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Neuropsychologia 43 (2005) 1362–1378

NEUROPSYCHOLOGIA

www.elsevier.com/locate/neuropsychologia

Disordered memory awareness: recollective confabulation in two cases of persistent déjà vecu

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Received 7 April 2004; received in revised form 10 December 2004; accepted 16 December 2004
Available online 11 March 2005

Abstract

We describe two cases of false recognition in patients with dementia and diffuse temporal lobe pathology who report their memory difficulty as being one of persistent déjà vecu—the sensation that they have lived through the present moment before. On a number of recognition tasks, the patients were found to have high levels of false positives. They also made a large number of guess responses but otherwise appeared metacognitively intact. Informal reports suggested that the episodes of déjà vecu were characterised by sensations similar to those present when the past is recollectively experienced in normal remembering. Two further experiments found that both patients had high levels of recollective experience for items they falsely recognized. Most strikingly, they were likely to recollectively experience incorrectly recognised low frequency words, suggesting that their false recognition was not driven by familiarity processes or vague sensations of having encountered events and stimuli before. Importantly, both patients made reasonable justifications for their false recognitions both in the experiments and in their everyday lives and these we term 'recollective confabulation'. Thus, the patients are characterised by false recognition, overextended recollective experience, and recollective confabulation. These features are accounted for in terms of disrupted control of memory awareness and recollective states, possibly following brain damage to fronto-temporal circuits and we extend this account to normally and abnormally occurring states of déjà vu and vecu and related memory experiences.

Keywords: Recollective experience; Episodic memory; Temporal lobe; Dementia; Metacognition; Déjà vu

A comparatively recent and important development in the study of human memory is the emergence of research programmes into consciousness and memory. In particular, this research has considered states of memory awareness that occur in every day life. Two interesting forms of memory awareness, which has been studied neuropsychologically as well as experimentally, are recollective experience and feelings of familiarity (Wheeler, Stuss, & Tulving, 1997; Tulving, 1985; see Gardiner & Richardson-Klavehn, 2000, for a review). Recollective experience (operationally referred to here as "remember" or "*R*" responses) occurs when a rememberer has a sense or feeling of the self in the past. Images (often visual), feelings, thoughts and verbal statements directly related to the recalled episode also often come to mind during recollective remembering. Familiarity (referred to here as "familiarity" or "*F*" responses) on the other hand does not have these features and instead is mainly characterised by a strong sense of having encountered a stimulus in the past. These two types of memory awareness have powerful functional qualities and many well established laboratory effects are differentially associated with them. For example, levels of processing, generation, self-reference, picture superiority, and many other effects are only found in remember responses. Manipulations that bring about these effects do not influence memory accompanied by feelings of familiarity (*F* responses), which instead are responsive to speed of presentation of items, their meaningfulness, and their long-term familiarity (Gardiner &

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doi:10.1016/j.neuropsychologia.2004.12.008

Richardson-Klavehn, 2000). Clearly then, these are important aspects of memory; their dysfunction following brain damage is likely to have major consequences, as we detail below in two new case studies.

Disorders of memory awareness states have been reported previously. In an important study, Schacter, Curran, Galluccio, Milberg, and Bates (1996) described patient BG who following an infarction of the right frontal lobe showed pathologically high levels of false recognition accompanied by chronically over extended recollective experience (see also Curran, Schacter, Norman, & Galluccio, 1997 for a further discussion of patient BG). Thus, BG not only incorrectly recognised items (words, pictures and sounds) he had not previously studied, but he also recollectively experienced these items. Interestingly BG did not show this pattern when required to learn a categorised list. Schacter et al. (1996) concluded that BG was only aware, when tested on uncategorised lists, that he had previously studied a list consisting of some words, pictures, or sounds. When presented with a recognition test containing old and new items, he over-extended his 'recognition' to new items, perhaps on the inference that as these were similar to the previously studied items they must all, or a majority, be old. However, if more structure was present in the encoding environment, i.e. semantic categories, then he was able to use this to discriminate old from new items at test. From the present perspective, the critical point was that when BG falsely recognised an item, he recollectively experienced that item (in contrast, see Ward et al., 1999 and Parkin, Ward, Bindschaedler, Squires, & Powell, 1999, for cases of abnormal familiarity). In other words, BG had a strong feeling of remembering even for new items and it is this phenomenon we focus on in the present study. Also, we note at this point that this abnormal recollective experience may be related to disrupted connections between frontal executive control systems and memory circuits in the temporal lobes—neuroanatomical pathways which were damaged following BG's injuries.

A related and equally interesting dysfunction of memory awareness has often been reported by patients suffering from temporal lobe epilepsy. It has long been known that seizures in the temporal lobe region give rise to memory-like hallucinations and the sensation of déjà vu (Jackson & Colman, 1898). Bancaud, Brunet-Bourgin, Chauvel, & Halgren (1994) investigated the 'dreamy state' associated with spontaneous seizure and electrical stimulation of the temporal lobes in 16 temporal lobe epileptics (all aged less than 33). Their patients report spontaneous retrieval of unconnected memories from their own past experiences alongside sensations similar to those encountered in dreaming, e.g. feelings of falling, general uneasiness, a feeling of having lost their body. Very common also were sensations of déjà vu. One patient described his habitual seizure as "... like a brief 'dream' without loss of consciousness, where suddenly he has a very strong memory of a scene that he has already lived through that nonetheless feels bizarre ... the impression of having already done what I am in the process of doing; it seems to me that I have already lived through the entire situation; with a feeling of strangeness and often fear" (Bancaud et al., 1994, p. 78). Eight of their 16 cases reported sensations of having experienced the present situation before (see Gloor, 1997, for a more detailed account of the phenomenology of epileptic experience; and Ide, Mizukami, Suzuki, & Shiraishi, 2000 for a case with recurrent déjà vu).

Some difficulty comes in discussing the sensations surrounding memory retrieval and states of awareness. Whereas the operational definitions of remembering and knowing are well established, and are empirically supported by more objective measures, difficulties arise when discussing erroneous sensations of remembering usually encompassed in the generic term déjà vu (for a full account of the range of déjà vu experiences, see Funkhouser, 1995 and Brown, 2003). Although cognitive psychology has often overlooked sensations of déjà vu, since it is so difficult to induce experimentally, it has been conceptualised as: 'any subjectively inappropriate impression of familiarity of a present experience with an undefined past' (Neppe, 1983). Other theorists have attempted to classify different forms of déjà vu. Sno and Linszen (1990), for example, describe major and minor forms of déjà vu. Minor déjà vu is transient and has a rapid onset, and can be thought of as a non-pathological, everyday memory error. Major déjà vu is 'clearly pathological and prolonged', and can be thought of as the chronic difficulties described in the temporal lobe epileptic patients above, for example. Whilst this distinction offers a good framework for discussing varieties of experience, it is unclear how it maps onto theories of memory, in particular, recollective experience. In this paper, we would like to distinguish between a déjà vu sensation, operationalised as an erroneous sense of familiarity, with an episodically mediated, erroneous sensation of recollection, déjà vecu. This definition of déjà vecu is somewhat novel, but based on Funkhouser's (1995) use of the term, emphasising the sensation of having lived through the present moment before. Given that there are two states of awareness driven by familiarity and recollection, it seems logical that there could be two separate disruptions of these states, and these are not well captured in the generic term déjà vu. To foreshadow the discussion in this paper, we believe this distinction is important, since we argue that the patients presented here show inappropriate recollection but not inappropriate familiarity.

Bancaud et al.'s epileptic patients generally had experiences of déjà vecu, that is of having 'lived through' or already experienced a current event; a state that has often been reported and commented on by writers, poets, and others (see Neppe, 1983; Brown, 2003, for reviews). More recently Ide et al. (2000) reported a similar case of persistent déjà vecu following meningitis, subsequently found to be associated with abnormalities in the right fronto-temporal region (see also Thompson, Moulin, Conway, & Jones, 2004 for a summary of other cases). Similarly, Tabet and Sivaloganathan (2001) reported a patient with an 8-week history of persistent déjà vu experiences. From the clinical description, these appear to be more like déjà vecu (false recollection) than déjà

vu (false familiarity). Their patient was subsequently found to have a high-density mass lesion in the right frontal lobe close to the midline. Finally, Petho (1985) described a case of a 12-year psychosis, the central feature of which was the delusion that the patient had lived her life before. The delusion was accompanied by intense experiences of déjà vecu and it was suggested that these might relate to temporal lobe abnormalities. Transient sensations of temporal reduplication are common in frontal head injury (see Sno, Linszen, & De Jonghe, 1992, for an account of the relationship between reduplicative paramnesia and déjà vu). For instance patient RJ's (Baddeley & Wilson, 1986) account of his car accident involves repeated crashes and passing a number of lorries. An important point of the patients reported in the present study is that their sensations are chronic and persistent. Unlike disruptive reduplicative autobiographical accounts of specific episodes in their life, they have the constant sensation of recollection.

