



## Neurocognitive and social cognitive correlates of formal thought disorder in schizophrenia patients

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### Abstract

The neurocognitive and social cognitive correlates of two types of formal thought disorder (i.e., bizarre-idiosyncratic and concrete thinking) were examined in 47 stable outpatients with schizophrenia. Both types of thinking disturbance were related to impairments in verbal learning, intrusions in verbal memory, immediate auditory memory, sustained attention, and social schema knowledge. Distractibility during an immediate memory task was associated with more frequent bizarre verbalizations but not concreteness. Impaired verbal learning rate and intrusions in verbal memory independently contributed to the prediction of bizarre responses, whereas intrusions in verbal memory and impaired immediate memory independently contributed to concrete thinking. This pattern of findings is consistent with the view that neurocognitive and, possibly, social cognitive deficits underlie these two aspects of formal thinking disturbance in schizophrenia.

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### 1. Introduction

Formal thought disorder is a multifaceted construct that encompasses a diverse set of thinking disturbances, including loose and indirect associations, overly abstract or concrete responses, illogicality, inappropriate intrusion of personal material, and unusual

word usage (Holzman et al., 1986). Thought disorder has been considered to be a core feature of schizophrenia (Bleuler, 1950) and has been described as either a positive symptom (Andreasen and Olsen, 1982) or as part of the disorganization syndrome (Liddle, 1987). Longitudinal studies have found that the severity of thought disorder in schizophrenia is moderately stable typically (Adler and Harrow, 1974; Asarnow and MacCrimmon, 1982; Docherty et al., 2003) but becomes exacerbated during acute episodes

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of illness. However, even in relatively stable outpatients, the frequency of thinking disturbance has been found to be greater among patients with schizophrenia than nonpsychiatric controls (Sponheim et al., 2003). Formal thought disorder appears to lessen in geriatric patients with chronic schizophrenia, but this might be an artifact of decreased verbal productivity in older patients (Bowie et al., 2005). This pattern of findings suggests that formal thought disorder reflects, in part, state-like exacerbations in illness but also might be associated with more stable underlying neurocognitive impairments. This conclusion is supported by longitudinal studies that have found the relationship between thought disorder and discrete neurocognitive deficits to be stronger during periods of stabilization than during acute episodes (Asarnow and MacCrimmon, 1982; Nuechterlein et al., 1986; Pandurangi et al., 1994). Neuropsychologists and experimental psychopathologists have frequently assessed the quality of thinking using proverb interpretation tasks (Lezak, 1995). Accurate interpretation of proverbs requires the individual to report the consensually recognized meaning from the symbols in the proverb. Bizarre-idiosyncratic thinking is defined as a unique response that often deviates from social norms and that may contain confused, contradictory, or illogical verbalizations. Consequently, idiosyncratic responses are typically inappropriate or inadequate in relation to the presented stimulus and are often difficult for others to empathize with or understand (Marengo et al., 1986). Assessment of thought disturbance on proverb interpretation tasks involves scoring the quality of participants' responses with standardized dimensional measures of bizarre-idiosyncratic and concrete thinking. Patients with schizophrenia perform more poorly than nonpsychiatric controls on proverb interpretation tasks, with their responses containing more idiosyncratic and concrete thinking disturbances (Carter, 1986; Sponheim et al., 2003). While patients with schizophrenia have been found to make both idiosyncratic and concrete thinking errors, these two types of thinking disturbances have been found to be only weakly to moderately related (Craig, 1973; Silverstein et al., 1993; Sponheim et al., 2003). A third construct based on proverb tasks, correct abstraction, is related to concrete thinking, but involves not only the ability to abstract beyond the concrete elements of the proverb

but also to correctly identify the consensually derived meaning of the proverb.

Despite the clinical significance and stability of thought disorder, relatively little is known about its neurocognitive underpinnings (Kerns and Berenbaum, 2002). Formal thought disorder has been found to relate to impairments in attention (Docherty and Gordinier, 1999; Harvey et al., 1998; Moser et al., 2001; Nuechterlein et al., 1986; Silverstein et al., 1991; Sowell et al., 2000), memory (Harvey et al., 1998; Nestor et al., 1998; Serper et al., 1990), and executive functions (Barrera et al., 2005; Nestor et al., 1998). However, few studies have examined multiple neurocognitive domains as correlates of formal thought disorder within the same sample. In addition, few, if any, studies have included measures of social cognition. Furthermore, the specific contributions of these measures beyond their correlations with general intellectual ability have not been adequately studied.

Prior studies of the neurocognitive contributors to bizarre-idiosyncratic thinking have produced inconsistent results. In their study of the determinants of idiosyncratic thinking, Harrow et al. (1989) noted that idiosyncratic responses are often not recognized as such by the speaker and can be reduced when the speaker is directed to focus on the quality of the response. These observations led them to hypothesize that bizarre-idiosyncratic thinking might, at least in part, result from impaired access to knowledge of what behavior is socially or contextually appropriate for a situation and from a reduced ability to monitor their verbalizations. In one of the first empirical studies designed to identify neurocognitive correlates of bizarre-idiosyncratic thinking Silverstein et al. (1993) used a battery of linguistic, complex attentional, and intellectual measures and found that 25% of the variance in idiosyncratic thinking could be explained by estimated intellectual ability and arithmetic performance. Similarly, Carpenter and Chapman (1982) reported a moderate relationship between bizarre-idiosyncratic thinking and intellectual ability. However, Sponheim et al. (2003) failed to find significant relationships between idiosyncratic thinking and intellectual ability, memory, or executive abilities.

Contradictory findings have also been found with regard to the correlates of concrete thinking. Silverstein et al. (1993) found that indices of left and right cerebral lateralization from the Luria Nebraska Neu-

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