A closer look at the relationship between the subdomains of social functioning, social cognition and symptomatology in clinically stable patients with schizophrenia

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Abstract

Impairments in social functioning commonly seen in schizophrenia are thought to be mediated by deficits in the domains of social cognition. Some previous research has explored how social cognitive skills and psychotic symptoms are associated with social functioning, however these associations are still under debate. The main aim of this study was to investigate the relationship between different domains of social cognition and psychotic symptomatology, and also to look at the relationships with individual subdomains of social functioning within a clinically stable schizophrenia population. 45 outpatients were recruited and symptoms were assessed with the PANSS, and measures of emotion processing, affective and cognitive theory of mind (ToM), mental state reasoning attributional biases, and social functioning were taken. A correlational analysis was performed with the data. Following this, a regression analysis was used to reveal which domains of social cognition best predicted psychotic symptoms. In this stable group of patients, our results support the suggestion of a likely distinction between affective and cognitive components of ToM. The study also demonstrated that ToM and mental state reasoning were the best predictors of psychotic symptoms. Here we reveal that cognitive ToM had the most widespread relationship with social functioning, across multiple subdomains, while only some specific subdomains of social functioning correlated with other domains of social cognition and symptomatology. Further to this, positive symptoms were associated with much fewer subdomains of social functioning than negative and general symptoms. These findings imply that different aspects of social functioning may be served by different domains of social cognition and symptomatology.

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1. Introduction

Schizophrenia is a chronic and debilitating illness of which poor social functioning is a core characteristic. The ability to function successfully in the social world requires an accurate understanding and interpretation of other people’s behaviour. The knowledge and skills utilised in social interactions are founded upon a set of cognitive processes that fall under the category of social cognition. Deficits in social cognition have been found to have a direct impact on the rate of relapse and symptom severity in schizophrenia [1,2]. Much research has revealed that neurocognitive deficits such as working memory, speed of processing, attention, problem solving and executive function contribute moderately (around 20%–60%) to the variance in social functioning in schizophrenia [3–5]. Other work has suggested that social cognitive deficits may explain at least as much of the variance in social functioning as non-social cognitive deficits, and are likely to have an even more substantial and mediating role in social functioning and functional outcome [6–9]. It is clear that the ability to process socially relevant information relies on neurocognition, however, research shows that neurocognition and social cognition are largely distinct domains [1,10,11]. It is also

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thought that social cognition is composed of different domains that may be partially independent [12], and are currently treated separately in social cognition training for schizophrenia [2].

In schizophrenia, some specific domains of social cognition have been identified to be particularly at a deficit [12], including emotion perception, theory of mind and attributional style. Emotion perception involves the reading of social emotional cues, mainly from facial expressions, which is also intrinsic to the awareness and understanding of one’s own emotional experiences [13]. Theory of mind is the ability to understand other people’s intentions and beliefs, and being able to put oneself ‘in others’ shoes’ [14]. Attributional style refers to the tendency to attribute the cause of negative or positive events to oneself or to others [15]. A crucial question for research on social cognition in schizophrenia to address is how clear the boundaries between different domains of social cognitive deficits in schizophrenia are. A handful of studies using factor analysis with different domains of social cognition have found inconsistent results, most probably due to the use of different measures. Van Hooren et al. [16] demonstrated that theory of mind, attributional bias and agency detection were loaded separately in three different factors, following an exploratory factor analysis on a battery of measures of neurocognition and social cognition. Another study revealed a four-factor solution with theory of mind, affect recognition, egocentricity and rapport loading in separate factors [17]. More recently, a factor analysis from Mancuso et al. [18] found the three domains of hostile attributional style, low-level social cue detection and high-level inferential and regulatory processes loading in separate factors. Although none of these factors correlated with negative symptoms, whereas only hostile attributional style correlated with positive symptoms. It is evident that there is some interaction between deficits in social cognition and psychotic symptomatology, which require consideration when discussing functional outcome.

