



Verbal memory intrusions in schizophrenia: Associations with self-reflectivity, symptomatology, and neurocognition

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ABSTRACT

Verbal memory deficits commonly observed among patients with schizophrenia include the tendency to commit intrusion errors (i.e., the incorrect recall of task-irrelevant material). Intrusion errors have been linked to deficits in self-monitoring, increased positive and disorganized symptoms, and poor executive functioning in these individuals, but such associations are inconsistent across studies. Accordingly, the purpose of the present study was to investigate further these relations in patients with schizophrenia. Seventy-nine patients with schizophrenia-spectrum disorders were grouped according to their number of intrusions on a verbal recall task (no intrusions, $n = 54$; two or more intrusions, $n = 25$) and compared on measures of metacognitive self-reflectivity (i.e., the ability to reason about one's own mental states), positive and disorganized symptomatology, and executive functioning. After controlling for overall verbal memory performance, the intrusion group exhibited less self-reflectivity and more disorganized symptoms and performed more poorly on neurocognitive measures sensitive to executive dysfunction, relative to the no-intrusion group. Hierarchical logistic regression controlling for overall verbal memory performance indicated that only self-reflectivity and disorganized symptoms significantly predicted group membership. These data suggest that verbal memory intrusions are linked to deficits in the ability to identify, organize, and reason about one's own thoughts in patients with schizophrenia.

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1. Introduction

Persons with schizophrenia have been robustly observed to experience deficits in memory for recently-presented verbal material. To date, most of this work has focused on schizophrenia patients' difficulties recalling and recognizing information presented during word lists or prose passages (Heinrichs and Zakzanis, 1998; Aleman et al., 1999; Cirillo and Seidman, 2003). These data indicate that patients with schizophrenia exhibit deficits related to storing and retrieving specific information relative to persons without psychoses. However, individuals with schizophrenia manifest another deficit related to memory as well. Specifically, they commit more intrusion errors during memory tests (Gold et al., 1992; Paulsen et al., 1995). Defined as the incorrect free recall of material not presented during the target list or passage, intrusion errors represent false recollections. These less-studied difficulties are of substantial interest given their potential

clinical implications. Intrusion errors have been linked previously with poorer social functioning and independent living skills in patients with schizophrenia (Stip et al., 2007). Furthermore, the origins of intrusive, irrelevant material into conscious awareness may be misinterpreted by individuals vulnerable to psychosis and contribute to the formation of hallucinations or delusions (Morrison, 2001).

Currently one issue of contention regards the correlates and possible causes of intrusion errors in schizophrenia. It is unclear whether intrusion errors reflect a single specific factor or a combination of general factors underlying schizophrenia. A better understanding of the correlates of intrusion errors could have theoretical and clinical implications by improving our understanding of how these difficulties emerge and by informing potential interventions. Accordingly, the current study examined whether the presence of intrusion errors was linked to three different factors which may play a role in their emergence: self-reflectivity, symptomatology, and neurocognition. Furthermore, we explored whether these different factors were uniquely related to the presence of intrusions or were merely part of a pattern of global dysfunction.

There were several reasons why we chose to study each of these different possible correlates of intrusion errors. Self-reflectivity is a dimensional construct which refers broadly to the ability to recognize

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and reason about one's own thought processes (Semerari et al., 2003). Self-monitoring, or the ability to distinguish between internally- and externally-generated information, may be thought of as a basic function of self-reflectivity (Frith, 1995; Lezak et al., 2004; Dimaggio et al., 2008; Brébion et al., 2009). Specifically, self-monitoring refers to the ability to recognize that one has thoughts and that those thoughts are one's own, and to distinguish different cognitive operations from one another. Higher levels of self-reflectivity include the ability to establish relations between mental states and behavior, and integrate one's own mental states and emotions into a coherent narrative (Semerari et al., 2003). Previous research has linked impaired self-reflectivity to poorer outcomes in multiple domains of functioning, including neurocognition (Lysaker et al., 2007; Lysaker et al., 2008), symptomatology (Lysaker et al., 2007), and work performance (Lysaker et al., in press).

