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False memory in schizophrenia patients with and without delusions

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ABSTRACT

Delusions are fixed 'false beliefs' and, although a hallmark feature of schizophrenia, no previous study has examined if delusions might be related to 'false memories'. We used the classic Deese–Roediger–McDermott (DRM) paradigm to compare false memory production in schizophrenia patients who were currently experiencing delusions (ED), patients not experiencing delusions (ND) and healthy control participants. The ED group recalled twice as many false-positive memories (i.e., memory for words not previously seen) as both the controls and crucially, the ND group. Both patient groups also recognised fewer correct words than the healthy controls and both showed greater confidence in their false memories; however, on the recognition task, the ED group made more false-negative (i.e. rejecting previously seen words) high confidence responses than the ND group.

1. Introduction

Fixed false beliefs (i.e., delusions) are a hallmark feature of schizophrenia presenting in virtually all persons with schizophrenia at some time in the course of their illness, (Moritz and Woodward, 2002). Understanding the cognitive basis of schizophrenia symptoms is a major goal of psychological schizophrenia research that could have implications for treatment. One important class of schizophrenia symptom is delusions — false, often bizarre beliefs about persecution, ideas of grandeur and so on.

Although delusions are perhaps the most common and central feature of schizophrenia, to date, little consensus exists about their psychological or neuropsychological basis (see Gilleen and David, 2005). Nevertheless, parallels may be drawn with the fact that healthy participants can be induced to make false recollections. The notion of false memories relates to either remembering events that never happened or remembering them quite differently from the way they happened (Roediger and McDermott, 1995). Researchers investigating false memories have used numerous techniques to demonstrate the phenomenon, although one method that has been widely used is the Deese–Roediger–McDermott (DRM) paradigm (Deese, 1959; Roediger and McDermott, 1995). This method involves presenting participants with lists of words and later testing their memories for the words. Each list of words has strong associates to a critical, target word (often the strongest associate with the list), e.g., needle was the critical unpresented target word for the following presented list: <thread, pin, eye, sewing, sharp, point, prick, thimble, haystack, pain, hurt, and injection>. Following presentation, participants are given a free recall test and after all presentations, they receive a recognition test. Roediger and McDermott found that participants recalled the unseen target word in 40% of the lists, and other unseen words in 14% of the lists.

Laws and Bhatt (2005) used the same DRM technique in healthy participants dichotomised into high and low 'delusion-proneness' groups (based on the Peters Delusional Inventory: PDI: Peters et al., 1999). They found that, as the score on this scale increased so did the number of false memories in the DRM paradigm and that participants with high delusional ideation also attached greater confidence to false- positive errors. Memory dysfunctions have been repeatedly shown within schizophrenia (Aleman et al., 1999). Specifically, studies using the DRM paradigm have established that simple memory intrusions are quite common in patients with schizophrenia (Huron and Danion, 2002; Moritz and Woodward, 2002; Elvevåg et al., 2004; Moritz et al., 2005) and that they may exhibit increased memory confidence for false memories (Moritz and Woodward, 2002; Moritz et al., 2005, 2006). In Moritz and Woodward's (2002) study, the findings suggested that the 'memory responses rated with high confidence by patients with schizophrenia contain a large number of intrusions'. More recent studies report that patients produce a greater percentage of high confidence responses that are errors (this is referred to as knowledge corruption[1] by Moritz and colleagues) and significantly so for false-negative errors (Moritz et al., 2004, 2006). Moritz et al. (2005) proposed that paranoid schizophrenia patients display a stronger tendency to trust information that is actually

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[1] In this context, Moritz et al. (2005) define knowledge as "statements or hypotheses that are held as accurate with high confidence"p.10.

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incorrect, whereas healthy controls are more cautious in their evaluation of information that turns out to be incorrect. Overconfidence in errors was thought to arise from the impaired ability to cast doubt on fallible information, whereas healthy controls were able to attach a so-called 'not trustworthy' tag to such representations. Finally, at the neurological level, patients with frontal lobe lesions show a well-documented susceptibility to false recognition/recall and problems with memory monitoring processes (e.g., Janowsky et al., 1989; Schacter and Slotnick 2004). Given that patients with schizophrenia display poor performance on tests of frontal lobe function (e.g., the Wisconsin Card Sort Test: see Laws 1999) and moreover, functional neuroimaging studies have revealed hypofrontality in patients with schizophrenia (for a review, see Hill et al., 2004), such factors may also underpin such memory distortions in patients with schizophrenia.

