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Research paper

Theory of mind in remitted bipolar disorder: Younger patients struggle in tasks of higher ecological validity

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ABSTRACT

Background: To date, research concerning Theory of Mind (ToM) in *remitted bipolar disorder (rBD)* has yielded inconclusive results. This may be a result of methodological shortcomings and the failure to consider relevant third variables. Furthermore, studies using ecologically valid stimuli are rare. This study examines ToM in rBD patients, using ecologically valid stimuli. Additionally, the effects of *sad mood induction (MI)* as well as of *age* and *gender* are considered.

Methods: The sample comprises $N = 44$ rBD patients (rBDPs) and $N = 40$ healthy controls (HCs). ToM decoding is assessed using the *Cambridge Mindreading Face-Voice-Battery* (CAM) and ToM reasoning using the *Movie for the Assessment of Social Cognition* (MASC). Both tasks were divided into two parts to conduct one part with and one without MI.

Results: While across the whole sample there was no evidence that rBDPs and HCs differed in ToM decoding or reasoning, in the younger subsample (age < 45) rBDPs performed worse than HCs in ToM decoding. While *MI* negatively influenced reasoning in both groups, *gender* had no effect.

Limitations: Most patients in this study had a high level of social functioning, limiting the generalizability of the results.

Conclusion: As important social steps have to be undertaken before middle-age, the decoding deficits in younger rBDPs might be of particular importance not only for social functioning but also for the course of illness. Furthermore, this age-related deficit may explain the inconclusive findings that have been reported so far.

1. Introduction

Successful social behavior is important for well-being and mental health (Adolphs, 2009). It requires a range of complex processes which are referred to as *social cognition* – meaning all components of cognition that explain complex social phenomena (Frith, 2008). One aspect of social cognition is *Theory of Mind (ToM)* - the ability to interpret and predict others' behavior by attributing mental states such as feelings, desires, and opinions (Fonagy et al., 2005; Premack and Woodruff, 1978). According to Sabbagh (2004), ToM encompasses two processes: first, *decoding* of mental states from observable social information. That includes *facial emotion recognition* (FER) – the ability to recognize and appraise others' emotions by processing relevant facial cues (Green et al., 2008; Lawlor-Savage et al., 2014; Samamé, 2013). Second, *reasoning* about mental states by integrating observable and further contextual information.

Deficits in social cognition may lead to impaired communication or inadequate coping with problematic social situations. Poor social functioning and interpersonal problems have been frequently reported in patients with *bipolar disorder (BD)* (e.g. Depp et al., 2010; Hoertnagl et al., 2014; MacQueen et al., 2001). One possible explanation for these findings may relate to social cognition deficits (Samamé, 2013). Indeed, studies have found impaired FER (e.g. Soeiro-de-Souza et al., 2012; Summers et al., 2006) and ToM reasoning (e.g. Bora et al., 2016; Kerr et al., 2003; Wolf et al., 2010) in BD patients in acute depressive or manic mood states. There is also emerging evidence for persisting deficits in *remitted BD (rBD)* in both FER (e.g. Bio et al., 2013; Lahera et al., 2008; Neves et al., 2015) and reasoning (Lahera et al., 2008; Martino et al., 2011). However, findings are inconsistent.

Studies investigating FER in rBD have often used standardized static photographs of facial expressions of basic emotion, such as the stimuli created by Ekman and Friesen (1976). Although many of these studies

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suggest that *patients with rBD (rBDPs)* perform worse than *healthy controls (HCs)* in the recognition of either specific or all basic emotions (e.g. Bio et al., 2013; Derntl et al., 2009; Hoertnagl et al., 2011; Lahera et al., 2008; Martino et al., 2011; Neves et al., 2015) some of them do not (e.g. Bora et al., 2005; Hulvershorn et al., 2012; Shamay-Tsoory et al., 2009; Vaskinn et al., 2007). Furthermore, given that in everyday life we are rarely confronted with fully developed facial emotional expressions, but rather with subtle expressions, these studies lack ecological validity. Studies using morphed pictures from facial emotional expressions have tried to address this issue but also yielded inconsistent findings (Baez et al., 2013; Venn et al., 2004). Moreover, ToM decoding refers to the recognition of complex rather than of pure basic emotions (Damasio, 2014). Interestingly, there are only a few studies investigating the recognition of complex emotions. Using the *Reading the Mind in the Eyes Task* (RMET; Baron-Cohen et al., 2001) Bora et al. (2005) found impaired FER in rBD, whereas others have not (Martino et al., 2011; Purcell et al., 2013). Again, the ecological validity of these studies is limited, since unlike in everyday experience, the RMET only presents the eye region and uses static rather than dynamic stimuli. Thus, one aim of the present study is to examine FER ability in rBDPs using more ecologically valid stimuli. In this study, we define FER tasks as being more ecologically valid when the following demands are met: stimuli that are used a) are dynamic and b) display real persons who in turn display c) complex emotional expressions in d) different developmental stages (ranging from subtle to fully developed).

