Psychiatry Research 179 (2010) 267–273

Contents lists available at ScienceDirect

Psychiatry Research

journal homepage: www.elsevier.com/locate/psychres

False memories in schizophrenia? An imagination inflation study

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ARTICLE INFO

Article history:
Received 6 July 2008
Received in revised form 1 April 2009
Accepted 12 May 2009

Keywords:
False memories
Schizophrenia
Imagination inflation
Source monitoring

ABSTRACT

Data showing how schizophrenia patients tend to be more susceptible to false memories have been rather mixed and, as far as we know, no studies have investigated whether patients with a schizophrenia spectrum disorder are particularly prone to imagination inflation effects, that is, whether repeatedly imagining an action increases the likelihood of remembering the action as having been performed. In this study, a group of patients with psychosis and a group of normal controls were asked to perform or to imagine performing simple action statements one or four times in a single study session. In a test session that occurred 24 h later, participants were instructed to discriminate whether the action statement had been carried out, imagined or whether it was new (a source monitoring task).

The primary finding was that patients were more susceptible to source-monitoring errors than controls, especially in terms of considering an imagined action as having been performed. However, both groups showed comparable levels of imagination inflation effects. Results add evidence to the hypothesis that the nature of patients' false memories may be particularly linked to poor use of source-monitoring processes.

1. Introduction

An increasing number of studies are interested in investigating whether individuals diagnosed with schizophrenia show elevated levels of false memories compared to normal controls (e.g., for a review Moritz et al., 2004). Data showing that patients with schizophrenia tend to be more susceptible to false memories is, however, rather mixed. For example, Lee et al. (2006) found that patients with schizophrenia exhibit more false memories than controls, whereas in a series of more recent studies using the so-called Deese–Roediger–McDermott (DRM) task (Roediger and McDermott, 1995), no differences were detected between patients and controls and in some cases, controls actually made more errors than patients (e.g., Elvevåg et al., 2004; Moritz et al., 2006a,b; Lee et al., 2007). One type of false memory that has received less or null attention in schizophrenia research is *imagination inflation*, namely that repeatedly imagining executing an action increases the probability that the action will be remembered as having been actually enacted. Interestingly, results reported by Elvevåg et al. (2003) might reflect a similar effect. Their participants had to remember to turn over a counter once during each trial while maneuvering a ball around an obstacle course. Patients with schizophrenia made more errors compared to controls of reporting (incorrectly) that they had turn over the counter. These false memories may reflect occasions when subjects repeatedly thought about operating the counter but did not do so and then later interpreted this thought as overt action memories.

One reason that this may be such an interesting topic is that studying imagination inflation may help clarifying the effect of imagination on memory, offer insights into aspects of reality monitoring deficits typically shown by patients with schizophrenia and help understand the cognitive mechanisms involved in the generation of this memory illusion. In particular, two main factors have been proposed to explain imagination inflation within the Source Monitoring Framework (SMF, Johnson et al., 1993), namely qualitative source encoding errors (e.g., difficulties in encoding qualitative source features that typically accompany external vs. internal events) and the appropriateness of judgement criteria used at test (e.g., familiarity vs. recollection). These two interpretations are complimentary rather than opposite, because both of them may help explain what causes this memory illusion.

According to Johnson (2006), when an imagined event is rich in sensory and contextual information (qualitative features that typically belong to external events), participants may be led to believe that the event really happened. In particular, repeatedly imagining an action that happened at a particular time, at a particular location, with a particular object, as the imagination inflation paradigm invites to do,

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doi:10.1016/j.psychres.2009.05.005

can lead people to misattribute the source of that action (e.g., Thomas et al., 2003). Basically, when imagination shares similar characteristics with perceiving, it can lead people to later falsely remember the event as having really happened. The other factor that can cause imagination inflation is the appropriateness of source-monitoring decision-making processes and criteria used at test. In particular, quick heuristic processes and snap judgements can easily lead to confusion, as is the case, for example, when one believes that something actually happened simply because it seems familiar. This hypothesis, first advanced by Jacoby et al. (1989), assumes that repeated imagination during encoding increases subjects' familiarity with the action statement. At test, participants may then *misattribute* the level of familiarity which is typically much stronger for actual events than for imagined events and, consequently, make a *did* response to repeatedly imagined actions. That is, participants claim that they heard and actually performed an action that was only imagined. Thus, repeatedly imagining an action increases participants' familiarity with the action to the extent that the level of familiarity of imagined actions resembles the level of familiarity of enacted actions and consequently, they recollect the imagined action statement as actually occurred.