In the current study, we used the Roediger and McDermott (1995) paradigm to investigate recall, recognition and memory confidence in schizophrenia patients with and without delusions and healthy controls. Laws and Bhatt (2005) speculated whether their findings would relate to those of studies of patients with schizophrenia. A review of studies (using the same DRM paradigm) appears inconsistent with Laws and Bhatt (2005) insofar as schizophrenia patients display no greater incidence of false-positive errors than healthy controls (Huron and Danion, 2002; Elvevåg et al., 2004; Moritz et al., 2004; Lee et al., 2006). All of these studies examined schizophrenia patients *per se* rather than focussing specifically on comparing schizophrenia patients who are experiencing delusions (ED) or not experiencing delusions (ND). Our main aim was to determine whether schizophrenia patients with delusions show a greater tendency to create false memories compared both to schizophrenia patients without delusions and to healthy controls. Furthermore, we aimed to determine if schizophrenia patients with delusions display greater knowledge corruption than schizophrenia patients without delusions and healthy controls.

2. Method

2.1. Participants

Twenty-five patients who met Research Diagnostic Criteria (RDC) for schizophrenia participated. All had a stable chronic illness and were drawn from a sample of day-patients under the care of one of the authors (PJM). The patient sample comprised a group of patients with schizophrenia currently experiencing delusions (ED: $n=13$) and a group who were not experiencing delusions (ND: $n=12$). The presence or absence of delusions was established by a structured psychiatric interview using the Present State Examination (PSE), 9th Edition (Wing et al., 1974). The PSE rates delusions as 0, 1, or 2. A score of 0 means that no delusions are present; 1 is for 'partially held' delusions, that is delusions which the patient has questioned; and 2 refers to delusions that are held with 'full conviction'. All of the patients with delusions in the study scored 2, while all of the patients without delusions were rated as 0 and had been in stable clinical condition, free of delusions for at least 2 years (and much longer in all but one case). The ED patients were exhibiting delusions at the time of testing while the ND group showed no delusions at the time of testing (Table 1 outlines the specific delusions experienced). All patients had a current WAIS-R IQ of greater than 85 and the two patient groups did not differ on WAIS-R IQ, ($M=94.4$ vs. 97.3: $F<1$). In terms of overall severity of symptoms as measured by the Global Assessment Scale (GAS: Endicott et al., 1976), again the ED and ND groups did not differ significantly ($M=35.54$[SD = 3.8] vs. $M=35.75$ [SD = 4.5]: $F<1$).

Table 1
Delusions experienced by the patients experiencing delusions ($n=13$).

1.	There is a conspiracy against her involving a group of lesbians; people can read her mind
2.	Two witches are at the centre of a conspiracy against him
3.	He is being poisoned by his wife and perhaps other people
4.	He is a famous writer and playwright; a nurse who he met in hospital many years ago is in love with him and sends him messages through the media
5.	There is a conspiracy against him; people can read his mind
6.	Various persecutory delusions involving the Devil
7.	His memories have been removed; a famous rock singer is in love with him
8.	She is being persecuted by the Devil; she is responsible for evil acts in the world; she is pregnant with an alien baby
9.	He is being tortured by various agencies who affect his bodily functions and cause him pain from a distance
10.	People breaking into his house; he is involved with intelligence services; he has invented various things
11.	He is being watched; he has telepathic powers; he is an important religious figure
12.	He is a rock star and chess master whose memories have been removed
13.	He is in league with the Devil and is going to be killed because of this

Table 2
Demographic characteristics for patients experiencing delusions (ED), not experiencing delusions (ND) and in healthy controls.