The evidence suggests then, that feelings of déjà vecu may be mediated by fronto-temporal circuits. According to our view, experiences of déjà vecu and recollective experience are highly related. In particular, we hypothesise that the basis for déjà vecu is recollective experience of the present moment. That is to say that the person experiencing déjà vecu has a strong feeling of the self in the past just as in recollection. By this account déjà vecu is an interpretation of a feeling of pastness for the present and takes the form of the belief: "I have lived through this before". On the basis of patient BG and temporal lobe epileptics, we postulate that recollective experience emanates from circuits in the temporal lobes, which are controlled by frontal systems. In déjà vecu following brain damage we conjecture that the memory circuits which mediate recollective experience are continuously active and their operation is no longer modulated by control processes (we elaborate on this later). It is this persistent experience of recollection, this persistent feeling of the self in the past that drives the déjà vecu states. This notion of déjà vecu parallels Spatt's (2002) theory of déjà vu, which suggests that déjà vu results from erroneous activation of a recognition memory system involving the parahippocampal gyrus, a memory system responsible for sensations of familiarity (e.g. Milner, 1989). Spatt suggests that perceiving an experience whilst in this state of heightened activation gives rise to sensations of familiarity that normally accompany conscious recollection. The prefrontal cortex and the hippocampus are then recruited (cf. Milner, 1989) in a 'normal' manner, finding no 'content', which leads to the sensation of déjà vu.

Our hypothesis that recollective experience underlies déjà vecu gives rise to some specific predictions. The main prediction is that patients suffering from persistent déjà vecu should show severely disrupted recollective experience when their memory is formally tested. Feelings of familiarity on the other hand may not be disordered in these patients. In contrast, the patients studied by Parkin and co-workers (Ward et al., 1999 and Parkin et al., 1999) had left frontal lesions and suffered from over extended familiarity rather than disordered recollection. Thus, there may be some dissociation between those circuits that mediate familiarity and those that mediate recollection and the sense of the self in the past. A further prediction, based on Marshall, Halligan, and Wade's (1995) observation that déjà vu type experiences may mediate some of the confabulations occasionally encountered in frontal patients, is that persistent and pervasive recollective experience will lead to confabulations and dysfunctional behaviour in everyday life (cf. spontaneous confabulation, Schnider, 2003). In two cases, we demonstrate that chronic recollection does indeed lead to difficulties in differentiating past from present and to withdrawal from daily activities that are erroneously believed to have been performed previously.

1. Case description: patient AKP

AKP, an 80-year-old man presented to his family doctor with memory problems, and complaining of frequent sensations of what his wife described as déjà vu (actually, déjà vecu). When it was suggested that AKP attend a memory clinic for memory assessment, he told his doctor that he had already been (which was not in fact possible). The sensations of déjà vecu were much more frequent and persistent than the sensations of déjà vu sometimes seen in reduplicative paramneisas or in temporal lobe epilepsy. AKP's wife thought that the sensation of déjà vecu was practically constant, and intensified when he encountered novel stimuli. The sensation of déjà vecu was so strong that it influenced AKP's daily activities. He refused to read the newspaper or watch television because he said he had seen it before. However, AKP remained insightful about his difficulties: when he said he had seen a programme before and his wife asked him what happened next, he replied, "How should I know, I have a memory problem!" The sensation of déjà vecu was extremely prominent when he went for a walk—AKP complained that it was the same bird in the same tree singing the same song, for instance. He also read car number plates and stated that the drivers must have very regular habits always passing by at the exact same time every day. When shopping, AKP would say that it was unnecessary to purchase certain items, because he had bought the item the day before. There was also further evidence of confabulation, including the belief that he had been married three times to the same woman, with three different ceremonies around Europe. These confabulations which are based on his feeling of déjà vecu, we shall refer to as recollective confabulation and this is in order to indicate the sense of pastness that underlies them.

AKP was Polish–English bilingual. He was trained to Masters level in the UK, and was a retired engineer. On formal testing (see Table 1 for a summary), AKP had an above average IQ based on his performance on the National Adult Reading Test (Nelson & Willison, 1991). On the WAIS, he scored in the 91st percentile for digit span, 75th percentile for similarities and in the 99th percentile for picture completion. He had a mini-mental state score (MMSE; Folstein, Folstein, &

Table 1
Raw scores on standardised neuropsychological assessments and *z*-scores for experimental measures

	AKP	MA
Raw scores		
Neuropsychological examination		
Age	80	70
Mini-mental state examination	25	20
NART IQ	115	103
Story recall immediate	7	12
Story recall delayed	0[a]	0[a]
Visual recognition (hits–FPs, cut off 8)	9	2[a]
Hopkins Verbal Learning (HVLT) recall	14[a]	14[a]
HVLT recognition–hits (FPs)	12 (8)[a]	12 (5)[a]
Trails A (sec)	60	182[a]
Trails B (sec)	186	420[a]
F.A.S. (adjusted for education)	30	25
z-Scores		
Source memory task		
Hits	−3.27	.39
False positives	4.19	8.78
Correct source judgements for hits	−3.25	−15.80
Feeling of knowing, general knowledge		
Correct recall as a proportion of all attempted	−2.12	−1.63
Correct recognition	−1.39	−2.77
Guesses as a proportion of all responses	−.39	.84
Proportion of incorrect answers that are certain	−.60	−.04
Forced choice recognition		
Correct recognition	−4.21	−5.69
Guesses as a proportion of all responses	1.70	3.79
Proportion of incorrect answers that are certain	−.49	.03
Face recognition		
Correct repetitions	.77	.77
False repetitions	22.27	17.69
Correct fame	1.68	1.08
Incorrect fame	4.71	3.34

[a] Denotes scores below cut off for normal performance.

McHugh, 1975) on initial testing of 26/30 and this remained stable during the period he was assessed and 13 months later, it was still 26/30. AKP had impaired recall and recognition. On the story recall test from the Adult Memory and Information Processing Battery (Coughlan & Hollows, 1985), he had below average recall immediately (10th percentile) and after a 20 min delay, recall was zero. On the Hopkins Verbal Learning Test (HVLT; Brandt, 1991) recall was abnormal. On free recall, AKP made three intrusion errors—one prior test item, and two semantically related words. On recognition, AKP made 12/12 hits, and also made 8/12 false positive errors—five semantically related items, and three unrelated items. On tests of executive function, he showed a mixture of impairment and preservation. Verbal fluency was low normal (30 items generated to F.A.S., 11th–22nd percentile), but this needs interpreting with caution since English is not AKP's native language. The Hayling Sentence Completion task (Burgess & Shallice, 1996) showed significant executive deficits, AKP finished sentences with connected completions in the unconnected condition, e.g. 'Most cats see very well at night.' On the trail making task (Reitan, 1992), however, he showed no impairment and completed the no-shift condition in 70 s, and the shift condition in 166 s.

Structural imaging by MRI showed atrophy only to the temporal lobes and hippocampus. There was some asymmetry, with more cell loss on the left. There was no atrophy of the frontal lobes. SPECT showed reduced perfusion to the medial cortex of both temporal lobes and to the visual cortex in both hemispheres. Perfusion to the frontal lobes was well within normal limits. An awake EEG was also in normal limits, with no focal or epileptiform features.

2. Case description: patient MA

Patient MA was a 70-year-old woman who presented to her GP with her husband, who reported that it was as though his wife could predict the future. She was often convinced that things had happened before. For example, on a trip to an electrical store to mend their washing machine, MA was convinced that they had already been there to the exact same office, sat on the same chairs with the same people in the room. She also reported that she already knew news events, for example, the number of people killed in the terrorist bombing in Bali. As with AKP, she had déjà vecu for television programmes, even if they were a new series or programmes that her husband knew that she had not seen previously. When MA was on a holiday, a woman had a fit in a restaurant one evening and MA commented that that was the second fit the lady had that day. She 'remembered' seeing the lady having a fit on the beach. MA reported that she found the déjà vecu frustrating. Recollective confabulation has an important practical aspect in that it has negative consequences for action: usually an action is not undertaken because the patient believes it to have already been performed. Recollective confabulation has then a powerful impact on daily life and if these patients had not received devoted care from spouses acting as full-time carers, then residential care would have been required.

