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Higher-order social cognition in first-episode major depression

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ABSTRACT

Patients suffering from major depression experience difficulties in multiple cognitive faculties. A growing body of research has linked affective disorders to abnormalities in social cognition and specifically the processing of discrete emotional stimuli. However, little inquiry has gone into possible impairment in higher-order social cognition including theory of mind, social perception and metacognition. Forty-four medication-naïve patients with first-episode unipolar major depressive disorder and an equal number of matched controls were assessed by the Metacognitive Assessment Scale-Abbreviated (MAS-A), The Frith-Happé animations (FHA) and The Awareness of Social Inference Test (TASIT). Additionally, neurocognition was assessed utilizing the Cambridge Neuropsychological Test Automated Battery (CANTAB). Depressed patients showed impairment in all domains of higher-order social cognitive ability. Importantly, social cognitive variables retained their inter-group significance after controlling for possible covariates including neurocognition. Results indicate that first-episode depressed patients experience difficulties in all domains of higher-order social cognition including theory of mind, social perception and metacognition.

1. Introduction

Major depression disorder (MDD) is considered one of the most debilitating diseases worldwide and is estimated to produce the second largest disease burden by the year 2020 (Haden and Campanini, 2001). MDD is characterized by impaired functioning in multiple domains, including social and interpersonal living, adding risk to negative psychosocial outcomes and prolonged illness (Rottenberg and Gotlib, 2004; Segrin, 2010; Tse and Bond, 2004). Social cognition provides a framework for examining the capacities that underlie social impairment in patients with psychiatric illnesses including mood disorders.

Social cognition is a broad, multifaceted construct referring to capacities which allow us to understand and predict other people's metal states and behavior including that of the self (Fiske and Taylor, 1991). Disturbances of social cognition have been found to be a dominant feature in several psychiatric illnesses (Kennedy and Adolphs, 2012) and neurodegenerative disorders (Elamin et al., 2012).

To date, most research targeting social cognition in MDD has focused on discrete perceptual decoding tasks and less on higher-order social cognitive capacities, e.g. theory of mind (ToM), social perception and metacognition. Moreover, despite the complexity of the issue at hand most studies only use one, or rarely two, measures of social cognitive ability. We advocate the need for a broader assessment in order to strengthen the validity of the individual studies and to get a more comprehensive understanding of the social cognitive difficulties facing depressed patients.

On the subject of social decoding, a general emotion recognition deficit has been reported in face perception (Csukly et al., 2009; Langenecker et al., 2005) along with a mood-congruent processing bias with hyper-activation towards sad or negative facial expressions and hypo-activation towards happy facial expressions (Stuhrmann et al., 2011). Impairment is not restricted to the visual domain, as deficits in recognition and identification of affective prosody has been reported as well (Péron et al., 2011; Uekermann et al., 2008). Reports on visually more complex and ambiguous tasks such as the Reading the Mind in the Eye Test (RMET) (Baron-Cohen et al., 2001) are mixed, pointing both towards normal functioning (Kettle et al., 2008; Wolkenstein et al., 2011) and deficits in depressed patients (Baron-Cohen et al., 2001; Lee et al., 2005; Wang et al., 2008).

Few studies have sought a higher-order inferential approach to social cognition utilizing false belief tasks as part of assessing theory of mind (ToM). ToM is the mental mechanisms whereby social agents attribute mental states to each other (Grézes and de Gelder, 2009). Utilizing a simple picture sequence task, depressed patients have been found to be as able as healthy controls in

Table 1

Demographic and clinical characteristics of first-episode MDD and control participants.

	MDD (*n* = 44)	Controls (*n* = 44)
DEMOGRAPHICS		
Female gender, *n* (%)	33 (75)	33 (75)
Age in years, Mean ($\pm$ S.D.)	32.5 (12.0)	32.9 (12.0)
Education attained, Mean ($\pm$ S.D.)	12.4 (2.15)	12.9 (1.93)
CLINICAL CHARACTERISTICS		
Severity of depression (HamD-17), Mean ($\pm$ S.D.)	22.3 (3.8)	1.6 (1.4)
Severity of anxiety (BAI), Mean ($\pm$ S.D.)	20.9 (3.7)	2.5 (3.7)

Note: S.D. = standard deviation, HamD-17 = Hamilton Depression Rating Scale (17-item version), BAI = The Beck Anxiety Inventory.

solving first-order ToM tasks (i.e. 'I think that he thinks that') but less able in regard to the more complex second-order ToM task ('I think that he thinks that she thinks that') (Inoue et al., 2004). Importantly, second-order ToM deficits have been shown to be a predictor for risk of relapse in MDD (Inoue et al., 2006). Recently, video based tests have been introduced (Dziobek et al., 2006) encompassing ToM tasks into a social perceptual paradigm putting demand on subjects to infer meaning from the behavior of others drawing on a multifold of cues (e.g. facial display of basic emotions or speech prosody) (Lipton and Nowicki, 2009). In one study social perceptual deficits in a depressed sample were reported (Wolkenstein et al., 2011) whereas none were found in a second study specifically assessing chronically depressed patients (Wilbertz et al., 2010).

Least studied within the realm of higher-order social cognition is the relationship between depression and metacognition or related constructs such as mentalization (Bateman and Fonagy, 2004). Metacognition builds upon the aforementioned skills and essentially mark the capacity to reflect and reason about the mental and affective states of oneself and others, moreover, utilizing such understanding to solve problems and master subjective suffering (Dimaggio and Lysaker, 2010; Semerari et al., 2003).