The inherent social nature of many psychotic symptoms, such as passivity symptoms and social withdrawal, implies a direct relationship between social cognition and symptomatology [18]. Emotion recognition deficits have generally been found to be more specifically associated with the severity of negative and affective symptoms [19], as well as poor vocational and global functioning [20]. Some have also found that the affective dimensions of theory of mind, i.e. reading others’ emotional states, is also more specifically associated with negative symptoms [21]. In fact, neuroimaging studies have revealed a close relationship between emotion perception and affective theory of mind [22]. According to earlier work of theory of mind deficits in schizophrenia, remitted patients were found to have intact theory of mind abilities, and it was therefore proposed that theory of mind deficits were causally related to psychotic symptoms, as a result of impaired self-monitoring [23]. However, more recently, a meta-analysis suggests that this relationship may not be so clear or direct [24]. Bentall et al. [25] have suggested that biases in self-representation can be caused by biases in causal attributions, such as an over-self-serving attributional bias, in which persecutory delusions and paranoid thoughts stem from the causal attribution of negative events to external agents. An increased externalizing bias has been found to be associated with reduced insight in a population with schizophrenia [26]. Although most notably, neither externalizing nor personalizing biases were related to theory of mind in this study, and additionally, patients with more misattribution biases were less flexible in emotion processing. In general, several studies have found a substantial relationship between positive symptoms, particularly paranoid delusions and a jumping-to-conclusions and attributional bias [27,28].

One main goal for research exploring the relationship between social cognition and symptomatology in schizophrenia is to understand how this can impact on real-world social functioning and functional outcome [29,30]. The majority of studies investigating social cognition and functional outcome has demonstrated a positive association between the two, as shown from the studies reviewed by Fett and colleagues [31]. However, the strength of the relationship between social cognition and social functioning varies substantially. This is likely due to the lack of standardization of measures of social cognition and functional outcome. Two recent meta-analyses [31,32] have revealed some limitations and methodological inconsistencies in the previous literature, therefore preventing these meta-analyses from being completely comprehensive. In addition, there is relatively little work documenting the intercorrelations between domains of social cognition, and the subdomains of social functioning, as many have pooled potentially separable dimensions together to report only aggregated scores [e.g. [33]].

Despite the large body of research exploring the associations between social cognition, social functioning and psychotic symptomatology, more work is required to clarify how the different domains of social cognition relate to one another, how these may be associated with positive and negative symptoms, and how these associations translate to real-world social functioning and persist during remission of psychotic symptoms. In this article, we follow the methodological recommendations made in the recent meta-analysis from Fett and colleagues [31] to facilitate the synthesis of data for future systematic reviews. Accordingly, the aim of the study was to explore the interrelationships between deficits in different domains, and sub-domains, of social cognition and social functioning in a group of clinically stable schizophrenia patients. We were also interested in looking at how these related to different factors on the PANSS, and which domains of social cognition and social functioning were best predicted by different dimensions of symptomatology. Measures of non-social neurocognition were not included in this study due to the demanding nature of these assessments, in consideration of the numerous
measures of social cognition already included, and because neurocognition was not central to our primary research question.

2. Methods

2.1. Participants

Forty-five clinically stable patients diagnosed with schizophrenia were recruited from the Psychosis Unit of the Psychiatry Department at Celal Bayar Hospital University. Diagnosis was confirmed with the DSM-IV SCID, and inclusion criteria were that patients had no psychiatric hospitalization in the previous 6 months, and antipsychotic medication had been stable for 6 months. The Positive and Negative Syndrome Scale (PANSS [34]) was used to assess the severity of psychotic positive and negative symptoms. The PANSS is a 30-item semi-structured interview that assesses three symptom categories specifically associated with psychosis, namely, positive (e.g., hallucinations and delusions), negative (e.g., avolition and anhedonia), and general symptoms. The PANSS was administered by a clinical psychologist who had received formal PANSS training. A score from 1 to 7 was assigned to each symptom item, with higher scores indicating more severe psychopathology. The scores for the items within each category were summed to produce a score for each symptom dimension. A battery of commonly used social cognitive measures was administered following PANSS assessment. Chlorpromazine equivalents were calculated for all patients in order to control for medication effects [35]. All participants gave written consent and the study was approved by the local ethics commission at Celal Bayar University, Manisa, Turkey.