Positive and disorganized symptoms are other potentially important correlates of verbal memory intrusions among patients with schizophrenia. One possibility is that positive symptoms which may reflect impairment in reality testing could be expected to contribute to a tendency to commit intrusion errors as well. Perhaps persons who are unable to detect the difference between a thought and a hallucinated voice might be unable to sort a spontaneous thought from an actual recollection. Indeed, previous research has supported a connection between intrusions and positive symptoms in patients with schizophrenia. Verbal memory intrusions have been found to be positively correlated with overall positive symptom scores (Moritz et al., 2001b), as well as delusions (Brébion et al., 2002; Rocca et al., 2006; Stip, et al., 2007) and hallucinations (Brébion, et al., 2002; Brébion, et al., 2009) among these individuals. Disorganized symptoms (e.g., disorganized thought or speech) might reflect a susceptibility to interference from internally-generated stimulus representations in the form of a deficit in the ability to inhibit representations of irrelevant stimuli (Baxter & Liddle, 1998; Brébion et al., 2002; Torres et al., 2004). In this way, relatively greater disorganization could hinder patients' abilities to effortfully recall previously-learned material, although relatively fewer studies have examined this possibility. Previous investigations have reported positive correlations between disorganized symptoms and intrusions among patients with schizophrenia (Brébion, et al., 2002; Torres et al., 2004; Subotnik et al., 2006), while others have reported no association between these measures (Moritz, et al., 2001b; Brébion, et al., 2009).

A third possibility is that neurocognitive deficits contribute to verbal memory intrusions among patients with schizophrenia. Specifically, deficits in executive functioning (i.e., reasoning, planning, decision-making, and regulating attention) have been identified as potential contributors to memory impairments in schizophrenia (Nathaniel-James et al., 1996; Perlstein et al., 2001; Salazar-Fraile et al., 2004). Executive dysfunction has been correlated with disorganized symptoms in schizophrenia as well (O'Leary et al., 2000; Nieuwenstein et al., 2001; Guillem et al., 2008). Thus, executive deficits may hinder patients' ability to suppress interference from irrelevant material or selectively attend to relevant information during verbal recall, thereby increasing the likelihood of intrusion errors during those tasks. Alternatively, executive dysfunction might exacerbate disorganized symptoms in patients with schizophrenia, which may disrupt memory processes as well.

For the current study, we divided a sample of patients with schizophrenia into those who made and those who did not make a significant number of intrusion errors. We then sought to ask two questions. First, did participants with more intrusion errors show greater difficulties with i) self-reflectivity; ii) positive and disorganized symptoms and iii) deficits in executive function, which have been hypothesized to contribute to this form of memory deficit? Second, would any of those variables which differed between the groups predict unique portions of the variance with regard to group membership? In other words, if levels of self-reflectivity, positive and disorganized symptoms and executive function differed between groups, were the relations between these variables uniquely related to intrusion errors, or were they suggestive of global dysfunction?

2. Methods

2.1. Participants

Sixty-eight adult men and 11 adult women with SCID confirmed DSM-IV diagnoses of schizophrenia ($n=51$) or schizoaffective disorder ($n=28$) participated in the present study. Participants belonged to a larger sample of persons enrolled in a larger study seeking to develop a cognitive behavioral therapy targeting working function in schizophrenia. All were recruited from the outpatient Psychiatry Service of a VA Medical Center ($n=56$) or Community Mental Health Center ($n=23$) and were in a post acute phase of illness as defined by having no hospitalizations or changes in medication or housing in the month prior to entering the study. Potential participants with mental retardation or active substance abuse were excluded from the study. The mean age and education of the sample were 46.47 (S.D.=9.23) and 12.67 (S.D.=2.14) years respectively. Mean number of lifetime psychiatric hospitalizations for the participant sample was 8.13 (S.D.=9.54), and participants' mean age at first hospitalization was 26.53 (S.D.=9.21). Thirty participants were Caucasian, 48 were African American, and one was Latino.

