency) and 30 pseudowords and the stimuli were presented via a computer, one at the time, and the participant’s task was to look at the items and read them aloud. One third of the items were randomly presented only once, another third twice and the remaining third three times. Following a five minute interval during which participants were asked to copy simple geometrical figures, they were presented with a series of 432 pairs of words and they had to decide which word in the pair had been seen more often in the earlier presentation. One third of the pairs were items which included words presented either once or twice, one third included items which had been presented either once or three times and the remaining third included pairs in which items had been presented either twice or three times. HF was as accurate as controls in making frequency judgments (t = 0.148, n.s.), and that was the case independently of the relative frequency difference in the pairs (t = 0.777, n.s.; t = 0.095, n.s.; t = 0.231, n.s. for 1 vs 2, 2 vs 3, and 1 vs 3 pairs respectively) (Table 2).

*Memory inhibition task*

This task was constructed following the description and procedure used by Schnider & Ptak ([1999](#_ENREF_26)). Fifty two line drawings from the set of pictures by Snodgrass & Vanderwart ([1980](#_ENREF_29)) were used to replicate the original paradigm which followed the structure and procedure detailed in the original article with item reversal. Care was taken to ensure that all items included in the test were balanced for lexical characteristics, structural complexity, etc. Both HF and the healthy control sample were tested on this task. HF’s performance was similar to that of controls, however he had a significantly lower number of hits in Run 2 (t = 3.983, p < 0.01, one tailed) than the controls. HF’s d-prime scores did not differ significantly from the controls (t = 1.76, n.s.; t = 0.348, n.s.; t = 0.007, n.s. and t = 1.286, n.s. for Run one, two, three and four respectively), whereas b differed significantly on Run 2 (t = 3.516, p < 0.05, two tailed).

*Source memory for personal, non personal and fictional event task*

This task consisted of 80 trials presented on a computer. Items consisted of short sentences which described an event presented for 2 seconds. Twenty sentences were about events related to HF’s personal autobiography (10 about his recent past – the last 5 years - and 10 about his remote past), twenty sentences were about public events chosen amongst those who had been in the news most in the reference period (10 about the recent past – the last 5 years – and 10 about the more remote past), 10 sentences were taken from science fiction books that he had read, and 30 sentences were about fictitious events which had never occurred and had been made up for the occasion. Due to the mainly autobiographical content only HF could be tested with this task. His remit was to first establish if the event described by the sentence referred to a real or fictitious event. If he established that the event were real he was asked to say whether the sentence referred to events which had happened 1) to him or someone he knew personally, 2) to someone he did not know or 3) if it had read about the event in a book. He was very accurate (95%) in recognizing events taken from his autobiography and in correctly attributing the events to himself. He was less accurate in recognizing public events and he made some source attribution errors. Although in most cases he would acknowledge that events referred to somebody else, in a small number of trials he would attribute the event to himself or somebody he knew personally or would be unable to establish the source of the event. In only 40% of the trials referring to book events was he able to correctly identify events as true and of these trials, 75% of the time was able to correctly establish their source. In one instance he mistook an event coming from one of the books he had read for a real public event and referred it to someone else. His performance on the fictitious events was also of interest. In about a quarter of the items, he mistook the made up events for true events and attributed these to either himself or somebody he knew personally or some of the books he had read, but more frequently he mistook these for real public events. HF’s performance on this task is summarized in Table 2 and shown in Figure 2.

- Insert Figure 2 about here -

*Autobiographical memory task*

The autobiographical memory test proposed by Ivanoiu et al ([2006](#_ENREF_11)) was used to assess HF and the controls. The administration and scoring procedures reported in the original article were used. This instrument is a modified version of the Autobiographical Memory Interview ([Kopelman, Wilson, & Baddeley, 1990](#_ENREF_16)). His scores in all parts of the test were compared with those of controls. His scores were not significantly different from controls, except for the recent episodic part (cued) which was significantly lower than that of controls (t = 2.608, p < .05). During this time period he also produced numerous elaborate confabulations, which were confirmed as false by his wife.

