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# Capacities for theory of mind, metacognition, and neurocognitive function are independently related to emotional recognition in schizophrenia



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## ABSTRACT

While many with schizophrenia spectrum disorders experience difficulties understanding the feelings of others, little is known about the psychological antecedents of these deficits. To explore these issues we examined whether deficits in mental state decoding, mental state reasoning and metacognitive capacity predict performance on an emotion recognition task. Participants were 115 adults with a schizophrenia spectrum disorder and 58 adults with substance use disorders but no history of a diagnosis of psychosis who completed the Eyes and Hinting Test. Metacognitive capacity was assessed using the Metacognitive Assessment Scale Abbreviated and emotion recognition was assessed using the Bell Lysaker Emotion Recognition Test. Results revealed that the schizophrenia patients performed more poorly than controls on tests of emotion recognition, mental state decoding, mental state reasoning and metacognition. Lesser capacities for mental state decoding, mental state reasoning and metacognition were all uniquely related emotion recognition within the schizophrenia group even after controlling for neurocognition and symptoms in a stepwise multiple regression. Results suggest that deficits in emotion recognition in schizophrenia may partly result from a combination of impairments in the ability to judge the cognitive and affective states of others and difficulties forming complex representations of self and others.

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## 1. Introduction

Persons with schizophrenia spectrum disorders have been widely found to experience significant difficulties recognizing the emotions other people experience. This includes problems inferring emotions in others from any of a range of verbal and non-verbal cues (Bell et al., 1997; Brüne, 2005a; Derntl et al., 2009; Hofer et al., 2009; Fiszdon and Johannesen, 2010), especially as social interactions become more complex (Baslet et al., 2009). These deficits are of both of theoretical and clinical interest in that they, by definition, represent a fundamental barrier to intimacy and

intersubjectivity (Salvatore et al., 2007, 2008) and have been found in a range of studies to uniquely predict social and vocational function above and beyond the effects of other aspects of illness, such as neurocognitive deficits (Bora et al., 2006; Bell et al., 2009).

One issue which is of increasing interest concerns whether there are different factors which might create or sustain deficits in emotional recognition (Fiszdon and Johannesen, 2010). Research has demonstrated that thinking about other people and oneself may involve semi-independent components (Lin et al., 2012; Mancuso et al., 2012). Some evidence, for instance, suggests that certain brain regions (e.g., amygdala) are activated when forming first impressions about the mental states of other people, while other areas may be active when people revise those quick judgments (Schiller et al., 2009). A slightly different set of brain

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functions may further be related to thinking about oneself and thinking about others (Heberlein et al., 2005; Mitchell et al., 2006; Saxe, 2006; Tamir and Mitchell, 2010). Other work suggests that cognitive and affective processes can be distinguished from each other when persons think about one another (Decety and Lamm, 2007; Grèzes et al. 2007; Jenkins and Mitchell, 2010).

Thus it is possible that deficits in emotion recognition may be a function of impairments in a number of semi-independent psychological and cognitive phenomena. Understanding the possible causes of emotion recognition deficits could be of considerable importance if it pointed the way to developing interventions which could address some of its root causes.

In the current study, we have sought to address this issue by examining whether a relationship exists between the capacity for emotional recognition and three sets of psychological processes that could potentially create or sustain deficits in emotional recognition. The first two processes of interest are phenomena linked to Theory of Mind (ToM), which has been found to be impaired in persons with schizophrenia (Greig et al., 2004; McGlade et al., 2008; Bosco et al., 2009). The first, mental state decoding, refers to the ability to infer the mental states of others on the basis of multichannel information (Pell et al., 2011). The second element, mental state reasoning, conversely refers to the ability to detect another person's intentions and to make inferences about the other person's knowledge or desire. This element can be examined on the basis of analysis of language in a written task or by using more nonverbal material such as cartoons (Brüne, 2005b). While there is not firm empirical work to support the distinction of these phenomenon, they are theoretically different in that the former involves noticing something about what another person is experiencing (e.g., related thoughts and feelings) while the second involves forming ideas about intentions and goals. Both mental state decoding and mental state reasoning are needed in order to expand impressions of others and to correct potentially erroneous first impressions (e.g., decide that a friendly smile hides a malicious plan).