2.2. Measures

2.2.1. Measures of social cognition

For emotion processing skills, the Face Emotion Identification Task (FEIT [36]) and the Face Emotion Discrimination Task (FEDT [36]) were given to participants. The FEIT consists of 19 photographs of emotional faces presented on screen, and participants are required to identify which emotion is being expressed in each photograph. The FEDT presents 30 pairs of photographs of emotional faces and requires the participant to decide if the two faces in each pair display the same or different emotions.

Both cognitive and affective domains of the theory of mind (ToM) were evaluated with the Hinting Task [37] and the Reading-the-Mind-in-the-Eyes Test-Revised (RMET [38]), respectively. The Hinting Task [37] consists of 10 written vignettes, including social hints that the participant is asked to interpret. The Hinting Task is believed to assess the social–cognitive domain of ToM. The RMET consists of 36 photographs of different emotional faces, but only with the region around the eyes displayed on screen. Participants have to choose which one of four emotional words best describes what the person thinks or feels. This is thought to assess the more social–perceptual, and affective dimension of ToM. Empathy and mental state reasoning were measured using the Unexpected Outcomes Test (UOT [39]). This is a 12-item measure that describes situations which are intended to infer an emotional response from one of the characters in the story, although the emotional response is unexpected and incongruent with the emotion-eliciting context. Participants are required to reason about the expressed emotions and present additional explanations to resolve the incongruity.

Attributional style was assessed with Internal Personal Situational Attributions Questionnaire (IPSAQ [40]), which consists of 32 items describing positive and negative social situations. Participants are asked to state the most likely cause for the event, and then indicate whether that cause is primarily due to themselves (internal attributions), other people (personal attributions) or circumstances (situational attributions). Two cognitive bias scores are obtained from the subscale scores: externalizing bias (EB) and personalizing bias (PB).

2.2.2. Measures of social functioning

The Social Functioning Scale (SFS [41]) is a 79-item questionnaire administered by a trained interviewer. The scale aims to assess a broad range of aspects of real-world social and community functioning. It comprises of 7 dimensions of social functioning: social engagement/withdrawal (e.g., how often will you start a conversation at home?); interpersonal communication (e.g., how easy or difficult do you find talking to people at present?); independence/performance (e.g., how often do you prepare and cook a meal?); recreation (e.g., how often will you play a sport?); prosocial activities (e.g., how often do you visit friends?); independence/competence (e.g., how able are you to budget?); and employment/occupation (e.g., when were you last employed?). Items are rated on a 4-point scale rated for frequency or ability, with higher scores indicating greater competency.

2.3. Data analysis

Preliminary descriptive analyses were performed to check that the data were normally distributed. A Pearson correlation analysis was first performed with all measures of domains of social cognition and social functioning, using individual scores for sub-domains. Following this, another correlation analysis was performed with all measures of social cognition and functioning and the different symptom dimensions on the PANSS. This was done to explore intercorrelations among domains of social cognition, and how these correlated with domains of social functioning. From the significant correlations found between measures of social cognition and symptomatology, we tested which social cognitive factors would be identified as possible predictors of symptom dimensions. Therefore, in the last step of analysis, a stepwise multiple regression was conducted using those variables that showed significant correlations in the first step to determine which domain of social cognition

...
best predicted symptomatology. Each variable was entered into the multiple regression analysis if its F value was > 4. A p value < 0.05 was considered significant. Statistical analyses were performed using SPSS 19.0 software (SPSS Inc., Chicago, IL).

3. Results

The mean age of the population was 36.16 (SD = 11.89) years, and from the 45 patients, the sample consisted of 22 females. Mean duration of illness was 12.17 years (SD = 9.18), with a PANSS positive score mean being 11.91 (SD = 4.43), a PANSS negative score mean of 17.84 (SD = 9.18), with a PANSS positive score mean being 11.91 years, and from the 45 patients, the sample consisted of 22 females. Mean number of years of education in the group was 11.11 (SD = 2.92), and in terms of antipsychotic medication, the group mean Chlorpromazine equivalent was 488.91 (SD = 330.92).