	ED (n = 13)	ND (n = 12)	Controls (n = 20)	ANOVA
Sex (M, F)	12, 1	11, 1	15, 5	$\chi^2=2.4$, $P=0.3$
	M (SD)	M (SD)	M (SD)	
Age	46.92 (9.15)	47.08 (8.07)	44.50 (8.81)	$F<1$
NART IQ	104.77 (12.82)	109.08 (10.81)	106.50 (10.11)	$F<1$
WAIS-R IQ	94.4 (13.10)	97.3 (6.90)		$F<1$

M = mean, SD = Standard Deviation.

Twenty healthy controls did not differ significantly from the patients for estimated premorbid National Adult Reading Test Intelligence Quotient (NART IQ) (Nelson, 1982) or age (see Table 2). Hence, 25 patients (two females, 23 males) and 20 controls (five females, 15 males) participated in the study. All participants provided written informed consent and the study was approved by the local Health Service Ethics Committee. The healthy controls also completed the Peters Delusional Inventory (PDI: Peters et al 1999), which measures the level of 'delusional ideation' in healthy participants. The PDI is based on the Present State Examination (Wing et al., 1974) and consists of 40 yes–no questions examining proneness to unusual thoughts (ranging from religious beliefs to classical delusional thinking: e.g. Do you ever feel as if you are a robot or zombie without a will of your own? Do you ever feel as if you are being persecuted in some way? Do you ever feel as if there is a special purpose or mission to your life? Do you ever feel as if your insides may be rotting? Do you ever feel as if other people can read your mind?). Peters et al. (1999) have shown that the PDI has good internal consistency (Cronbach $\alpha=0.88$) and test-retest reliability (over 6–12 months was 0.82). In the current study, the controls had a mean PDI score of 5.3 [SD = 5.3] with a range from 0 to 20.

2.2. Materials/apparatus

2.2.1. False memory task (Roediger and McDermott, 1995)

The participants were shown eight consecutive lists of 15 words (from Roediger and McDermott, 1995). After each list, participants were given 1 min to recall as many items as possible. Following the presentation of all eight lists, participants were given a recognition test in which 23 words were shown one at a time and participants had to report their confidence rating in each word (whether it was old or new and whether they were sure or unsure).

Participants viewed 120 words (eight lists of 15 words) on a computer screen. Each of the eight lists consisted of associates to a critical target word (see Appendix A). The words were presented individually on the centre of the screen for 1.5 s, with a 1.5 s interval between each word. The unseen target words for each of the eight lists were <anger, black, bread, chair, cold, doctor, mountain, and needle>. For example, for the target word <Anger>, the 15 associate words presented were <mad, fear, hate, rage, temper, fury, ire, wrath, happy, fight, hatred, mean, calm, emotion and enrage>. Following presentation of the 120 words, the participants were instructed to immediately recall and write as many of the words as they could remember. The recall task was scored for: Number of Correct Recalls — the number of words that are recalled only from the lists that have been presented to the participants (out of 120 words in total). Number of Target Intrusions — the number of critical target words that have been recalled (out of eight possible words relating to the eight lists presented). Number of Other Intrusions — words that may not be obviously related to the critical target words (or the words given in the lists) or may be just idiosyncratic erroneous recalls.

The recognition test then followed and comprised 23 words: (i) eight studied words, (ii) eight target words (semantically related to the studied words) and (iii) seven unrelated words not previously studied. Participants also rated each word as to their confidence that they had seen it in the previously shown lists. A 4-point Likert Scale was used: 1 (sure old — sure that had studied the word previously), 2 (probably old — maybe previously studied), 3 (probably new) or 4 (sure new — not previously studied in the lists). Comparisons were made for the 'sure' ratings for studied items (including the words that were sure were 'old' i.e., correctly accepted and sure they were 'new' i.e., false negatives); target (containing words they were sure were new 'correctly rejected' and sure were old i.e. false positives); and unrelated words (containing words considered as new i.e., 'correctly rejected' and considered as old i.e., false positives). Finally, following the procedure outlined by Moritz et al (2004), we calculated the Knowledge Corruption Index, KCI that is, which reflects the proportion of high-confidence errors as a proportion of all high-confidence responses.