Unlike AKP, whose diagnosis was uncertain, MA was given a diagnosis of Alzheimer's disease. For a comparison and summary of the two patients' neuropsychological test scores, see Table 1. On neuropsychological examination, MA initially scored 16/30 on the MMSE, but over the next 10-month period, this ranged from 19 to 21. MA had held various jobs as a maid and in canteens and was of average intelligence as predicted by the NART.

On the WAIS, she scored in the 91 percentile for digit span, 75 percentile for similarities and in the 99 percentile for picture completion. On the story recall test from the Adult Memory and Information Processing Battery, she had below average recall immediately (10th percentile) and after a 20 min delay, like AKP, recall was zero. On the HVLT recall was abnormal, but she made no intrusion errors. On the recognition part of the HVLT, she scored 12/12 hits but also made 5/12 false positive errors—four semantically related items, and one unrelated item. On tests of executive func-

tion, she showed some impairment. Verbal fluency was low normal (25 items generated to F.A.S., 11–22 percentile). The Hayling Sentence Completion task showed significant executive deficits, MA was extremely slow and finished sentences with connected completions in the unconnected condition, e.g. 'The whole town came to hear the mayor make a fool of himself.' She also showed clear impairment on the trail making task, completing the no-shift condition in 182 s, and the shift condition in 420 s. This shows a clearer picture of executive/frontal dysfunction than AKP.

MA's EEG showed some abnormalities, with an excess of intermittent slow wave activity seen over the left temporal region and on occasions on the right side. A CT scan showed a greater degree of atrophy than expected for the patient's age. This was generalised, involving no particular portion of the brain. There was no infarct, space occupying lesion or intracranial haemorrhage.

In summary, both MA and AKP complained of feeling that they recognised everybody that they encountered, and during the course of a day, complained that many events were repeated. They both believed that they had watched television programs, listened to radio programmes, read books, newspapers, taken trips and made professional visits when they had not. These beliefs (recollective confabulations) were derived from their constant feeling of remembering. The recollective confabulations disabled them in their daily actions and they required constant care.

It was decided to conduct formal tests of recollective experience with AKP and MA partly on the basis of Schacter et al's successful use of the technique with patient BG. However, we also noted that the patients' description of their sensation of déjà vecu contained elements that suggested they were experiencing recollective experience for the present in that they justified the sensation by mentioning contextual and source information. For instance, when taking part in an interview on his condition for radio, AKP claimed that he had been interviewed for radio before. When asked to justify this, he described his appearance, the details of the furnishings and decoration in the interview room, how the interviewer was sitting, and commented that he had been asked all the same questions during his previous (non-existent) interview. Thus, we aimed to explore recollective experience in series of formal memory experiments similar to those conducted by Schacter et al. (1996) but we also conducted experimental measures of recognition and metacognition (confidence in recognition and feeling-of-knowing) and it is these we report first.

3. Experiment 1. Recognition memory and metamemory tasks

3.1. Participants

AKP and MA were compared to control groups of volunteers from the Research Institute for the Care of the Elderly's (RICE) older adult volunteer panel, with the exception of the feeling-of-knowing or FOK task (see below), where data from a previous (unpublished) study was used and the forced choice recognition task, where control data from a previously published study was used (Moulin, James, Perfect, & Jones, 2003). Volunteers were tested individually in a quiet room at the Memory Clinic. The patients were tested at home. All older adult controls were screened for dementia using the MMSE, and all achieved scores of 28 and above. They ranged in age from 62 to 82 years.

3.2. Source memory task

Nineteen older adult control participants were given an incidental memory task with the cover story that it was a test of language. Participants studied four stimuli in a grid. Two of these stimuli were pictures (from Snodgrass & Vanderwart, 1980), and the other two were words. Participants were required to select and name items from the grid on the basis of questions given by the experimenter, for instance, for the picture that depicted a trumpet, participants were required to name the item that began with 'T'. Each of the four items was a target twice, once the response was to an initial letter cue (as above) and on the other occasion, the cue was semantic, e.g. name the musical instrument. Items presented in a given format (e.g. picture) were presented in the same format on both encoding occasions. There were no errors made by any participant in this phase of the task. Twelve items in total were presented (four on each of three cards and six words and six pictures), and each was named twice. An immediate surprise memory test was then administered. In this, participants were read a list of 24 items, including 12 old items and 12 new (previously unpresented) items. They were required to report whether, in their judgement, an item was old or new and if judged old they then judged whether it had been seen as a word or a picture. If they could not remember then they were required to guess.

3.3. Feeling of knowing, general knowledge task

We were interested in whether the patients were metacognitively competent, i.e. whether they could make appropriate judgements about the content and process of their memory. One task that has been commonly used to assess metacognition is the FOK task (e.g. Lipinska & Bäckman, 1996; Nelson & Narens, 1990). In the FOK paradigm, participants judge the likelihood that they will be able to correctly recognise later a currently non-retrievable item (an FOK rating, with higher ratings suggesting higher likelihood). Following convention, a person is described as metacognitively proficient if they make higher FOK judgements for items that are ultimately recognised, and lower FOK ratings for items that are not recognised. From such tasks, it has been shown that even groups with moderate memory impairment are nonetheless cognizant of their memory processes and know which non-recallable items are likely to be recognised (e.g. Lipinska &

Backman, 1996). We used a semantic memory FOK task, in which participants were required to recall answers to general knowledge questions with instructions not to guess. For those questions they were unable to answer they made a prediction of how likely it was they would be able to recognise the correct answer. These FOK predictions were made on a three point scale: 'I am certain I will be able to recognise this answer later, I am quite sure I will be able to recognise this answer, I will have to guess.' There were 25 control participants (recruited from the University of Bristol older adults volunteer panel) who ranged in age from 52 to 77. They were screened for dementia using the MMSE. Participants were tested individually in a quiet room. They were given a test sheet with 50 general knowledge questions, e.g. What is the name of Dick Turpin's horse?, with space to write an answer or make a FOK judgement. Immediately after the recall phase, participants were given a recognition phase, where they were required to select the correct answer for every question from a set of four alternatives e.g. Black Bess, Black Beauty, Blessed Bess, Blessed Beauty.

3.4. Forced choice recognition

As for FOK, this task measured how metacognitively appropriate the patients' performance was on a memory task. Again, confidence in recognition has often been used as an index of how well people are cognizant of their memory processes (Nelson & Narens, 1990). In this task, we compared AKP and MA to existing data on forced choice recognition in older adults and in Alzheimer's disease (Moulin et al., 2003). All participants were tested individually in a quiet room. Again, this was an incidental memory task, described as a test of reading ability. Participants were instructed to read 32 words presented in a random order on flash cards. Immediately after presentation, participants were informed that this was a memory test, and a test questionnaire was administered. In this two-alternative forced choice test (2-AFC), participants had to select one word from a pair as being old. After selecting the word, they rated their confidence in their memory using the same three point scale, as used for the FOK task (certain, quite sure and guess).

3.5. Face recognition task

This task examined whether AKP's and MA's false recognition extended to tests of face recognition. Both patients' carers indicated that the déjà vecu sensations were frequently experienced for people that they met and both patients reported that unfamiliar faces were known to them (for other cases of this phenomena see Ward et al., 1999). In this task, participants were required to make two judgements about each face they were presented. First, they reported whether the face was famous and, second, they reported whether they had seen the face before during the test session. There were 54 trials presented in pseudo-random order in one long sequence, using a procedure similar to continuous recognition. Eighteen stimuli were presented once, and 18 twice. In each of these sets of 18, half of the faces were famous and half were non-famous. No face was repeated immediately after its first presentation. The famous faces were selected on the basis that they were likely to be known to older adults, e.g. Winston Churchill, Clement Atlee, etc., and the non-famous faces were drawn from a set of unfamiliar faces used in previous research work (Thompson, 2002).

4. Results

The strategy in comparing the patients with controls was to use *z*-scores. This procedure assumes that the control group forms a population of scores with a normal distribution. The *z*-score considers the difference between the patient and control group mean in units of the standard deviation. For a *z*-score of −2.5, for example, the patient's score lies two and a half standard deviations below the group mean. It is conventional for *z*-scores of over 2 to be considered as significantly different from the group mean. A separate *z*-score was calculated for each participant, comparing that person to the control group mean. This was carried out separately for each dependent variable.