The correlation analysis of the different domains and subdomains of social cognition and social functioning is presented in Table 1. Significant intercorrelations were found between variables in different domains of social cognition; most significantly, the affective measure of ToM (RMET) was highly correlated with both measures of emotion perception. Other significant, but weaker intercorrelations were seen between cognitive and affective ToM, and between cognitive ToM and emotion discrimination. In addition, mental state reasoning correlated with both affective and cognitive ToM, and with externalizing bias. Different dimensions of social functioning significantly correlated with different domains of theory of mind and emotion perception, with prosocial activities correlating with emotion perception, affective ToM and mental state reasoning. Cognitive ToM (Hinting Task) correlated with a

Table 2 Pearson’s bivariate correlations between symptomatology from PANSS factor scores and measures of social cognition and social functioning showing significant correlation coefficients in bold.

<table>
<thead>
<tr>
<th>Measure</th>
<th>PANSS Pos.</th>
<th>PANSS Neg.</th>
<th>PANSS Gen.</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEDT</td>
<td>−.155</td>
<td>−.252</td>
<td>−.178</td>
</tr>
<tr>
<td>FEIT</td>
<td>−.246</td>
<td>−.187</td>
<td>−.206</td>
</tr>
<tr>
<td>RMET</td>
<td>−.257</td>
<td>−.479**</td>
<td>−.241</td>
</tr>
<tr>
<td>Hinting task</td>
<td>−.190</td>
<td>−.314*</td>
<td>−.310*</td>
</tr>
<tr>
<td>UOT</td>
<td>−.416**</td>
<td>−.229</td>
<td>−.292</td>
</tr>
<tr>
<td>IPSAQ—EB</td>
<td>−.008</td>
<td>−.169</td>
<td>−.032</td>
</tr>
<tr>
<td>IPSAQ—PB</td>
<td>.113</td>
<td>.125</td>
<td>.119</td>
</tr>
<tr>
<td>SFS—engagement</td>
<td>−.356*</td>
<td>−.124</td>
<td>−.243</td>
</tr>
<tr>
<td>SFS—interpersonal</td>
<td>−.228</td>
<td>−.315*</td>
<td>−.349*</td>
</tr>
<tr>
<td>SFS—prosocial</td>
<td>−.207</td>
<td>−.330*</td>
<td>−.337*</td>
</tr>
<tr>
<td>SFS—recreation</td>
<td>−.174</td>
<td>−.346*</td>
<td>−.319*</td>
</tr>
<tr>
<td>SFS—ind. &amp; competence</td>
<td>.094</td>
<td>−.170</td>
<td>−.044</td>
</tr>
<tr>
<td>SFS—ind. &amp; performance</td>
<td>−.229</td>
<td>−.362*</td>
<td>−.506**</td>
</tr>
<tr>
<td>SFS—employment</td>
<td>−.215</td>
<td>−.410**</td>
<td>−.300</td>
</tr>
</tbody>
</table>

FEIT = Face Emotion Identification Task; FEDT = Face Emotion Discrimination Task; RMET = Reading-the-Mind-in-the-Eyes Test-Revised; UOT = Unexpected Outcomes Test; IPSAQ = Internal, Personal and Situational Attributions Questionnaire; EB = Externalizing Bias; PB = Personalizing Bias; SFS = Social Functioning Scale; PANSS = Positive and Negative Syndrome Scale.

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Table 1 Pearson’s bivariate correlations between measures of social cognition and social functioning showing significant correlation coefficients in bold.

