

## Factor analytic support for social cognition as a separable cognitive domain in schizophrenia

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Received 18 August 2006; received in revised form 10 February 2007; accepted 16 February 2007

Available online 10 May 2007

### Abstract

Social cognition has received increasing attention in schizophrenia due to its theoretical relevance to core features of the disorder as well as the marked deficits in social functioning exhibited by these patients. However, there remains a need to develop and validate measures of social cognitive abilities and to demonstrate that they are constructs that are separable from non-social neurocognitive processes. In the current study, the Wechsler Adult Intelligence Scale-Revised (WAIS-R) was administered to 169 males with schizophrenia, and test results were subjected to confirmatory factor analysis (CFA) to determine if those WAIS-R subtests containing social content would form a distinct Social Cognition (SC) factor. CFA was used to evaluate various models that hypothesized an SC factor, and for comparison purposes the same models were evaluated in the WAIS-R standardization sample. Results confirmed the presence of a four-factor model that included an SC factor, as well as the more commonly reported Verbal Comprehension, Perceptual Organization, and Working Memory factors. The SC factor consisted of the Picture Arrangement and Picture Completion subtests, and demonstrated small but significant correlations with disorganization and negative symptoms, as well as with an index of social functioning. Results provide support for the validity of the SC factor as a measure of social cognition in schizophrenia, and demonstrate that at least some aspects of social cognition represent separable cognitive domains in schizophrenia.

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**Keywords:** Schizophrenia; Social cognition; Confirmatory factor analysis; Intelligence; Latent structure; Symptoms; Function

### 1. Introduction

Schizophrenia is characterized by severe impairment of neurocognitive function with differential impairment of attention, abstraction and problem solving, and learning and memory (Heinrichs and Zakzanis, 1998; Fioravanti et al., 2005; Seaton et al., 2001). More recently, evidence indicates that individuals with schizophrenia demonstrate impairments in social cognition. Social cognition broadly

refers to the diverse set of cognitive abilities that are required for social interaction (Fiske and Taylor, 1991; Ostrom, 1984) including the perception, interpretation, and generation of responses necessary to determine “the intentions, dispositions, and behaviors of others” (Green et al., 2005, p. 882; Penn et al., 1997). Some have linked social cognition to core symptoms of schizophrenia (Frith, 1992) while others have demonstrated that it is associated with poorer functional outcomes (Green et al., 2005; Penn et al., 1996). Thus, understanding abnormalities in social cognition is imperative in schizophrenia, and research to date has generally focused on emotional processing (i.e.,

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aspects relevant to perceiving and generating emotion), social intelligence (i.e., abilities relevant to inferring the intentions and beliefs of others), social perception (i.e., ability to judge roles and rules relevant to social contexts), social knowledge (i.e., awareness of roles, rules, and goals that are relevant to social situations), and attributions (i.e., how one explains the causes of positive and negative outcomes involving social behavior) (see Green et al., 2005, pp. 882–883).

Because of its theoretical and practical significance for schizophrenia, social cognition was included in the National Institute of Mental Health — Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Consensus Cognitive battery as one of seven separable neurocognitive domains. Although the MATRICS Neurocognition Committee initially did not identify social cognition as a separable cognitive domain because of a lack of factor analytic support and the absence of well-validated measures in schizophrenia (Nuechterlein et al., 2004), it was included because of the aforementioned theoretical and functional considerations. The test that was selected to represent this domain differs from other measures in the MATRICS battery in a number of important respects (e.g., not extensively validated in schizophrenia). Thus, there remains a clear need to develop new measures to assess social cognition, and to determine whether or not its various subcomponents represent constructs that are separable from more basic (non-social) neurocognitive tests, with factor analysis particularly well-suited to address this issue.

In establishing the factorial validity of social cognitive constructs from nonsocial cognitive processes, one approach is that of considering already established and well-validated measures whose items contain social content. The Wechsler Intelligence Scales may prove useful in this regard, not only because they are well-validated and commonly used in evaluation of schizophrenia, but also because their subtests assess a variety of cognitive abilities, some which are deficient in schizophrenia (Aylward et al., 1984; Goldberg et al., 1993) and others that contain social content. Indeed, for many years, Comprehension and Picture Arrangement have been used as measures of social reasoning (Rapaport et al., 1968; Schafer, 1948) and used to investigate social cognition in schizophrenia (Lipsitz et al., 1993; Shean et al., 2005). However, it remains unclear whether a combination of these subtests would form a separate social cognition construct. Early exploratory factor analysis demonstrated the WAIS was composed of three factors, namely Verbal Comprehension (VC), Perceptual Organization (PO), and memory or alternatively Working Memory (WM) (Cohen, 1957). These findings have since been replicated in many

investigations of both clinical and non-clinical populations including schizophrenia (Allen et al., 1998; Dickinson et al., 2002).

However, despite extensive factor analytic investigation and the apparent social content of some WAIS subtests, to our knowledge there has not been an attempt to identify a WAIS social cognition factor in schizophrenia using confirmatory factor analysis (CFA), although such a factor has been recently identified in autism (Goldstein et al., 2006) and the WAIS-III standardization sample (Allen and Park, 2007). CFA is preferable to exploratory factor analysis, particularly when there are expectations regarding the factor structure of the data, because it allows for testing of specific hypothesis regarding the adequacy of competing factor solutions. The current study investigates the possibility of a social cognition factor in a sample of 169 males with schizophrenia utilizing the 11 subtests from the Wechsler Adult Intelligence Scale—Revised (WAIS-R). The study represents a follow-up to a CFA investigation of the WAIS-R that identified the standard three-factor model in this sample (Allen et al., 1998), with the current goal being that of determining the validity of a fourth Social Cognition factor. It was hypothesized that a Social Cognition factor would be identified in schizophrenia, and CFA was used to test this hypothesis. Additionally, based on theoretical considerations (Frith, 1992) and prior investigations (Shean et al., 2005) it was further hypothesized that the Social Cognition factor would be differentially sensitive to neurocognitive dysfunction in schizophrenia, and have significant associations with negative and disorganization symptoms, as well as with an index of social functioning.

## 2. Methods

Participants included 169 males with schizophrenia whose mean age was 36.2 years ( $SD=7.9$ ) and had an average of 12.3 years ( $SD=1.9$ ) of education. Participants were inpatients on a schizophrenia treatment and research unit at a Veterans Hospital, and were participating in a clinical research protocol. Diagnosis of schizophrenia was established using structured clinical interviews (SCID or SADS), psychological testing, and all available information from medical and educational records. Thorough physical, neurological, and psychiatric evaluations ruled out the presence of coexisting psychiatric, physical, or neurological disorders, and patients had not used alcohol or illicit drugs during at least the 3 months prior to evaluation. Age at illness onset was 23.3 years ( $SD=5.7$ ) with a mean length of illness of 12.7 years ( $SD=7.3$ ). When tested, 18 subjects were medication free, 66 were treated with haloperidol alone, 58 with haloperidol

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