4.1. Source memory task

The mean number of hits (correct recognition) on this task for controls was 97%, and for AKP it was 75% and MA 100%. Only three control participants made any false positive (FP) errors and across 19 controls only 5 FPs were made in total. In contrast, AKP made 3 FP errors and MA made 6 FP errors. It was not the case, however, that the patients made 'old' responses to all items and MA and AKP both had some correct rejections and AKP some misses. For the measure of source memory, items were scored as correct if participants correctly assigned them to their original source, i.e. word or picture. For controls, the mean source memory performance was 99%, indicating that this was an extremely easy source judgement task. However, AKP had a source accuracy of only 89%, and MA performed at chance, correctly judging the source as correct 50% of the time. MA judged all old items as being pictures. For false positives, both patients were more likely to report that they had 'seen' the false positives as pictures, although both patients used both picture and word responses. The *z*-scores (Table 1) clearly indicate that the patients make significantly more false positive errors, and that their source judgements are far less accurate than controls.

4.2. Feeling of knowing task

We considered general knowledge performance by examining the proportion correct on the four-alternative force choice recognition task. Our patients tended to have poorer general knowledge recognition than our controls, with the controls having mean performance of 80% correct, whereas

AKP had 69% correct and MA 58% (see Table 1 for *z*-scores). We also measured recall. Because we instructed participants not to guess, the level of incorrect recall is indicative of whether people are metacognitively accurate. If people do not know an answer in the recall phase, they should make no response, and wait until the recognition phase to answer that question. The recall scores suggest that AKP and MA attempt to answer questions to which they do not know the answer; the proportion of correct recall is lower than the controls (*z*-scores: AKP, −2.12; and MA, −1.63).

We were also interested in whether AKP and MA were prone to just guessing on recognition memory tasks, measured as the proportion of all responses that were guesses. The patients did not report a significantly different level of guessing than controls (*z*-scores: AKP, −.39; MA, .84). Most crucially, we were interested in whether MA or AKP were more certain of their incorrect answers than controls, as would be predicted if they were unaware of their memory operations (metamemory failure). Such a failure might explain their high propensity to make false positives on tests of episodic memory. Of the items that they judged 'certain' to recall, AKP ($z = -.60$) and MA ($z = -.04$) do not make significantly more errors than controls. That is, they make appropriate judgements of certainty, and there is the expected relationship between FOK and later memory performance: these patients are metacognitively proficient. Thus, there is no striking deficit on tests of feeling of knowing for general knowledge materials. Most importantly, the sensation of déjà vecu found in these patients does not extend to a dysfunctional feeling of knowing, these test results indicate that these patients do not make overconfident, unrealistic FOK judgements.

4.3. Forced choice recognition

AKP and MA showed poor recognition performance on the 2-AFC recognition task, scoring 66 and 56% correct, respectively. The *z*-scores (Table 1) show that their performance was well below that of controls. AKP and MA also made more guesses than controls, the mean for controls was 12% of all responses, but for AKP it was 31% and for MA, 55%. Again, the crucial analysis is the relationship between metacognitive evaluations and actual performance. We were interested, therefore, in whether the patients were inappropriately confident, with the hypothesis that over-confidence could lead to false recognition. The data do not support this hypothesis: the proportion of incorrect items that were judged 'certain this is an old item' was 20% for controls and 9% for AKP and 21% for MA. That is, these patients do not make any more metacognitive errors than controls (see Table 1 for *z*-scores).

Taken with the high levels of guessing, this suggests that AKP and MA are aware of their poor memory and, accordingly, judge past occurrence cautiously. The data do not support the idea that they are simply over confident in their memory performance. It does, however, illustrate that AKP and MA have memory problems that extend to an easy forced-choice memory task. Moderately demented Alzheimer's patients (mean MMSE score = 17.0) score a mean of 64% on this task and patients with MMSE in the same range as MA and AKP (20–25) score 71%.

4.4. Famous face task

AKP and MA showed a striking pattern of performance on this task in which they made far more false repetition judgements than controls (see Table 1 for *z*-scores). They reported that most of the stimuli had been presented before. AKP, for example, reported that only six (from 36) of the stimuli had not been presented before. MA judged that 12 of the items had not been repeated. There is a similar pattern of performance for fame judgements, with AKP judging all faces except one as being famous, and MA judging all but 7 of the 54 as famous. These marked errors of fame and repetition make it difficult to interpret the 'correct' repetition and fame judgements. Although the *z*-scores are in keeping with control group performance, their responses overall are biased towards reporting any face as famous and repeated. It is clear that this task assessing fame and repetition is a very difficult one for AKP and MA and their déjà vecu sensations of false recognition extend to judgements based on episodic (repetition) and semantic (fame) familiarity. Interestingly, both AKP and MA made justifications of their sensations of fame and repetition. For instance, AKP spontaneously reported that one face belonged to a local painter, and that you could see his village in the background, for another picture he said '... seen before, I know because his tie is lower than it should be. Does he wear artificial hair now and then?'

5. Discussion

AKP and MA both showed marked deficits of recognition memory and on all memory tasks there was an abnormally high FP rate. This was the case even for an undemanding forced choice recognition task and a continuous recognition task, where the participants were to report whether it was the first or second time they were encountering a stimulus. In addition to this, AKP and MA also showed deficits in source memory and they made a large proportion of guesses on tests of general knowledge and memory for words. Additionally, both patients showed marked difficulty with source memory – indicating particular difficulties with episodic memory.

Set against these striking deficits, both patients made proficient metacognitive evaluations of their memory performance: the relationship between their introspections and actual performance is appropriate. The general knowledge test did not produce a marked amount of errors or inappropriate feeling of knowing judgements. Thus, their deficit in memory awareness is not one that applies to all stimuli in all learning situations, and not all subjective reports of performance are inappropriate. Rather, the report of déjà vecu, or false recollection seems most strongly related to the retrieval of recently formed episodic memories. We should also like to point out

that these patients did not merely respond 'yes' to everything, as can be observed in perseveration in patients with frontal lobe damage (Hotz & Helmestabrooks, 1995). AKP and MA did make some correct rejections, and some misses. Most importantly, their performance on non-memory tasks such as verbal fluency did not indicate that these patients were merely perseverative.

On the basis of these appropriate metacognitive judgements, we turned our attention to recollective experience judgements, with the aim of investigating the phenomenological basis of these patients' false recollection. Because these patients made metacognitive evaluations that are appropriate given their actual performance, we anticipated that they would similarly make recollective experience judgements which are reflective of their subjective state.

6. Experiment 2: Recollective experience

6.1. Method

Patients AKP and MA were compared to a sample of 19 participants from the same group of older adult volunteers from RICE as used in Experiment 1. Participants were instructed that this was a memory experiment and that they would be required to try to learn a list of words. They were also instructed that they were going to be asked to report their state of awareness at a latter point.

During the study phase, participants were verbally presented 20 words in a pseudo-random order. Ten of these words were of moderately low frequency (e.g. anecdote) and 10 were of higher frequency (e.g. record). To ensure strong memory performance, and elicit a moderate level of remember responses, participants made pleasantness judgements, judging whether each word was pleasant, unpleasant or neutral. Such deep levels of processing have been found to increase *R* judgements (Java, Gregg, & Gardiner, 1997). Each word was read aloud and a pleasantness rating then made in a booklet provided. The recognition test followed immediately after the study phase. Participants were presented with the original 20 'old' words at test, plus 20 word-frequency-matched distracters, i.e. 10 high-frequency (e.g. part) and 10 low-frequency (e.g. abandonment) words as new items. The 20 old words were presented interspersed in a pseudo-random order with the 20 new items. Participants reported whether the word was old or new. When an item was judged 'old' then they indicated what the basis of their response was: remember, familiar, or guess. Participants were introduced to the different memory awareness states through the use of a vignette about a chance encounter with another person. In this, participants were told that they can sometimes remember a lot about someone when they see them on the street: who they are, where they work, when they last saw them, how they felt when they last saw them. It was also suggested that on other occasions, we merely know that we recognise the person, but we are not sure where from or who they are. The different response categories were provided on a cue card which the participants could refer to all through testing. The categories were—Remember: This is one of the words I saw/heard before. I can remember hearing it. It has a feeling of pastness. I can remember something about it when it was presented before. Familiar: This is one of the words I saw/heard before, it seems familiar to me. Guess: This is one of the words I heard before, but I'm guessing. New: This is a word I did not see before.' After the participant had made their judgement, the next test item was read to them. No feedback was given on performance.

7. Results and discussion

For the raw data and *z*-scores for the patients, see Table 2. As with the previous tasks, AKP and MA had a high FPs rate. AKP and MA both made 14 false positives (from a possible 20), with the control group making a mean of .63 (S.D. = .90). Only 8 of 19 control participants made any FPs. There was no difference in the hit rate: AKP had 20, MA 18, and the control a mean of 18.21 (2.04). Table 2 shows the *R*, *F*, and *G*-values separately for hits and false positives (with *z*-scores). Importantly, the *R* rate for hits is similar for the controls and patients. With the deep encoding of to-be-remembered items, a high level of *R* responses is usually observed: MA and AKP show the expected pattern in that they make a majority of *R* judgements (around 75%) and make less guesses than *F* responses.