<table>
<thead>
<tr>
<th>Measure</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
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<tbody>
<tr>
<td>1. FEDT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. FEIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. RMET</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Hinting task</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. UOT</td>
<td></td>
<td></td>
<td>.344*</td>
<td>.003</td>
<td>.041</td>
<td>.365*</td>
<td>.318*</td>
</tr>
<tr>
<td>6. IPSAQ—EB</td>
<td>−.026</td>
<td>−.061</td>
<td>.152</td>
<td>.106</td>
<td>.364*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. IPSAQ—PB</td>
<td>.161</td>
<td>.079</td>
<td>−.049</td>
<td>.223</td>
<td>−.096</td>
<td>.163</td>
<td></td>
</tr>
<tr>
<td>8. SFS—engagement</td>
<td>.261</td>
<td>.211</td>
<td>.014</td>
<td>.380*</td>
<td>.206</td>
<td>.000</td>
<td>.228</td>
</tr>
<tr>
<td>9. SFS—interpersonal</td>
<td>.169</td>
<td>−.057</td>
<td>.085</td>
<td>.585*</td>
<td>.227</td>
<td>.083</td>
<td>.051</td>
</tr>
<tr>
<td>10. SFS—prosocial</td>
<td>.272</td>
<td>.320*</td>
<td>.312*</td>
<td>.259</td>
<td>.309*</td>
<td>.047</td>
<td>.059</td>
</tr>
<tr>
<td>11. SFS—recreation</td>
<td>.197</td>
<td>.081</td>
<td>.188</td>
<td>.401**</td>
<td>.256</td>
<td>−.003</td>
<td>−.275</td>
</tr>
<tr>
<td>12. SFS—ind. &amp; competence</td>
<td>.168</td>
<td>.093</td>
<td>.290</td>
<td>.280</td>
<td>.203</td>
<td>.188</td>
<td>.104</td>
</tr>
<tr>
<td>13. SFS—ind. &amp; performance</td>
<td>.198</td>
<td>.117</td>
<td>.125</td>
<td>.494**</td>
<td>.247</td>
<td>−.080</td>
<td>−.070</td>
</tr>
<tr>
<td>14. SFS—employment</td>
<td>.069</td>
<td>−.002</td>
<td>.074</td>
<td>.170</td>
<td>.085</td>
<td>−.019</td>
<td>−.177</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).
symptom dimensions, although affective ToM had a strong association with negative symptoms. Cognitive ToM was equally correlated with both negative and general symptom factors on the PANSS. Interestingly, mental state reasoning was strongly correlated with only positive symptoms. Negative and general symptoms were most strongly associated with social functioning, with significant correlations emerging in several different subdomains of social functioning. However, social engagement was the only subdomain that correlated with positive symptomatology. No significant correlations were found between medication and measures of social cognition or social functioning. In the regression model, positive symptoms were best predicted by mental state reasoning, whereas negative symptoms were predicted best by the affective component of ToM. Lastly, the analysis revealed that cognitive ToM best predicted general psychotic symptoms (see Table 3).

4. Discussion

The aim of the study was to explore the interrelationships between the domains of social cognition and social functioning. Much previous work has been done looking at these relationships in schizophrenia, however the novel aspect of this study is that here we took a more fine-grained approach to social functioning to look in detail at how different aspects, as reflected in the individual subdomains, relate to domains of social cognition and separate symptom domains. In addition, we were interested in the interrelationships between the domains of social cognition. Each of these aspects of the study will now be discussed in turn.

4.1. Intercorrelations between the social cognition domains

According to the intercorrelations between the domains of social cognition our findings partially confirm much of the previous literature [42]. The correlation analysis reveals a strong association between emotion processing and affective theory of mind (ToM), which is in accordance with previous neuroimaging work showing overlapping activation in an affective ToM and an emotion recognition task [22], in areas including the inferior frontal gyrus, superior temporal sulcus, temporal pole and amygdala. There is also other work suggesting that cortical midline structures are more relevant for cognitive ToM, whereas cortical surface structures are more involved in emotion recognition/affective ToM [43]. Therefore, our study provides further support to previous suggestions for the distinction between cognitive and affective ToM [21], in that affective ToM represents a more basic form of ToM as compared to higher level cognitive components of ToM and mental state inference.