This approach may be further specified by assuming that repeatedly imagining an action increases activation for imagined items to a level that typically characterises enacted actions, leading participants to misattribute source information. In particular, Balota et al. (1999), using the DRM paradigm, recently reported that frontal patients have difficulties inhibiting items that were not presented but were highly activated due to their semantic relatedness to studied items. The authors suggested that a breakdown in the attentional/inhibitory control system may produce such an increase in false memories. In addition, the imagination inflation paradigm can be considered as a situation where people are asked to differentiate between different levels of activation: one from memories of an action being performed and the other from memories of an action being imagined. It may be, in fact, that enacted and imagined items are very similar in terms of levels of activation after repeated imaginings and it is possible that a deficit in attentional/inhibitory control could produce increases in false memories pushing participants to claim that an imagined action was actually performed. Specifically, we hypothesise that patients with psychosis may have specific difficulties in controlling for different patterns of activation, thus inhibiting inappropriate responses to events repeatedly imagined. To this end, this study also investigated whether performance on the Continuous Performance Test (CPT) correlated with false memories especially in patients as compared to healthy participants. The CPT is a widely used to measure inhibition (Servan-Schreiber et al., 1996). Particularly, the frequency of cue–target sequences (e.g., A–X) was increased to introduce a strong tendency to respond to the letter X. Thus, in the non-cue condition followed by a target condition (e.g., B–X) or when the cue was followed by an invalid probe (e.g., A–Y) participants had to rely on the previous letter in order to inhibit responses to an invalid cue (X) or an invalid probe (Y).

To sum up, the primary aim of the current study was to establish whether patients with schizophrenia spectrum disorder show higher levels of imagination inflation compared to normal controls. Schizophrenia is, in fact, typically associated with both source memory deficits, especially when an external/internal discrimination is required (e.g., Rankin and O'Carroll, 1995; Keefe et al., 1999; Brébion et al., 2002; Moritz et al., 2003, 2006a,b; Brunelin et al., 2006; Peters et al., 2007) and with the tendency to rely on familiarity more often — rather than recollection-based judgements. In other words, to rely on gist-based strategies more than source information (e.g., Danion et al., 1999; Moritz et al., 2004, 2006a,b; Thoma et al., 2006). Thus, greater source-monitoring deficits and corresponding higher levels of imagination inflation would be expected in schizophrenia patients compared to controls. To this end, we used a shortened version of the typical imagination inflation paradigm first proposed by Mammarella (2007). In this study, during the initial single encoding session, action statements were enacted or imagined once or four times, whereas in the final session, participants were asked to do a source monitoring test. Finally, if false memories in patients with psychosis reflect their inability to inhibit highly activated memories, one might expect that increases in false memories should be correlated with measures of attentional/inhibition control (especially B–X ; A–Y errors).

Table 1
Characteristics of patient and control samples (means and ±S.D.).

	Patients, $n=26$ (22M, 4F)		Controls, $n=26$ (14M, 12F)	
	M	S.D.	*M*	S.D.
Age (years)	39.2	(8.4)	39.2	(8.6)
Education (years)	9.1	(2.5)	14.5	(2.5)
Handedness	60		80	

Table 2
Clinical characteristics of patients.

Diagnosis	
Schizophrenia	18
Paranoid	13
Disorganised	1
Undifferentiated	1
Residual	3
Psychosis NOS	6
Schizoaffective disorder	2
Duration of illness (years)*	15.4 (6.3)
Brief Psychiatric Rating Scale (BPRS)*	
Total	45 (12.4)
Positive symptoms	9.08 (3.3)
Negative symptoms	5 (2.3)
Neuroleptic medication**	*n.*
Atypical antipsychotic***	21
Haloperidol	7
Anticholinergics	1
Adjunctives****	24
Chlorpromazine equivalent (mg)	384 (158)

*Values are given as mean (S.D.); **two patients were receiving a combination of two neuroleptics; ***risperidone,Olanzapine, Quetiapine, Amilsupirid, Aripripazole. ****Benzodiazepines, depakote, oxcarbamazepine, sertraline, paroxetine.

2. Methods

2.1. Participants

This study included 26 patients with schizophrenia spectrum disorder and 26 non-psychiatric comparison participants (Table 1). Patients were recruited from consecutively admissions to an acute psychiatric unit. Diagnoses were made according to the DSM-IV criteria, as determined by the structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) (SCID), by a board-certified attending research team of psychiatrists. All patients [schizophrenia: paranoid ($n=13$), disorganised ($n=1$), undifferentiated ($n=1$), residual ($n=3$); psychosis NOS (not otherwise specified, $n=6$); and schizoaffective disorder ($n=2$)] were relapsing multiple-episode patients able to live in the community with a maintenance neuroleptic therapy. The mean length of illness, defined as current age minus age at onset of symptoms, was 15.4 years (S.D. 6.3). All patients were receiving neuroleptic medication at the time of the study (12 on risperidone, 7 on haloperidol, 4 on olanzapine, 2 on amisulpirid, 2 on quetiapine, 1 on aripripazole). Two patients were receiving a combination of two neuroleptics. Psychiatric symptoms were assessed using the 24-item Brief Psychiatric Rating Scale (BPRS; Ventura et al., 1993; Table 2). The clinical assessment was administered by a psychiatrists and/or licensed research psychologists who were trained to a minimum interclass correlation of 0.80 when patients were in remission, as close as possible to the administration of the neuropsychological tests. Healthy controls were chosen among employees and relatives of the hospital staff and were matched for age with patients. Exclusion criteria for healthy participants were the presence or previous presence of psychiatric disorders established by a screening questionnaire. Exclusion criteria for all participants included a history of traumatic brain injury, epilepsy, developmental disorder, diagnosable current substance abuse dependence or other known neurological condition. Handedness was assessed by the Edinburg Inventory (Oldfield, 1971), which range from −100 for strong left-handedness to +100 for strong right handedness. All participants provided written informed consent after a complete description of the study.