In contrast, there is a marked difference in the memory awareness judgements to FPs. Since there is no contextual information present in 'memory' for FPs made following the study of unrelated items, it is usual to observe a higher proportion of *F* than *R* responses, the reverse of the pattern found for hits. This is taken as indicating that FPs arise because a new item feels familiar (Gardiner & Richardson-Klavehn, 2000). And, indeed, this was the marginally the case for the control group whose false positives were mostly *F* responses or guesses (62%). In comparison, AKP and MA assign 57 and 43% of their false positives to the *R* response category, respectively. Twenty-two percent (AKP) and 36% (MA) of the false positives were assigned to the *F* category in patients compared to 38% in the control group, and for both patients 21% of FPs were guesses, which is similar to the 25% for the control group. Crucially, both participants appeared to understand the response categories. For instance, AKP volunteered that he 'remembered' the word 'kink' because he ". . .could not hear what it was [at study – the word had to be repeated to him]", and he made a familiar judgement for the word 'part', reporting "It is so familiar it is hard to tell." The strong implication of these findings is then that both patients are using the responses appropriately, and that both suffer from chronically over extended recollective experience.

This experiment also considered memory for high and low frequency words. For false positives, we observed that AKP and MA showed abnormally high levels of false positives for

Table 2
Recollective experience

	Hits			False positives		
	R	*F*	*G*	*R*	*F*	*G*
Experiment 2						
Max. = 20						
AKP (*z*-score)	15 (−.78)	3 (1.93)	2 (3.34)	8 (14.55)	3 (3.73)	3 (5.67)
MA (*z*-score)	13 (−1.51)	4 (2.82)	1 (1.47)	6 (10.82)	5 (6.46)	3 (5.67)
Controls (S.D.)	17.16 (2.75)	.84 (1.12)	.21 (.54)	.21 (.54)	.26 (.73)	.16 (.50)
High frequency						
AKP	.70	.30	.00	.70	.30	.00
MA	.88	.00	.13	.71	.00	.29
Controls ($n = 7$ for FPs)	.92 (.10)	.06 (.07)	.02 (.06)	.43 (.53)	.29 (.49)	.29 (.49)
Low frequency						
AKP	.80	.00	.20	.25	.00	.75
MA	.60	.40	.00	.14	.71	.14
Control ($n = 1$ for FPs)	.96 (.09)	.04 (.09)	.00 (.00)	.00	1.00	.00
Experiment 3						
Max. = 30						
AKP (*z*-score)	16 (−.96)	8 (.86)	2 (1.69)	7 (13.69)	9 (4.92)	6 (10.51)
MA (*z*-score)	6 (−3.20)	15 (3.68)	3 (3.01)	7 (13.69)	8 (4.26)	3 (4.85)
Controls (S.D.)	20.29 (4.46)	5.86 (2.48)	.71 (.76)	.29 (.49)	1.57 (1.51)	.43 (.53)
High frequency						
AKP	.46	.38	.15	.23	.46	.31
MA	.25	.67	.08	.36	.55	.09
Controls ($n = 5$ for FPs)	.71 (.15)	.25 (.13)	.04 (.07)	.12 (.16)	.73 (.25)	.15 (.22)
Low frequency						
AKP	.77	.23	.00	.44	.33	.22
MA	.27	.64	.18	.43	.29	.29
Controls ($n = 2$ for FPs)	.78 (.11)	.20 (.10)	.02 (.03)	.00 (.00)	.50 (.71)	.50 (.71)

Table to show number of remember (*R*), familiar (*F*) and guess (*G*) judgments for hits and false positives, for Experiments 2 and 3. Patients values and mean for control group (figure in parenthesis is *z*-score (patients) and standard deviation (controls)).

low frequency words. The control group produced very few false positives overall, but most of these (75%) were produced for high frequency words. In fact, only one control participant made any false positives for rare words. In comparison, AKP made four false positives to rare words, and MA made seven (although both patients made more high frequency false positives than low frequency false positives). We were also interested in the differences in recollective experience for high and low frequency words. Because of overall differences in performance for hits and FPs for the two types of word, we examined the pattern of recollective experience as a proportion of all responses made. The pattern of *R*, *F* and *G* judgements for high and low frequency words (see Table 2) suggested that although it is normally the case that more FPs are made for high frequency words, and that these errors are made on the basis of familiarity, the false positives to these common words made by AKP and MA seem to be made on the basis of inappropriate recollection: 70% (AKP) and 71% (MA) of high frequency false positives were *R* judgements. This interesting pattern of results is considered more fully in the following experiment. Although these word frequency results need interpreting with caution, as so few items were used in any one category, and so few controls made any FPs, making the proportions somewhat misleading, it does indicate, at least, that the FPs made by AKP and MA are not only for easily confused common words, and not merely on the basis of familiarity.

In summary, AKP and MA have a profile of recollection for false positives which is highly similar to that usually only observed in correct recognition (hits). Because no true contextual information can be present on which to base these *R* responses to FPs, they are recollective confabulations in which AKP and MA attribute false recognition to the sensation of remembering, rather than the item merely feeling familiar. Thus, a recollective confabulation to a FP item in the present experiment is directly analogous to their recollective confabulations in everyday life in which actions and events are believed to have already been experienced because they are accompanied by the feeling of remembering. In Experiment 3, we aimed to replicate these findings and provide further support that the pattern of subjective report was a true reflection of underlying phenomenology.

8. Experiment 3: Justifications for recollective experience

This experiment replicates Experiment 2 and includes a formal manipulation check to ensure that the participants are completing the items appropriately and understand the mem-

ory awareness categories. The patients gave justifications for each of their *R* and *F* responses and these were checked for compatibility with the definitions of the response categories. This experiment also examined distinctiveness in the context of the observations of FP and word frequency in Experiment 2 in more detail. Informal reports from spouses suggested that the feelings of déjà vecu and false recognition were more pronounced for more distinct events, e.g. a funeral announcement, a radio interview, a striking piece of world news, etc., rather than mundane events, e.g. conversations with a spouse, daily routine (although even here recollective confabulations were present). For instance, neither of the patients ever refused to eat because they had just eaten, or refused to get dressed because they had already done it. AKP's wife noted that he reported sensations of déjà vecu much more in unfamiliar surroundings, and his déjà vecu was more pervasive and intense outside than in the house. At the outset of symptoms, both patients had déjà vecu for more distinct events, e.g. seeing a woman have a fit whilst on holiday, or finding money, compared to more commonplace occurrences. In itself, this suggests that the déjà vecu is not driven by a mere confusion of familiarity with memory. Instead, it seems that the more the information engaged attention, the more it gave rise to déjà vecu and the resulting recollective confabulations.

We examined this experimentally using a recognition test with high and low frequency words as in Experiment 2, with the expectation that the pattern of recollective confabulation again would be more pronounced for low frequency (distinctive) than high frequency (common) words. The use of high and low frequency words also enabled the test of how appropriate the *R* and *F* judgements were. For hits, more *R* judgements should be made for low frequency words than high frequency words, whereas more *F* judgements should be made for the less distinctive high frequency words (Arndt & Reder, 2002). The words in Experiment 2 were all moderately high (mean rating = 6.2 for high and 3.5 for low frequency, maximum = 7; Gilhooly & Logie, 1980), and in this task lower frequency words were used with a larger difference between high and low frequency words. Finally, the task in Experiment 2 was easy: with the majority of controls making no false positives. Whilst this emphasises the extreme memory difficulties AKP and MA experience, it was difficult to compare their performance with normal patterns of false positives. Thus, more items were used, in order to try to reduce ceiling (hits) and floor (FPs) effects.

8.1. Method

A randomly-selected sub-sample of seven of the same volunteer control participants was tested, with AKP's wife also taking part in this task as a control. The experiment was performed some weeks after Experiment 2. Participants were visually presented 30 words (15 high frequency and 15 low frequency) intermixed in a pseudo random order and made a pleasantness judgement for each word. This was followed immediately by a verbally presented test phase in which the 30 previously presented 'old' words and 30 word-frequency matched not previously presented 'new' words were read aloud individually in an intermixed pseudo random order. Low frequency words had a mean frequency rating of 2.7 (e.g. pampas), and the high frequency words (e.g. marriage) a mean frequency rating of 5.0 (Gilhooly & Logie, 1980). At test, participants indicated whether the word was old or new. If they reported the word as old they made a *R*, *F* or *G* judgement. The same *R*, *F*, *G* and new prompts were used as in Experiment 1. Following a *R*, *F*, or *G* response, participants indicated their justification of the response by answering the question: How do you know that this response is a remember answer/familiar answer/guess? This procedure is comparable to that used by Java et al. (1997).