It is likely that both affective and cognitive ToMs are necessary prerequisites for higher-level mental-state reasoning, which may explain the intercorrelations between the eyes test, the hinting task and the UOT seen in our results. This suggestion is also supported by an earlier study from Bora and colleagues [44], who found significant correlations between the empathy quotient, which is thought to tap into both cognitive and affective ToM, and mental state reasoning as assessed by the UOT. It may be the case that intact mental state reasoning is required for externalizing one’s thoughts, as implied by the negative intercorrelation in our data. Therefore, as there is not a healthy cut-off for this measure of mental state reasoning, this correlation may not necessarily be reflecting a pathological characteristic of schizophrenia. Additional support for this assumption comes from the negative correlations seen between the PANSS positive score and UOT performance in our findings.

4.2. Correlations between social cognition and social functioning

The association between the prosocial activities subdomain of social functioning and different domains of social cognition is in line with a previous study from our group that found mental state reasoning as the best predictor of the intrapsychic foundation domain of quality of life [45]. In addition to this, we see the importance of the role of ToM skills in social functioning, with cognitive ToM having the most substantial impact across the widest variety of subdomains of social functioning. Bora and colleagues [46] demonstrated that affective mental state decoding, as measured with the eyes test, was the best predictor of social functioning. However our findings suggest that a more sophisticated level of ToM or mental state reasoning, as opposed to affective ToM and emotion processing, appears to be more associated with real-life functioning. This is confirmed by a study from Lysaker and colleagues [47] who demonstrated that high order mentalizing skills, specifically in terms of metacognition, were predictive of social functioning in schizophrenia, even when controlling for symptomatology and neurocognition. The recent meta-

Table 3
Stepwise multiple regression for subdomains of social cognition and psychotic symptoms.

<table>
<thead>
<tr>
<th>PANSS subdomains</th>
<th>Predicting factors</th>
<th>F (df)</th>
<th>Partial R²</th>
<th>Model R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive Symptoms</td>
<td>UOT</td>
<td>9.02 (1,44)***</td>
<td>.17***</td>
<td>.17</td>
</tr>
<tr>
<td>Negative Symptoms</td>
<td>RMET</td>
<td>12.78 (1,44)***</td>
<td>.23***</td>
<td>.29</td>
</tr>
<tr>
<td>General Symptoms</td>
<td>Hinting Test</td>
<td>4.58 (1,44)**</td>
<td>.10**</td>
<td>.10</td>
</tr>
</tbody>
</table>

*p < =0.05; **p < =0.01; ***p < =0.005. P values indicate the significance of each model (F(df) column) and the contribution of each variable (partial R² column) independently.

RMET = Reading-the-Mind-in-the-Eyes Test-Revised; UOT = Unexpected Outcomes Test.
analysis from Fett and colleagues [31] that included 56 previous studies also found that ToM had the strongest association with functional outcome, relative to other domains of social cognition. In fact, a very recent study also confirmed the lack of association between emotion recognition and a more ecologically valid measure of social functioning [48]. Taken together, in a stable group of patients, improvement of low order emotion perception and affective ToM may provide a foundation upon which to build high order skills of cognitive ToM and high order mentalizing skills such as metacognition, and thus addressing both low and high order domains of social cognition may be necessary for enhancing social functioning in schizophrenia [49]. The differential relationships seen here between the domains of social cognition and the subdomains of social functioning also highlight the need for more ecologically valid measures of social functioning that capture different aspects of functioning, which aggregated scores of self-report measures alone may miss.