To date, *ToM reasoning* in rBD has mostly been investigated by means of *stories* (e.g. Fletcher et al., 1995), *cartoon comprehension* (e.g. Kerr et al., 2003) or *picture sequence tasks* (e.g. Inoue et al., 2004). Some studies using these tasks have found reasoning deficits in rBD (e.g. Bora et al., 2005; Lahera et al., 2008; Martino et al., 2011; Olley et al., 2005), whereas others have not (e.g. Caletti et al., 2013; Kerr et al., 2003; Ozel-Kizil et al., 2012; Simon et al., 2013). In their recent meta-analysis, Bora et al. (2016) conclude that there are significant but modest-sized ToM reasoning dysfunctions in rBDP which are more severe during acute depressive or manic episodes. However, similarly to studies of ToM decoding, few studies have used highly ecologically valid measures. Demands on highly ecologically valid tasks assessing ToM reasoning are: a) using *dynamic* stimuli, b) showing *real* persons, and c) displaying *everyday life* situations to ensure the possibility of using contextual information to draw conclusions. So far, only one study has addressed this need, using the *Movie for the Assessment of Social Cognition (MASC;* Dziobek et al., 2006). This task is a naturalistic measure of ToM reasoning since it includes real peoples' actions, voices and gestures as well as contextual information about the capacity to attribute mental states (Samamé, 2013). In a study by Montag et al. (2010), MASC performance of rBDP was impaired as compared to HC when looking at affective ToM as opposed to cognitive ToM. A further aim of the present study is to replicate this finding and, beyond that, to compare the overall performance in MASC between rBDP and HC.

Besides issues concerning stimulus material, one explanation for the inconsistent findings concerning social cognition in rBD is the presence (or absence) of negative mood induction. Some studies indicate an influence of the current mood on emotion recognition in rBD (e.g. McKinnon et al., 2010). Indeed, the induction of negative mood influences emotion recognition even in healthy samples (Chepenik et al., 2007). Therefore, another goal of the present study is to experimentally investigate whether FER and reasoning performance differs between rBDPs and HCs as a function of whether a negative mood induction (MI) takes place or not.

In search of further possible reasons for the above-mentioned inconsistencies concerning ToM in BD, additional variables such as age of onset (e.g. Bozikas et al., 2006; Wolf et al., 2010) or general cognitive abilities (e.g. Lawlor-Savage et al., 2014; Martino et al., 2011) have been investigated. This also includes variables assumed to generally influence social cognition – regardless of the presence or absence of a mental disorder – such as gender or age. It has become evident that associations present in non-clinical samples may be different, or even absent, in BD. Vaskinn et al. (2007), for example, found that healthy male subjects performed worse than their female counterparts in FER, whereas no gender difference was observed within BDPs. Another variable that might be of interest in this context is age. Some studies have investigated the change in FER performance across age groups in non-clinical samples and revealed a significant decrease with age (e.g. Calder et al., 2003; Mill et al., 2009; Phillips et al., 2002; Richter et al., 2011; Sullivan et al., 2007). However, it is not yet clear whether this relation also exists in rBD. This is problematic because the probability of overlooking differences between BDPs and HCs would be relatively high – even when matching for age – if the relationship between age and social cognition was different in BDPs compared to HCs. Therefore, besides matching for age and gender, the current study explored whether the relation between these variables and social cognition is the same for rBDPs as for HCs.

In summary, the present study tests the following hypotheses: first, rBDPs show deficits in FER and ToM reasoning compared to HCs when using tasks of high ecological validity. Second, these deficits are more pronounced under negative MI. Furthermore, we aimed to explore the influence of *age* and *gender* on FER and reasoning in rBDPs compared to HCs.

2. Methods

2.1. Sample

$N = 84$ participants were recruited by advertisements in inpatient and outpatient clinics as well as on the internet. Inclusion criteria for the rBD group were: a) lifetime bipolar I or II disorder or cyclothymia according to the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV; American Psychiatric Association, 1994); b) currently remitted as defined by a *Hamilton Depression Rating Scale* score below 8 (HDRS17; Hamilton, 1967), an *Inventory of Depressive Symptomatology* score below 12 (IDS-C30; Rush et al., 1996) and a *Young Mania Rating Scale* score below 12 (YMRS; Muehlbacher et al., 2011). Healthy participants were included if there was no evidence of current or lifetime mental disorder. Trained interviewers conducted the Structured Clinical Interview for DSM-IV (SCID-I and SCID-II; Wittchen et al., 1997) in both groups. The groups were matched with regard to gender, level of education, and age (± 5 years).

Exclusion criteria for all participants were: a) insufficient knowledge of the German language, b) diseases affecting the central nervous system, c) age below 18 or above 69 years, and d) neurocognitive impairments as defined by an IQ-score below 85 according to the *Multiple Choice Word Fluency Test (MWT-B;* Lehrl, 2005) or extreme outlier downwards (< 3 * interquartile range) in either the *Verbal Learning and Memory Test* (*VLMT;* Helmstaedter et al., 2001) or the *Trail Making Test* (*TMT;* Reitan, 1992). Further exclusion criteria for the rBD group were: a) current alcohol or substance abuse and/or dependency or lifetime dependency if abstinence period < 3 years, b) acute or lifetime psychotic symptoms except mood congruent delusions during affective episodes, c) current anorexia nervosa (Body Mass Index $\leq 18\,kg/m^2$), d) comorbid schizoid, schizotypical, paranoid, antisocial and/or borderline personality disorder according to DSM IV (Saß et al., 1996).

Table 1 shows the sample characteristics. rBDPs met criteria for remitted bipolar I (54.55%) or bipolar II disorder (45.45%). There were no participants with cyclothymia in the study sample. Of the rBDPs, 40.9% had one or more co-morbid mental illness(es) and 95.45% were on medication at the time of testing.

2.2. Materials

2.2.1. Assessment of symptoms and neurocognitive functioning

In the rBD group we used the *Structured Interview Guide for the Hamilton Depression Scale and Inventory of Depressive Symptomatology*