*Provoked confabulation task*

The test proposed by Cooper et al ([2006](#_ENREF_3)) was used to test HF and the controls. The administration and scoring procedures reported in the original articles were used. His scores on the free recall and recognition part of the test were both significantly poorer than those of controls (t = 12.294, p < 0.001 and t = 11.572, p < 0.001 respectively). He showed no abnormal confabulatory tendency in the part of the questionnaire specifically designed to elicit confabulation. During story recall, however, he produced four new elements, a pattern inconsistent with the performance of the controls who produced no new elements.

**Discussion**

HF presented with spontaneous and abundant confabulatory beliefs and behaviours. The content was fantastic and grandiose. He had limited insight that his stories were implausible, commenting that if his wife were informed of the content, she would not be very pleased. Otherwise he displayed no grasp that the events he recounted could not possibly represent lived experience. These implausible beliefs were accompanied by a striking and persistent change in awareness so that he experienced déjà vécufor events, conversation and media, and in detailed analysis a tendency to attribute to himself or someone he knew personally events that either had been made up for the purpose of this study or that occurred to others he did not know personally. He also tended to mistake general public knowledge for events that were sourced from his books or that had been invented for his assessment.

His neuropsychological profile at the time these symptoms appeared showed only mild deficits in executive tests such as the Wisconsin Card Sorting Test ([Nelson, 1976](#_ENREF_21)), where although he identified a low number of sorting categories, the percentage of perseverative errors which would indicate more severe executive dysfunction was below the cut-off of 48%, and in the Stroop Test ([Venneri et al., 1993](#_ENREF_32)), on which no errors were noted, although there was a slowing down of execution. He also had borderline performance in both verbal and non verbal long term memory tests, where he achieved scores which fell in the lower end of the range of reference controls. Poor performance was observed in the part of the Autobiographical Memory test referring to events in the last five years of his life.

In contrast to other published cases of spontaneous confabulation, HF showed no overall impairment in a continuous recognition task and suppression of intrusion was maintained, suggesting that failure to suppress intrusions was not causal in this case. Another study has also found that the performance of confabulating patients on the continuous recognition task could not be distinguished from either controls or matched patients without confabulation ([Gilboa et al., 2006](#_ENREF_10)).

The temporal consciousness model proposed by Dalla Barba, Cappelletti, Signorini & Denes ([1997](#_ENREF_6)) might provide a better explanation given HF’s borderline long term memory scores and his relatively inaccurate autobiographical recollections for the most recent years of his life. The essential feature of this model is the proposal that confabulations might be due to impairments in the search processes of a Long Term Storage System (LTSS). The model predicts that confabulators would have impaired retrieval of relevant detailed memory traces from within the LTSS, but could still access the more stable traces concerning habits and factual information. Impairments in medial temporal structures are said to be essential to the genesis of confabulation, since integrity of these anatomical structures is needed to support an individual’s full awareness of their past, present and future and its temporal context.

Following this line of reasoning confabulations would appear when general semantic and episodic information rather than the detailed episodic information necessary to retrieve a specific memory in its correct temporal context was retrieved. Confabulated responses appearing in neurodegenerative dementia (i.e. Alzheimer’s type) would then be based on residual stable everyday personal memories rather than updated evolving events and experiences ([Dalla Barba et al., 1999](#_ENREF_7)). This model, however, offers only a partial explanation for HF’s beliefs which were not based on distorted and outdated personal information. In fact, degradation of autobiographical memories for recent years was mild. His confabulations were only loosely based on real events and featured elaborate, bizarre and completely implausible scenarios. Finally, there was no evidence of impairment in establishing the correct temporal context and framework of these imagined events.