9. Results and discussion

As expected, AKP and MA had an abnormally high FP rate. For high frequency words, AKP and MA made 13 (87%) and 11 (73%) false positives, respectively, whereas controls had a mean of only 2.00 (13%, S.D. = 1.73), in this task all but two of the controls made at least one false positive. For low frequency words, AKP and MA made nine (60%) and seven (47%) false positives, respectively, whereas the controls had a mean of .29 (2%, S.D. = .49). It is striking that the FP rate was so high for these obscure words (e.g. mica, sanatorium, puck), since normally, these words would be so distinctive as to leave little or no confusion as to whether they had been encountered before. Thus, this is similar to Experiment 2, in that there are FPs made to low frequency words, where controls virtually make none.

For hits, memory performance was similar for patients and controls, with AKP and MA scoring 13 and 12 for high frequency words and 13 and 12 for low frequency words. In comparison, the control hit rate was 12.67 (S.D. = 1.51) for high frequency words and 14.29 (S.D. = .95) for low frequency words. Again, this pattern is comparable to the previous experiments.

As for Experiment 2, we compared the number of *R*, *F* and *G* judgements separately for hits and false positives (see lower panel of Table 2). The control performance on Experiment 3 is similar to that on Experiment 2, with a high proportion of hits being remember responses (75%), but in this experiment with the clearer finding of far more *F* then *R* responses for false positives (65% versus 10%). The overall pattern of performance is different for the two patients. AKP has a pattern of recollective experience for hits that is comparable to his performance in Experiment 2 and comparable to controls, with 62% of hits being remembered. However, possibly as a result of justifying her responses, MA made far fewer *R* responses, even for hits (25%), making most of her judgements as familiar (63%). For false positives, the patients still make a large proportion of *R* responses to words they had not studied earlier (AKP, 32%; MA, 39%; compared to 10% for controls), but this pattern is not as pronounced as

in Experiment 2. In the present experiment, the majority of false positives (regardless of word frequency) are judged to be familiar AKP, 41%; MA, 44%).

We were again interested in the differences in recollective experience for high and low frequency words and examined the pattern of recollective experience as a proportion of all responses made. As for Experiment 2, for hits, controls show very little difference in the pattern of *R* and *F* responses for the two stimuli types, although the means are in the predicted direction (with higher *R* and lower *F* for low frequency words (.78 and .20 compared to .71 and .25). The small size of this effect is probably due to the fact that the pleasantness judgement made at encoding diminishes the effect of word frequency (distinctiveness), and through deeper encoding makes all of the stimuli somewhat more distinctive (e.g. Hischman & Ardnt, 1997). However, in controls, there is a clear difference in responses to FPs, with more familiar judgements being made for high frequency words (.73) than low frequency words (.50), as expected. As in Experiment 2, for low frequency false positives, no remember judgements were made in the control group and this is the most striking finding of the present experiment because the patients make most recollective confabulations (erroneous *R* judgements) in this category. In fact, the pattern of FP $R > F$ (as seen in our patients in Experiment 2) was only shown in the low frequency words. The patients showed a pattern of recollective experience for high frequency false positives which was similar to controls (i.e. more *F* judgements than *R*). Thus, for the patients the more distinctive items (low frequency new words) gave rise to more extensive recollective confabulation. (For further evidence of the complex effects of word frequency and pleasantness judgements on remember and familiar judgements see Reder et al., 2000; and Arndt & Reder, 2002.)

It is important to briefly note that there are some inconsistencies between the two sets of data for Experiment 2 and 3, most notably for the *R* and *F* responses made to high and low frequency words. Interestingly, control performance differs between these two tasks also, and we suggest that some of the differences shown are due to changes in methodology: there are more items, and the word frequency values are different for the high and low frequency words between experiments. Most importantly, justifications were made for the responses; this may have attenuated the exaggerated pattern seen in Experiment 2. Further inconsistencies may arise due to the fact that so few control participants made any false positives, and this may skew the proportional analysis. However, we emphasise the fact that the most striking pattern in our patients is one of marked difficulties with false positives, and at that for items and with subjective reports that are extremely uncommon in normal controls.

Most positively, as a manipulation check, there is some support for the patients using the judgements according to known patterns of performance. For hits, AKP makes more *R* judgements for low frequency (77%) than high frequency words (46%). However, MA makes the same pattern of high levels of *F* for both high (67%) and low frequency (64%) words. Some further support for the patients making appropriate judgements comes from the high frequency false positives, which as for controls and previous research, shows that AKP and MA made false positive errors mostly on the basis of these very common words merely feeling familiar.

Strong support for the patients completing the task in an appropriate manner comes from their justifications of responses. Table 3 shows some examples of justifications. As we expected, AKP and MA make plausible justifications of recollective experience, whether or not they were presented the word for study. *F* or *R* responses, the justifications referred to qualities of the words as they encountered them at study, e.g. how the word looked, what it meant, where it ap-

Table 3
Some examples of justifications of *R* and *F* judgements, Experiment 3

Stimuli	Status	Judgement	Justification
Patients			
Science	FP	*F*	Just rings a bell, a familiar word
Bargain	FP	*F*	I just feel I saw it, what else can one say?
Puck	FP	*R*	By association – change the first letter
Plaza	FP	*R*	Polish is the same, it means beach
Enigma	FP	*R*	Enigma variations, it sticks in the mind
Abode	FP	*R*	It just seems like I remember it. I cannot explain, except the symmetry at presentation
Edict	Hit	*F*	Just a feeling
Modernist	Hit	*F*	It's vague, I think I saw it before
Handkerchief	Hit	*R*	Because I have not got one on me, I always forget it
Gondola	Hit	*R*	I remember seeing this at the beginning
Polka	Hit	*R*	Polka is Polish for female
Employment	Hit	*R*	It's very long, one of the longest you showed me
Controls			
Preference	FP	*F*	I think I saw it, not remember
Employment	Hit	*F*	I think I have heard it
Arrival	Hit	*F*	I'm not sure, it just seems to me
Fissure	Hit	*R*	I saw rocks opening
Handkerchief	Hit	*R*	I thought the word is so out of the group, the others are posh
Gondola	Hit	*R*	Almost certainly, it's a romantic thing
Polka	Hit	*R*	I made an association with polka dot. It is a Polish word, it means woman

peared in the list, or an association that had been made. For familiar words, a more vague sensation was reported which did not include information about the quality of the stimulus or the study episode but instead mentioned feelings of familiarity. We are confident that the *R*, *F* and *G* judgements that were made by the patients were reflective of their subjective experience. The tendency to make plausible explanations of their erroneous sensations of remembering is the most striking part of the persistent sense of déjà vecu. We tentatively suggest that these 'recollective confabulations' generated in these experiments, are reflective of, if not identical to, their day-to-day spontaneous complaints of recollection and déjà vecu, in that they draw together perceptual experience and use it as if evidence to justify what they are experiencing has been encountered before.

10. General discussion

Patients AKP and MA have abnormal feelings of remembering in their everyday lives. They have persistent and widespread déjà vecu—the feeling of having lived through or experienced novel events previously. They feel that they have already read newspapers, magazines, books, visited health professionals, bought goods, been on walks, taken trips, etc., when they have not and this leads them into recollective confabulations, rationalisations of how they could have experienced these events and actions previously. We have demonstrated that this disorder of memory awareness extends into formal tests of recognition memory and associated awareness states. Both patients have poor recognition memory and falsely recognise items that have not been studied. This is particularly evident in their memory for faces where all faces appear familiar and many appear (falsely) famous. On the other hand, they are not overconfident in their memories and have some awareness of what they know and do not know (Experiment 1). Both are aware of their memory disorders but do not appear to have insight into their recollective confabulations. Importantly, both patients have abnormal and persistent recollective experience for items that they falsely recognise (Experiment 2 and 3). At the same time, they give response-appropriate accounts of their mental states when falsely recognising and can show normal patterns of memory awareness for items they correctly recognise (Experiment 3).

Whilst a degree of caution is necessary because the exact same pattern of results is not found in Experiment 2 as in Experiment 3, it is clear that these patients are peculiar in excessive amounts of 'remembering' novel stimuli. Even though *R* judgements are not always in excess of their own *F* judgements, their level of *R* judgements is always far greater than that of controls. The findings indicate that their memory disorder is a disorder of recollective experience and we suggest that this also underlies their everyday experiences of déjà vecu. We now consider the findings and their implications in further detail.