A third possible antecedent of deficits in emotion recognition we considered is metacognitive capacity. Metacognition is a psychological function. It is a spectrum of mental activities that involves thinking about thinking, ranging from more discrete acts in which people recognize specific thoughts and feelings to more synthetic acts in which an array of intentions, thoughts, feelings, and connections between events, are integrated into larger complex representations (Lysaker and Dimaggio, 2014; Lysaker et al., 2013; Semerari et al., 2003). Whereas metacognition has been referred to as a part of social cognition (Pinkham et al., in press) one operational difference is that more synthetic forms of metacognition are assessed by analyzing discourse and not by assessing correctness of judgment. Theoretically, this approach diverges from social cognitive assessments in that it seeks to assess a kind of understanding which is greater than the sum of its parts (Lysaker and Dimaggio, 2014). For instance, the synthetic aspects of metacognitive capacity diverge from the constructs of mental state decoding and mental state reasoning in that they do not call as much for the correct detection of a discrete thought or feeling. Instead, synthetic metacognition involves the integration of those details into a whole, whose coherence, rather than absolute correctness, is of concern. Metacognition also includes the complex ability to shift back and forth from one's own perspective to the valid and differing perspectives of others.

We anticipated that deficits in some of the more synthetic aspects of metacognition might also be related to the ability to recognize affects for several reasons. First, having access to one's own thoughts and feelings may be necessary to identify how one has felt during similar experiences (Fonagy et al., 2002; Dimaggio et al., 2008). Having integrated representations of others and the

ability to see events from multiple valid perspectives may allow for an understanding of the context which influences emotional states. Mastery, or the ability to use metacognitive knowledge to respond to social and psychological dilemmas, may allow persons to manage their own anxiety when encountering others which might otherwise cloud the ability to reflect about the experiences and perspectives of other persons. Support for these possibilities can be found in studies of both non-clinical and clinical populations, suggesting that deficits in self-awareness mediate difficulties in understanding the emotions of others (Moriguchi et al., 2006; Pedrosa Gil et al., 2008; Ridout et al., 2010). Additionally, other studies have linked metacognitive deficits with other impairments which could themselves hinder emotional recognition, including decrements in intrinsic motivation and negative symptoms (Tas et al., 2012; Rabin et al., 2014; Vohs and Lysaker, 2014; McLeod et al., 2014).

To investigate these questions we administered a video-based task of emotion recognition which simulates a social exchange, the Bell Lysaker Emotion Recognition Test (BLERT; Bell et al., 1997) and three tests tapping different potential antecedents: mental state decoding using the Eyes Test (Baron-Cohen et al., 2001), mental state reasoning using the Hinting Task (Corcoran et al., 1995), and the ability to form complex representations of oneself and others using the abbreviated form of the Metacognition Assessment Scale (MAS-A; Lysaker et al., 2005; Semerari et al., 2003) to a schizophrenia spectrum disorder and psychiatric control group. We hypothesized that (i) the schizophrenia group would perform more poorly than psychiatric controls experiencing no psychosis on tests of affect recognition, mental state decoding, mental state reasoning and metacognition; that (ii) for persons with schizophrenia, performance on tests of mental state decoding, mental state reasoning and metacognition would be related to performance on the affect recognition test, and that the relationship of each of those tests would be to some degree independent of the others. The control group we chose was a group in an early phase of recovery from substance abuse but without psychosis. Previous research suggests some with substance abuse experience some deficits in social cognitive phenomenon (De Rick et al., 2009; Kim et al., 2011; Saladin et al., 2012) though the deficits in emotional recognition noted in substance abuse patients may not be as severe as those found in schizophrenia spectrum disorders (Bell et al., 1997).

Given the link of deficits in neurocognition to metacognition (e.g., Lysaker et al., 2005, 2007), affect recognition, and Theory of Mind in schizophrenia (Bell et al., 1997; Shur et al., 2008; Bora et al., 2009) we also included a test of flexibility of abstract thought to be used as a covariate. Additionally, given the possible association of positive and negative symptoms with metacognition and emotion recognition (Shamay-Tsoory et al., 2007; Shur et al., 2008; Abdel-Hamid et al., 2009; Hamm et al., 2012), we also included a measure of both to determine whether they were related to the BLERT, and if so, to assess whether that relationship was independent of ToM and metacognitive function as well.

## 2. Methods

### 2.1. Participants

Participants in the schizophrenia spectrum group were 115 adults with SCID (Spitzer et al., 1994) confirmed diagnoses of schizophrenia ( $n=70$ ) or schizoaffective disorder ( $n=45$ ) enrolled in outpatient treatment. Serving as psychiatric controls were 58 adults with SCID confirmed diagnoses of a substance use disorder in the absence of a schizophrenia spectrum disorder. All schizophrenia spectrum disorder participants were in a non-acute phase of illness, defined by no changes in medication, hospitalization, or housing within the last 30 days. Exclusion criteria were active substance dependence or a chart diagnosis of mental retardation. The schizophrenia spectrum disorder participants were recruited from either a local VA

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