The possible contribution of a primary source monitoring deficit should also be considered. HF’s source memory skills were extensively tested. He performed like controls when asked to identify the source of memories for common words presented in a list learning and recognition task in which the source had also to be established. He had lower recognition scores, however, in addition to a greater false alarm rate. In a task which involved the attribution of source for autobiographical events, public events, events from books he had read and events which had been invented he showed an interesting and revealing pattern of performance. He attributed the source of autobiographical events correctly in 100% of cases. However his source monitoring skills broke down when attribution of source had to be made for public events, those derived from books he had read and events which had been completely made up. He attributed a large proportion of such items as having happened to himself or somebody he knew personally or someone he did not know personally. Source memory impairments or defective episodic memory alone, however, would not fully explain HF’s confabulations, and in particular the parallel failure in his capacity to make a distinction between the real and the unreal and to reject implausible material independently of source confusion and uncertain memory for events.

The accompanying déjà vécu phenomenon is also difficult to reconcile with these attempts at explanation. Moulin, Conway, Thompson, James & Jones ([2005](#_ENREF_20)) suggested that déjà vécu might be generated in situations where abnormal control of memory awareness and recollective experiences result in events, people and places being mistaken for real memories. HF’s impaired memory abilities would align with this interpretation, but in more general terms the argument is hard to sustain. His episodic autobiographical memory deficits were minor at the time this examination took place and hardly of a severity to justify the quality and extent of his abnormal experience. If this interpretation were a sufficient account of HF’s experience, then déjà vécu phenomena should be frequently found in patients with memory deficits and should be encountered more often in clinical practice. Instead, despite the high frequency of memory deficits, the symptom is relatively rare in organic amnestic disorders. When déjà vécu has been reported in organic brain disease, however, then (as with HF) spontaneous confabulation with persistent and variably motivating false beliefs were also present ([Moulin et al., 2005](#_ENREF_20)) ([O'Connor et al., 2010](#_ENREF_22)). In another case of probable vascular brain disease, a patient with déjà vécu believed he was being discriminated against based on false beliefs about local driving pass regulations (Todd Feinberg, personal communication). It appears likely, therefore, that the two phenomena are linked. In these cases, the abnormal expansion of subjective attribution which colours the current stream of consciousness, including the reading of books and newspapers as well as conversation, events and imagined mental contents seems to imply that the representation and retrieval of memories encoded in this way will inevitably strike others as bizarre invention, but will be believed by the subject.

A more general argument is possible. The objective experience of the world as represented in consciousness is arguably built into the act of perception ([Burge, 2010](#_ENREF_2)). Most theories of false belief invoke a two factor argument by which re-represented mental contents retrieved from memory or generated from imagination are misidentified as real. In HF’s case this misrepresentation is seen to operate at the very time the represented world is retained in memory, a process of abstractive encoding which will usually include the discrimination of personal memory from other forms of experience. For HF, however, the immediate retention of experience in all forms is coloured by the subjective or tagged as subjective. Déjà vécu is rare but such breakdowns of the distinction between subjective experience and the real world associated with neuropsychological impairment are common in neurodegenerative states even at the earliest stages ([Shanks & Venneri, 2002](#_ENREF_28); [Venneri, Shanks, Staff, & Della Sala, 2000](#_ENREF_36)). These changes in awareness are also frequently accompanied by spontaneous confabulation although with a more emotionally relevant and less fantastic content. They often lead to misidentification of the patient’s familiar environment and important relationships, and divergence from the shared world of others. Such changes may show up when normally inaccessible/unobtrusive “background” neural systems which must support discrete structures of awareness are damaged or dysfunctional in addition to or comorbid with more easily detectable neuropsychological dysfunctions. Examples include personal memory confabulations, animistic beliefs and formal misidentification syndromes.