10.1. Recollection, familiarity, déjà vecu, and déjà vu

An alternative to our account of the findings in terms of recollective experience is that AKP and MA actually experience strong feelings of familiarity rather than recollection but misattribute these to recollective experience. However, because our patients made a high proportion of 'remember' responses to items they had never encountered before, and more importantly, gave appropriate justifications of their memory sensation, we discount the view that familiarity forms the basis of their responding or their everyday experience. Also we note their appropriate use of familiarity judgments in Experiments 2 and 3 further indicating that these patients have intact and normal experiences of familiarity. Thus, it is not merely that they feel everything to be familiar but rather that they recollectively experience the present moment. For instance, AKP's wife put it to him that it was not rational to believe that things had happened before, he agreed, but said that it just felt like they had, which was a persistent complaint of MA too. Indeed, AKP and MA both freely volunteer that current events are repeating and they are remembering them. Rather like BG (Schacter et al., 1996), they have overextended feelings of recollection but unlike BG, these cannot be easily remedied by providing more structure in the encoding environment. Rather, there is some evidence that distinctive events were found to promote rather than diminish false recognition, and over-extend recollective experience and recollective confabulation (Experiment 3) (although it should be noted that in patient MA, over extended recollective experience did appear to reduce and be replaced by over extended familiarity when each memory awareness response had to be justified, Experiment 3). Possibly, then, disorders of recollection can be attenuated by providing additional support in the retrieval environment, in at least some patients.

These patients, however, provide further insight into the nature and ways in which recollection and familiarity might arise. Processing an item might give rise to a feeling of familiarity because that item has been recently encountered (the way in which the term is used in memory awareness research). But feelings of familiarity might also arise when a frequently processed item is encountered, e.g. a known face, and similar feelings may arise yet again when an expectation is satisfied (see Gardiner & Conway, 1999, for further discussion of this). We assume that these routes to feelings of familiarity are intact in our patients and, moreover, we suggest that it is these feelings that underlie states of déjà vu but not states of déjà vecu. Our suggestion is that strong feelings of familiarity triggered by recent, frequent, or expected stimuli enter consciousness but that representations of the stimuli that triggered the feelings of familiarity do not, for whatever reason, gain conscious representation. When this occurs familiarity is experienced as déjà vu, the feeling of having been somewhere before, or related states of having felt or seen, etc., before (see Brown, 2003, for a review of déjà vu as familiarity and Spatt, 2002, for a neuropsychological interpretation of this idea).

In contrast, déjà vecu, an intense feeling of having lived through a current experience previously is, we propose, a special state that arises when recollective experience occurs for the present moment. That is to say, that when an item/stimulus undergoing on-line processing recruits or triggers the experience of recollection, the sense of the self in the past then the experience becomes one of déjà vecu. Recollective experience is frequently triggered when specific information is brought to mind and especially when episodic memories are accessed (Conway, 2001; Wheeler et al., 1997). Conway (2001, in press) proposes that one function of recollective experience is to signal to the rememberer that they are actually in a state of remembering rather than in some other state, e.g. dreaming, fantasising, imagining, etc. Thus, specific episodic information, often in the form of sensory-perceptual details derived from a past experience, triggers recollective experience and, in the undamaged brain, the individual experiences remembering.

Episodic memories themselves are accessed by the process of encoding specificity (Tulving & Thompson, 1973). According to this principle, episodic memories are 'content addressable' and when a cue that corresponds to knowledge in an episodic memory enters the retrieval process then a specific memory can be accessed and enter consciousness. As it does this it triggers recollective experience. In one model of autobiographical memory (Conway & Pleydell-Pearce, 2000), it is proposed that cues automatically access long-term memory, and in particular the autobiographical memory knowledge base, where they activate autobiographical and semantic knowledge and, occasionally, specific episodic memories. Because cues cause patterns of activation to constantly arise and dissipate over long-term memory knowledge structures then there is at any given time a high potential that specific knowledge will enter consciousness. However, when such knowledge does enter consciousness, especially if it is in the form of an episodic memory, then attention is diverted to it. This attentional cost needs to be controlled and, moreover, there is no guarantee that the cued knowledge will be relevant to the goals of current processing. Performance on most tasks would be attenuated or prevented altogether if the items processed in the task led to the persistent recall of memories, even though these items might automatically access memories. As Norman and Shallice (1986) pointed out long ago, executive processes have to 'gate' (control) output from long term memory. In the cases of AKP and MA, we believe that this process of gating or inhibiting output from long term memory has been impaired by their brain damage. It has been suggested that hippocampally-mediated episodic memory processes are 'rapid, obligatory, informationally encapsulated, and cognitive inpenetrable' (Moscovitch, 1992; p. 260). Clearly, our theory of déjà vecu in these cases resonates with this idea: when hippocampal activation of long term memory is ungated by other brain regions, output is not monitored 'to determine whether the elicited memories are veridical or even plausible' (Moscovitch, 1992; p. 261, see also Milner, 1989).

In summary, it is suggested that states such as déjà vu are mediated by feelings of familiarity arising from activated long-term knowledge, but knowledge which does not enter consciousness. More strongly it is proposed, on the basis of the findings in Experiment 2 and 3 and the patients' persistent memory awareness disorders, that the déjà vecu state arises when specific memories are activated by a currently processed cue but these memories do not enter consciousness. However, their activation level is sufficient to trigger recollective experience (which because of their brain damage now occurs in an uncontrolled way) and it is this that underlies the experience of déjà vecu. Clearly, in AKP and MA, the brain areas that mediate and modulate this process are dysfunctional, a later section considers what areas these might be and the specific form the impairment might take.

10.2. Recollective confabulation

An important point about the dysfunctional experience of recollection is that the patients, even though they have some knowledge of their memory impairment, have no option but to experience it and this leads them to act on their experience. Recollective experience no doubt serves several functions but one of the main ones may be to indicate what mental state is currently in mind (see Conway, 2001, for further discussion and, also, Wheeler et al., 1997). When we experience recollection then we have a high degree of certainty that what we have in mind is a memory and not a daydream, fantasy, or some other mental construction. Note that it does not follow from this that what we have in mind is correct or accurate and, moreover, it is perfectly possible to have recollective experience for false memories (Conway, Collins, Gathercole, & Anderson, 1996; Roediger & McDermott, 1995). This latter finding demonstrates that the experience of recollection is not an integral attribute of memories but can be experienced for other mental constructions too. Of course, we do not normally call false recognition of an item on a memory test, even when it is 'remembered', déjà vu (or vecu). In fact, for the general population, déjà vu and vecu are experienced with strong sensations of feeling like it has happened before, but knowing that it has not (Brown, 2003). In contrast, our patients are anosognosic for their inappropriate sensations.

When AKP and MA dysfunctionally experience recollection, they believed themselves to be remembering but cannot find a mental representation that could stand as a memory. We believe that what patients do instead is focus on the stimuli most closely associated with their feeling of remembering and confabulate an explanation, usually in the form of a false memory that accounts for, or justifies the feeling. This idea of confabulation arising from adapting the present situation to fit with erroneous or false memory traces is comparable to the spontaneous confabulations of autobiographical memory seen in frontal lobe patients (Schnider, 2003). AKP, for example, described how he had managed to read the newspaper, prior to his wife bringing the morning paper to him, by having arisen during the night to go and read the paper in

the newsagents. On another occasion, when his wife found a coin in the street, he described how he had earlier placed the coin in the street in order for his wife to find it. Highly similar post-hoc rationalisations were also generated by MA who presented confabulations of encoding events that could not have occurred. AKP and MA appeared anasognosic for these implausible recollective confabulations which, despite their implausibility and possibly because of the lack of insight, nonetheless guided their behaviour. This aspect of these cases, revealed formally in the justifications provided in Experiment 3 (see Table 3), demonstrates an important form of memory awareness when experience inappropriately can lead to delusion and behavioural disorder. We feel that these sorts of explanations, are, in our experience, similar to the justifications issued by confabulators. The idea that recollective experience leads to post-hoc explanations or justifications is not entirely novel. Whereas young people show a high level of concordance between think-aloud reports of processes at encoding and subsequent justifications of *R* responses, older adults have been shown to justify *R* responses on the basis of sensory experience that they did not report at encoding (Perfect & Dasgupta, 1997). Thus, this chronic recollective confabulation may be an extension of a normal memory process.

