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Theory of mind in schizophrenia: The role of clinical symptomatology and neurocognition in understanding other people's thoughts and intentions

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Abstract

A wealth of studies has demonstrated that patients with schizophrenia are impaired in "theory of mind" (ToM). Here, we used a novel five-factor model of the Positive and Negative Syndrome Scale (PANSS) to test the hypothesis that selectivity of ToM deficits in schizophrenia depends on the predominating symptoms. We predicted that ToM impairments would be non-selective in patients with pronounced negative (NF) or disorganized symptoms (DF), whereas selective ToM impairment would occur in patients with predominant positive symptoms (PF). We recruited 50 patients diagnosed with schizophrenia or schizoaffective disorder and examined premorbid intelligence, executive functioning, ToM and psychopathology in comparison to a group of 29 healthy controls. Compared with healthy controls, patients performed more poorly on tasks involving executive functioning and ToM abilities. Using a novel PANSS five-factor model, we found a significant association of ToM deficits with the "disorganization" factor. Moreover, several individual PANSS items that were included within the disorganization factor correlated with impaired ToM, albeit the majority of correlations disappeared when controlled for executive functioning, and, to a lesser degree, when controlled for IQ. In addition, in the patient group we found interactions of poor ToM with symptoms belonging to the "emotional distress" factor of the PANSS. Contrary to expectations, associations of impaired ToM with positive symptoms were absent, and poor with regards to negative symptoms. This study lends further support to the assumption of differential associations of ToM deficits with individual symptoms and symptom clusters in schizophrenia.

Keywords: Schizophrenia; Heterogeneity; Disorganization; Theory of mind; PANSS five-factor model

1. Introduction

A wealth of studies has demonstrated that patients with schizophrenia have profound cognitive deficits across various domains. In the last two decades, researchers have drawn attention to cognitive processes involved in the recognition and interpretation of stimuli from other humans, commonly referred to as "social cognition" (Adolphs,

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2001). This kind of research has proved fruitful, because social cognitive problems predict impaired social competence in schizophrenia better than "non-social" cognitive deficits (Pinkham et al., 2003; Green et al., 2005; Brüne et al., 2007). One particular aspect of social cognition, known as "theory of mind" (ToM) or "mentalizing", has repeatedly been shown to be compromised in many, but not all patients with schizophrenia (reviewed in Lee et al., 2004; Brüne, 2005). ToM may best be conceptualized as the ability to reflect upon one's own and other persons' mental states including desires, beliefs, knowledge, intentions and feelings (Frith and Frith, 2003).

While a number of theoretical frameworks delineate how ToM deficits in schizophrenia are associated with individual symptoms (Frith, 1992; Hardy-Baylé, 1994), it has proven difficult to establish a link between impaired ToM and clinical subgroups of schizophrenia or individual psychotic symptoms. C. Frith (1992) has introduced a hierarchical model according to which patients with schizophrenia can be allocated to either a (1)"behavioral" (negative and disorganized syndromes) group, (2) a group of patients with paranoid symptoms, (3) patients with "passivity" symptoms (third-person hallucinations, delusions of alien control) and (4) remitted patients, which differ regarding the severity of a mentalizing deficit.

Evidence in support of this model has been mixed. It now seems to be quite well established that patients with profound negative or disorganized symptoms generally perform poorly on tasks tapping into ToM, perhaps similar to people with autistic spectrum disorders. By contrast, findings in patients with predominant positive symptoms such as delusions and hallucinations are much more ambiguous. Only one recent study has found an association of the severity of persecutory delusions and ToM deficits (Harrington et al., 2005a), and another one between the PANSS "delusion" item and ToM performance (Greig et al., 2004), whereas others have failed to confirm such a link (Langdon et al., 1997). Similarly, remitted patients who had experienced psychotic episodes have been found impaired in their ability to appreciate other people's mental states (e.g. Inoue et al., 2006) — an apparent contradiction to Frith's original model.

In a different approach Hardy-Baylé and co-workers have focused on the role of thought and language disorganization for ToM performance in schizophrenic patients (Sarfati et al., 1999; Hardy-Baylé et al., 2003). These authors have postulated that a disorganization syndrome not only underlies ToM deficits, but also a more general incapacity to process context-specific information and to generate action plans, suggesting that ToM deficits are non-selective. This model has also received partial empirical support, with executive planning deficits being independent of ToM performance in some studies (Langdon et al., 2001; Pickup and Frith, 2001).

With regards to the association of factor-analytically derived symptom clusters with ToM deficits, some study groups have used Liddle's three-dimensional model, but failed to unequivocally reveal differences in ToM performance between patients with disorganization syndromes, psychomotor poverty and reality distortion (Langdon et al., 1997; Mazza et al., 2001). Likewise, studies in which schizophrenia was subtyped using the most widely used three-factor model of the Positive and Negative Syndrome Scale (PANSS, Kay et al., 1989) produced ambiguous results with little more than correlational associations between ToM performance and positive or negative symptoms.

The problems with these approaches in ToM research have recently been summarized by Harrington et al. (2005b). These authors basically argue that subgrouping patients with schizophrenia bears the risk of Type I error, and to overlook confounding effects of lower order symptoms in hierarchically organized models. A further shortcoming of factor solutions could lie in high intercorrelations of dimensions and lack of statistical evidence for particular symptom clusters (Peralta and Cuesta, 1999). On the other hand, it is obvious that symptom clusters exist in schizophrenia and that schizophrenia spectrum disorders can be clinically subtyped in a meaningful way. In any event, with regard to research into ToM in schizophrenia, the most parsimonious interpretation of empirical findings to date suggests that disorganization of thought (and behavior), paranoid symptoms and negative syndrome are most consistently associated with ToM deficits (Harrington et al., 2005a; Sprong et al., 2007).

Both theoretical models and empirical evidence point to the possibility that ToM can be impaired in different subtypes of schizophrenia for fundamentally different reasons. For example, Murray et al. (1992) have proposed that "adult onset schizophrenia" is a heterogeneous illness, a proportion of which is caused by an ontogenetically early disruption of neuronal development. This neurodevelopmental subtype is associated with multiple cognitive and behavioral deficits among which negative and disorganized symptoms prevail. It could therefore be well that reduced social cognitive skills in patients with profound disorganized or negative symptoms are non-selective deficit due to manifold and more diffuse neurocognitive disturbances. By contrast, schizophrenia patients with prevailing positive symptoms usually show less neurodevelopmental signs and