In most of these cases an additional psychogenic factor driving the false beliefs may be identified like bereavement or loneliness. In HF’s case the grandiose element of the confabulations may have inflated and supported self esteem in a person with similar premorbid personality traits. This would provide an additional psychogenic drive and contribute to the spontaneous expression, fluency and grandiosity of his confabulations. Some, for example, have argued that spontaneous confabulations and false beliefs often, in addition to emotional biases, have the attribute of being more pleasant than real events ([Fotopoulou, Solms, & Turnbull, 2004](#_ENREF_9)).

The neuroscientific study of brain networks contributing to self awareness and awareness of the world has only recently begun (unfortunately the early phase of this study was completed before brain network connectivity imaging and analysis were widely applied in clinical settings). The study of early and discrete changes in awareness in patients with organic brain disease will make an important contribution to this developing field, but it seems likely that neurocognitive and neuroanatomical explanations of abnormal experience and behaviour will not be sufficient, and neuro-psychoanalytical interpretations supported by neurocognitive evidence ([Venneri & Shanks, 2010](#_ENREF_34)) will offer a more developed understanding of cases like HF.

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**Figure caption**

Figure 1: a) Axial T1W MRI slices showing sulcal enlargement in parietal regions and medial temporal atrophy. b) Coronal T2W MRI slice showing medial temporal lobe atrophy more pronounced on the right side and no relevant vascular burden. These scans were acquired at the time of HF’s baseline assessment.

Figure 2: Graphic representation of HF’s responses to the experimental source memory task. Bars represents the percentage of items attributed to different sources including as options, personal (recent and past), public (recent and past), fictional and invented events.

Table 1: Neuropsychological assessment scores for HF and a matched control sample.

|  |  |  |  |
| --- | --- | --- | --- |
| **Neuropsychological Assessments** | **HF (baseline)** | **HF** **(1 yr follow-up)** | **Mean for Controls (SD)#** |
| MMSE | 25\* | 22\*\*\* | 28.5 (1.2) |
| Confrontation Naming | 20 | 19 | 19.8 (0.6) |
| Verbal Paired Associates | 7 | 12 | 11.9 (3.2) |
| Pyramids and Palm Trees Test | 52 | 51 | 51.1 (0.9) |
| Rey Complex Figure – copy | 30\* | 36 | 34.5 (2.0) |
|  – delay (10 minutes) | 4.5\* | 5 | 17.8 (6.0) |
| Semantic Fluency | 39 | 41 | 56.1 (13.4) |
| Phonemic Fluency | 33 | 27 | 42 (11.2) |
| Digit Span – forward | 9 | 9 | 7 (1.6) |
|  – backward | 5 | 5 | 5.7 (1.5) |
| Raven’s Progressive Matrices (PM47) | 32 | NA | 32.7 (2.4) |
| Stroop – error interference | 0 | 0 | 0.0 (0.0) |
|  – time interference | 62\*\* | 42 | 25.4 (11.2) |
| Digit Cancellation – (number correct) | 46 | 47 | 52.1 (6.0) |
| Visuoconstructive Apraxia Test | 13 | 13 | 13.7 (0.6) |
| Token Test | 33 | 32.5 | 34.1 (1.5) |
| WAIS Similarities | 23 | NA | 21.4 (8.6) |
| Prose Memory – immediate | 10 | 13 | NA |
|  – delay (10 minutes) | 9 | 1 | NA |

Note: Significantly different from control sample at \* p≤0.05, \*\* p≤0.01, \*\* p≤0.001 (two-tailed),

NA – not available

#Control sample from normative local database: n=15; all male and right-handed; mean age 74.1 (SD 2.9); mean education 13.3 yrs (SD 3.3)

Table 2: Performance of HF and the control sample on the selection of ad hoc neuropsychological assessments performed at baseline