There is considerable overlap between our notion of recollective confabulation and more general theories of confabulation (for a review of confabulation see Gilboa & Moscovitch, 2002). For instance, some confabulation has long been thought to be produced to make up for deficiencies or 'gaps' in memory (e.g. Kopelman, 1999). We suggest that our patients confabulate on the basis of their continuous false recollections, in order to justify the sensation they have that they have encountered the present moment before and that they fail to control and monitor these erroneous sensations of remembering. This idea also resonates with more recent ideas that confabulation is driven by recollective experience and the need to adapt thought to ongoing reality (Schnider, 2003), and based on a failure of frontal systems co-ordinating memory output (Moscovitch & Melo, 1997).

One prominent distinction in the confabulation literature is between spontaneous and provoked confabulation (Kopelman, 1999; Schnider, vonDaniken, & Gutbrod, 1996). Our patients are typical of spontaneous confabulators, they freely and fluently describe their experience without questioning or provocation, and they act on their beliefs: it is not merely something that is generated by responding to tests of memory. However, similar to the provoked confabulations seen in Alzheimer's (e.g. Tallberg & Almkvist, 2001), these patients also produce more specific confabulations when prompted to make reports of the memory task, in this case rather than intrusion errors in free recall, the justifications of believing that they had experienced something in the present before. However, in AKP and MA, autobiographical confabulation was somewhat infrequent and limited to reduplicative episodes, and thus, we suggest secondary to the continuous sensations of recollection.

10.3. Neurological aspects of disordered recollective experience

Both AKP and MA had widespread bilateral temporal lobe pathology and although this damage was rather diffuse, some tentative observations about neurological aspects of recollective experience can be made. In an event related fMRI study, Henson, Rugg, Shallice, Josephs, & Dolan (1999) found remember responses for previously studied words to be associated with activation in anterior left prefrontal, left parietal, and posterior cingulate brain areas. Possibly, the predominance of left temporal damage in AKP and the presence of such damage in MA fits this very general view, that recollective experience is mediated by circuits in the left hemisphere. Set against this, however, is the fact that Henson et al. (1999) did not find temporal lobe activation to be uniquely associated with *R* responses nor did they find activation of right frontal sites, the area most implicated in the neuropsychological case studies. In a very similar paradigm to Henson et al., Eldridge, Knowlton, Furmanski, Bookheimer, & Engel (2000) found that recollection was associated with increased activation of hippocampal areas, suggesting that recollection is driven by rich contextual information from the hippocampus.

We suggest that there are control networks most likely sited in frontal regions which control the construction of memories and the experience of recollection (Conway, in press; Conway, Pleydell-Pearce, Whitecross, & Sharpe, 2002; Moscovitch, 1992, 2000). On the basis of AKP and MA and the temporal lobe epileptics reviewed earlier, it seems to us that the brain regions most likely to mediate the feeling of remembering are the temporal lobes. Indeed, as Bancaud et al. (1994) suggest there may be a recollective experience circuit located in the medial portion of the temporal lobes - a crucial part of what Moscovitch (1994) termed the medial temporal lobe (MTL) memory system. The MTL must, however, interact with frontal system in integrated processing sequences.

We suggest that what may underlie over extended recollective experience and the experience of déjà vecu is a disruption to this fronto-temporal circuit, the putative structure which monitors and controls experiences of recollection. The basis for this suggestion is that both our patients have damage to these fronto-temporal regions, and neuroimaging suggests that these areas are the neural correlates of recollective experience. Moreover, models of episodic memory tend to consider a hippocampal-temporal store of episodic memories which are accessed and controlled by frontal structures. Clearly, functional imaging of patients such as AKP and MA would test this suggestion.

In the meantime, it is important to note that patients with the sort of diffuse and progressive temporal lobe atrophy as AKP and MA are rather common, whereas reports of persistent déjà vu/vecu appear less so. Our findings are somewhat surprising if the recollective confabulation is based on damage to fronto-temporal regions, since one might expect

damage to this area to reduce recollective experience, rather than increase it. Whereas in epilepsy, we could conceive of over-stimulation leading to inappropriate recollection, it is not quite so clear how pronounced cell loss (as in our patients here) could lead to the same problems. Indeed, fronto-temporal damage has lead to case reports of participants with no recollective experience whatsoever. Levine et al. (1998) report the case of ML, who suffered damage to the right ventral frontal cortex and the uncinate fasciculus, a fronto-temporal band of fibres hypothesized to mediate retrieval of specific events from one's personal past. ML was densely amnesic for experiences predating head injury, but showed normal anterograde memory performance. However, when this post-injury performance was examined with the remember/know technique, ML did not episodically re-experience post-injury events, using familiarity to distinguish events he had experienced from those he had not. Thus, this patient has damage to an area which we might postulate that is damaged in our patients: however, in this case there is a complete absence of recollection, not the over-extended recollection reported in our cases here. Presumably, ML fails to recollect events because the output from the MTL recollection system implicated in temporal lobe epileptics' sensations of déjà vecu, is disconnected completely from the frontal lobes, and therefore, these sensations are not brought to consciousness. In the case of our patients, the system that gives rise to recollection is presumably active, but poorly controlled. Further research needs to address these possibilities, in particular considering the role of control mechanisms in sensations of recollection, and how they are brought to awareness.

11. Conclusions

We have described two patients, both with diffuse temporal lobe pathology who suffered from dysfunctionally over extended feelings of remembering, high levels of false recognition arising from these feelings, and what we have termed "recollective confabulation". Recollective confabulations are rationalisations that attempt to explain the powerful feelings of remembering in the absence of any memory and usually take the form of false memories, e.g. believing they had seen a television programme, read a newspaper, made a visit, etc., when they had not. The recollective confabulations were strongly held and immune to contradiction even though both patients were aware that their memories were malfunctioning. In addition to this, the persistent feelings of remembering appeared to be highly associated with frequent experiences of déjà vecu, the sensation of having previously lived through the present moment. We suggest that recollective experience and feelings of familiarity might underlie the experience of déjà vecu and déjà vu, respectively.

Although there is some difficulty in producing déjà vu in the laboratory, future research should assess this possibility. Work in progress from our own laboratory has found that déjà vu (but not déjà vecu) induced by post-hypnotic amnesia (e.g. Banister & Zangwill, 1941a,b) is characterised by a lack of recollective experience or reduced *R* responses (O'Connor, Moulin, & Conway, in press). However, it should also be possible through the comparison of patients who display false familiarity (e.g. Ward et al., 1999) and false recollection (as reported here) to disentangle the mechanisms responsible for déjà vu and déjà vecu. AKP and MA clearly have an experience which we could describe as déjà vu, this is how the carers and patients themselves talk of their difficulties. However, our investigations show that this sensation of déjà vu is nothing like the current operational definition (as erroneous familiarity, Brown, 2003). We believe that the déjà vu state needs to be fractionated further into distortions of familiarity (déjà vu) and of recollection (déjà vecu). Also, it is important to note that the *R* judgements made by our patients may be appropriate given objective performance and stimuli chracteristics, and they may be reflective of their internal processes, but they may not be wholly identical to 'normal' reports of recollective experience. Further research should explore patients' recollective confabulations in more detail, with more response categories and possibly with manipulations of source and item characteristics which enable the examination of true *R* responses and 'false' *R* responses where no real contextual information is available.

Finally, we suggest that two structures are involved in episodic remembering—one recollection system (triggered by episodic memory) and one system that controls the obligatory recollective experience generated by the activation of this system (cf. Moscovitch, 1992, 2000). It is brain damage to this latter control system which could give rise to persistent feelings of recollection. We tentatively suggest that these feelings of recollection emanate from networks in the temporal lobes, and it is the lack of control of these networks from the frontal lobes which gives rise to the problems reported here (see Moscovitch, 1992; Schnider, 2003). Our impression is that these types of disorders of memory awareness may be more common than the few cases in the literature suggest. Possibly they go unreported because sufferers and their carers regard them as too trivial, ephemeral, or too bizarre and, similarly agencies that would usually detect such disorders may not recognise them as cognitive disturbances indicating brain pathology. Our experience has been that providing an explanation to both patient and carer can alleviate a great deal of the stress that is caused by over extended recollective experience and the recollective confabulation to which it gives rise.

Acknowledgements

We are extremely grateful to AKP and his wife and MA and her husband for their participation in the experiments reported here. We are also grateful to Clare Mann and Kelly Mitchell, who helped in the collection and preparation of data for this paper. A version of this paper was presented at the International Conference on Memory, Valencia, Spain, July

2001 and the Society for Applied Research into Memory and Cognition, Aberdeen, Scotland, July 2003.

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