A single case study (Carcione et al., 2008), demonstrated how the metacognitive capabilities of a young depressed woman improved rapidly as she began to recover from her depressed state. Concurrently, a pilot study by Fischer-Kern et al. (2008) found evidence of impaired mentalizing capacity in depressed patients. A first controlled study by Taubner et al. (2011) was not able to replicate the results previously reported, finding no impairment in metalizing capacity in chronically depressed patients compared to healthy controls. However, in the most recent controlled study, Fischer-Kern et al. (2012), assessed 46 female inpatients diagnosed with MDD reporting an marked impairment in metalizing capacity in the depressed sample. Moreover, research in the field of alexithymia has drawn attention to impairments pertaining to the self-directed pole of metacognition finding that difficulties in identifying and describing subjective feelings are associated with a depressed state (Honkalampi et al., 2000; Saarijärvi et al., 2001). Finally, neuroimaging studies of depressed patients point to abnormalities in neural networks known to support higher-order social cognition (Fitzgerald et al., 2008; Videbech et al., 2002; Ravnkilde et al., 2003). Most importantly, these include the medial prefrontal cortex (mPFC), the temporoparietal junction (TPJ) and the posterior superior temporal sulcus (pSTS) (Amodio and Frith, 2006; Shamay-Tsoory, 2011). Collectively, these areas of relevance for social cognition have been dubbed the 'mentalizing network' (Blakemore, 2008).

This study aimed at investigating higher-order social cognition in first-episode MDD. To approach this domain we assessed central tenants within social cognition: ToM, social perception and metacognition. We hypothesized that individuals in the depressed sample

would perform significantly worse than healthy controls across all social cognitive tasks. Furthermore, we anticipated that these variables would be moderately related to one another but not so strongly correlated as to suggest they assessed entirely overlapping phenomenon. Finally, we were interested in assessing neurocognitive functioning, which we expected to be impaired in the test group. Importantly, this would enable us to test the robustness of any possible group differences in social cognition by adjusting for neurocognition as a confounding factor.

2. Methods

2.1. Participants and procedure

A total of 88 participants took part in the study. Forty-four outpatients were matched with an equal number of healthy controls. Groups were pairwise matched according to gender, age and level of education. See Table 1 for demographic characteristics. All subjects had Danish as first language. Patients were recruited from general practitioners in the Central Denmark Region. Inclusion criteria for the test group were (a) first-episode major depression as primary diagnosis, (b) moderate to severe MDD, and (c) psychotropic drug-naïve. Only recruiting drug-naïve patients were prioritized in order to rule out possibly psychotropic effects on cognitive ability. Exclusion criteria were substance use disorder and neurological illness or head trauma. Healthy participants were recruited via newspaper advertisements and offered a small monetary compensation if included in the study. Criteria for eligibility were no history of psychiatric or neurological illness or head trauma. Participants were assessed at a time-of-day similar to his or her match. Test duration was approximately two hours. A trained clinician assessed participants for psychiatric disorders including severity of depressive and anxiety symptoms. Confirmation of MDD diagnosis and severity was subsequently obtained through an independent clinician.

The study was approved by the local scientific ethics committee (id. no.: 20100161) and the Data Protection Agency. All participants gave informed consent.

2.2. Measures

2.2.1. Psychiatric assessment

Axis I and Axis II diagnoses were assessed with the Mini International Neuropsychiatric Interview (MINI) (Sheehan et al., 1998) and The structured clinical interview for DSM-III-R personality disorders (SCID-II) (Spitzer et al., 1989). Severity of depression and anxiety was assessed using the 17-item Hamilton Depression Rating Scale (HamD-17) (Hamilton, 1967) and The Beck Anxiety Inventory (BAI) (Beck et al., 1988). Patients with a confirmed depressive disorder was reassessed for diagnosis and severity by a physician revealing good reliability on the HamD-17 (intraclass correlation coefficient (ICC), $\rho = 0.71$).

2.2.2. Social cognition

The Frith-Happé animations (FHA) (Abell et al., 2000) are short video sequences depicting animated shapes; a red and a blue triangle in a contained space. Half the animations are scripted to evoke mental state attribution by their kinetic properties (ToM animations). The ToM animations depict a distinct story (e.g. "the small triangle mimicking the big triangle and being told off for it"). The other half of the clips are designed as to give the impression of random movements with no overarching storyline (random animations). After viewing each clip, subjects were asked to describe what was happening in the animation. The test can be characterized as an on-line ToM task targeting mental state attribution. The verbal description given after each clip was transcribed for later coding along two primary dimensions: 'intentionality', and 'appropriateness'. The intentionality score sought to capture the degree of appreciation of mental states. The variable had a range of 0 (nondeliberate action) to 5 (deliberate action with the goal of affecting others mental state). The appropriateness score reflected how well the overarching storyline was captured with scores ranging from 0 to 3. On all scales, a higher score represents a higher capacity. Additionally, a secondary dichotomous scale was utilized to capture whether appropriate terms had been used for each particular animation (target terms). Responses to the ToM animations were treated as primary outcome measures. For a comprehensive description of scoring rules see Castelli et al. (2000) and Russell et al. (2006). Inter-rater reliability was assessed with one blind rater revealing fair to excellent reliability across individual scales (intentionality for random animations, $\rho = 0.69$; intentionality for ToM animations, $\rho = 0.41$; accuracy for ToM animations, $\rho = 0.70$; target for random animations, $\rho = 0.80$; and target for ToM animations, $\rho = 0.42$).

The Awareness of Social Inference Test (TASIT – Minimal subtest – part 2 A – Danish version) (McDonald et al., 2003) was used to assess social perception and specifically subjects' ability to interpret naturalistic social interactions. The test comprises short video vignettes of exchanges between actors. Alternating between the clips, the actors exhibit sincere, sarcastic or paradoxical sarcastic communication. Paradoxical sarcasm