2.2. Instruments

2.2.1. Hopkins Verbal Learning Test (HVLT; Brandt, 1991)

The HVLT is an auditory verbal memory test designed to measure working memory, recognition memory, and learning potential. It consists of four trials of free recall of a 12-item, semantically categorized list, and a recognition test. The present study used two HVLT scores: total items recalled correctly and total intrusions across all three recall trials.

2.2.2. Indiana Psychiatric Illness Interview (IPII; Lysaker et al., 2002)

The IPII is a semi-structured interview developed to assess illness narratives. A research assistant conducts the interview which typically lasts between 30 and 60min. Responses are audio taped and later transcribed. The interview is divided conceptually into four sections. First, rapport is established and participants are asked to tell the story of their lives in as much detail as they can. Second, participants are asked if they think they have a mental illness and how they understand it. This is followed with questions about what has and has not been affected by their condition in terms of interpersonal and psychological life. In the third section participants are asked whether and, if so, how their condition "controls" their life and how they "control" their condition. Fourth, participants are asked what they expect to stay the same and what will be different in the future, again in terms of interpersonal and psychological function. For the purposes of the current study we have added an additional group of two questions into the third section which ask how much their illness is affected by others and how much others have been affected by their illness. This was added to offer another opportunity for persons to portray the world in a decentered manner. The IPII procedures differ from other psychiatric interviews in that they do not introduce content. For instance, if the participant does not mention hallucinations, the IPII interviewer does not inquire about hallucinations. The interviewer may ask for clarification when confused and may query non-directively. The tone of the interview is directed to be conversational and questions are not posed for participants to solve. The IPII thus results in a narrative of self and psychiatric challenges that can be analyzed in terms of the metacognitive capacities which are utilized during the telling of the story.

2.2.3. Metacognition Assessment Scale (MAS; Semerari et al., 2003)

The MAS is a rating scale that assesses metacognitive abilities as manifest in an individual's verbalizations. It was originally designed to detect within psychotherapy transcripts changes in the ability of persons with severe personality disorders to think about their own thinking. In consultation with the authors, the MAS has been adapted for the study of IPII transcripts (Lysaker et al., 2005). The MAS conceptualizes metacognition as the set of abilities that allows persons to understand mental phenomena and to use that understanding to tackle tasks that are sources of distress. The focus of the MAS is on metacognitive functions rather than metacognitive contents. For the purposes of this study we were interested in the "self-reflectivity" subscale of the MAS, which assesses one's capacity to comprehend one's own mental states. Scores range from 0 to 9 with higher scores reflecting the capacity to perform increasingly complex metacognitive acts central to self-reflectivity. For instance, a rating of "3" out of "9" suggests the ability to identify and distinguish different cognitive operations, a "4" indicates to the capacity to identify and distinguish one's own emotions while a "5" suggests an ability to see one's own thoughts as subjective and fallible. Interrater reliability was assessed in this study with two blind raters for 10 transcripts. Consistent with our earlier use with a different sample, good reliability was found with an intraclass correlation of 0.86 ($P<0.05$) for the "self-reflectivity" subscale. Regarding validity, other studies have linked self-reflectivity with both general awareness of illness and other objective and projective tests of self awareness (Lysaker et al., 2005; 2008; in press).

2.2.4. Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987)

The PANSS is a 30-item rating scale completed by clinically trained research staff at the conclusion of chart review and semi-structured interview. Individual items are rated on a "1" to "7" scale with higher scores reflecting greater psychopathology. For the purposes of this study, three factors derived from a factor analysis of participants involved in rehabilitation were used, corresponding to ratings for positive symptoms, negative symptoms, and disorganized symptoms (Bell et al., 1994). Good to excellent interrater

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