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Ad hoc Assessment** | **HF** | **Mean for Controls (SD)** | **t-value** | **p-value** |
| **Recognition and Source Memory Test** |  |  |  |  |
| Percentage Correct Recognitions | 54.17 | 90.00 (8.64) | 3.786 | **0.010#** |
| Percentage False Alarms | 50.00 | 23.33 (6.97) | 3.493 | **0.025** |
| Percentage Source Errors  | 23.08 | 40.76 (13.17) | 1.225 | 0.288 |
| **Frequency Judgement Task** |  |  |  |  |
| Overall Performance(percentage correct) | 50.50 | 50.06 (2.72) | 0.148 | 0.890 |
| **Memory Inhibition Task** |  |  |  |  |
| Run 1 Hits | 27 | 27.80 (0.45) | 1.623 | 0.090 |
| Run 1 False Alarms | 4 | 3.00 (6.16) | 0.148 | 0.889 |
| Run 2 Hits | 25 | 27.40 (0.55) | 3.983 | **0.008#** |
| Run 2 False Alarms | 4 | 10.40 (7.27) | 0.804 | 0.467 |
| Run 3 Hits | 27 | 26.60 (1.14) | 0.320 | 0.382 |
| Run 3 False Alarms | 3 | 3.60 (0.89) | 0.615 | 0.572 |
| Run 4 Hits | 21 | 26.00 (2.55) | 1.790 | 0.074 |
| Run 4 False Alarms | 2 | 3.40 (3.44) | 0.372 | 0.729 |
| **Autobiographical Memory Questionnaire** |  |  |  |  |
| Episodic Cued Recall: Childhood) | 23 | 21.60 (7.02) | 0.182 | 0.864 |
|  Early Adulthood | 21 | 24.40 (4.28) | 0.725 | 0.508 |
|  Late Adulthood | 11 | 21.00 (4.74) | 1.926 | 0.063 |
|  Recent | 16 | 25.60 (3.36) | 2.608 | **0.030#** |
| Episodic Free Recall: Childhood | 24 | 25.40 (18.34) | 0.070 | 0.948 |
|  Early Adulthood | 21 | 20.00 (13.51) | 0.068 | 0.949 |
|  Late Adulthood | 7 | 18.60 (17.94) | 0.590 | 0.293 |
|  Recent | 2 | 20.60 (16.98) | 1.000 | 0.187 |
| Semantic Cued Recall: Childhood | 23 | 21.60 (1.67) | 0.765 | 0.487 |
|  Early Adulthood | 14 | 22.00 (2.83) | 2.581 | 0.061 |
|  Late Adulthood | 16 | 14.80 (5.26) | 0.208 | 0.423 |
|  Recent | 13 | 20.00 (4.18) | 1.529 | 0.101 |
| Semantic Free Recall: Childhood | 11 | 11.00 (6.12) | 0.000 | 1.000 |
|  Early Adulthood | 11 | 7.40 (2.19) | 1.501 | 0.208 |
|  Late Adulthood | 2 | 7.60 (2.51) | 2.037 | 0.056 |
|  Recent | 8 | 8.80 (2.95) | 0.248 | 0.408 |
| **Confabulation Test** |  |  |  |  |
| Card recall | 4 | 4.60 (0.55) | 0.996 | 0.376 |
| Story recall (percentage correct) | 22.22 | 97.50 (5.59) | 12.294 | **0.001** |
| Confabulation (new elements) | 4\* | NA | NA | NA |
| Questionnaire (correct responses) | 9 | 18.00 (0.71) | 11.572 | **0.001** |
| **Wisconsin Card Sorting Test** |  |  |  |  |
| Categories | 2 | 5.20 (0.84) | 3.478 | **0.025** |
| Errors | 21 | 3.00 (5.10) | 3.222 | **0.032** |
| Percentage of perseverative errors | 19.05 | 5.00 (11.18) | 1.147 | 0.315 |

**#**one-tailed analysis, due to the expected deficits in memory recognition and recall.

Significant differences are highlighted in Bold font.

\*During story recall SE produced 4 confabulatory elements. The controls did not produce any, statistical comparison was not possible.