4.3. Social cognition domains and symptomatology

Illness related symptom severity in schizophrenia is represented by the clusters falling into the either positive, negative or the general group of symptoms. Although they are crucial for diagnostic and prognostic reasons, the underlying social cognitive factors that contribute to these clusters have received less interest in the past. To the best of our knowledge this is the first study that treats symptomatology as a dependent variable of social cognition. It is plausible to argue that cognitive deficits may precede behavioral manifestations of the illness pathology, as opposed to looking at the behavior, in terms of symptoms, as a prerequisite to dysfunctional cognition. Here we found that different domains of social cognition have different relationships with each of the symptom clusters. In line with some previous work [21], negative symptoms were best predicted by affective ToM, although interestingly, this association with negative symptoms was not seen with the more specific emotion recognition tasks. This could help to support our earlier suggestion of affective ToM being more associated with emotion processing rather than mental state reasoning per se, and therefore having a specific role for predicting the negative symptoms. It may be the case that the emotion recognition tasks used here were too simplistic and easy, and consequently performance may not have reached the threshold for a pathological level to reveal the association between negative symptoms and emotion processing deficits in this remitted group of patients. This may partly contrast a study by Fiszdon and colleagues [50], which shows correlations with negative symptoms and cognitive ToM as measured by the hinting task. Instead, we found that cognitively based ToM and mental state reasoning were the best predictors of positive and general symptoms as compared to other social cognitive domains, and therefore also following our proposal that a high order (more cognitive) form of mental state reasoning and ToM may be an important target for therapeutic intervention to potentially reduce a broader range of symptoms. The other relationships between social cognition and symptomatology presented in our study also partially contrast some previous work looking at the relationships between social cognition and symptomatology. For example, Mancuso and colleagues [18] found a strong relationship between hostile attributional style and psychotic positive symptoms, which interestingly is not shown by our findings, as there were no correlations seen between both types of attributional biases and any of the symptom clusters. It should also be noted that, in general, the variance explained by the social cognition domains in each of the symptom clusters is relatively low, therefore supporting previous suggestions that a multi-dimensional approach including neurocognitive and prognostic variables is required for understanding symptomatology in schizophrenia [2].

4.4. Symptomatology and social functioning

The impact of negative and general symptoms appears to permeate through a wide range of the different subdomains of social functioning, including occupational functioning. The strength of the correlations also suggests a substantial effect of both negative and general symptoms on social functioning. One study from Bowie and colleagues [51] found that both interpersonal and occupational skills were best predicted by negative symptoms, which was also the case with our findings. Furthermore, Leifker and others [52] demonstrated that blunted affect and passive apathetic social withdrawal accounted for all of the predicted variance in real-world social functional outcome, whereas cognitive impairments did not have substantial predictive power. Our findings highlight the importance of looking more closely at the differential relationships between symptom clusters and the individual components of social functioning that may have independent and differential effects on functional disability and on different aspects of one’s social life and occupational functioning.

4.5. Limitations

This study has some limitations. Firstly, our sample consisted of a stable group of schizophrenia patients and therefore may not be representative of the whole schizophrenia population. Secondly, we suggest that longitudinal studies would be required to demonstrate a causal relationship between symptomatology, social cognition and functional outcome. Another shortcoming is the lack of non-social cognitive tasks. The reason for not including more tasks in the study was that the many divergent social cognitive tasks were already very demanding for many patients. Despite the limitations, this study presents data on the role of social cognition in clinical and functional outcomes and includes a number of well validated scales of social cognition, while looking in detail at the associations with specific aspects of social functioning and symptom clusters.
4.6. Conclusion

In sum, our main findings are that cognitive mental state reasoning emerged as the domain of social cognition which had the strongest and broadest relationship across a variety of aspects of social functioning, and that positive psychotic symptoms were less associated with social functioning than negative and general symptoms. This study adds further support to the suggestion that emotion perception and affective ToM are overlapping domains of social cognition. A similarly plausible explanation could be, however, that the tasks used are not ideal to disentangle affective ToM from emotion perception. Further clarification of the boundaries between emotional mental state reasoning and emotion processing would be required before clear implications about the deficits in social cognition in schizophrenia can be defined. This may involve the design of new tools to disentangle performance in these two domains, and consequently to determine therapeutic targets. This study highlights the importance of the role of cognitive mental state reasoning, over other domains of social cognition, in functional outcome, and particularly how there can be differential relationships between the components of social functioning that may manifest in divergent aspects of real-world functioning in a variety of ways. The present findings support for social cognition as a separable cognitive domain in schizophrenia. Due to the contrasting nature of some of our results in comparison to previous work, and even in previous studies that have used similar measures, this study emphasizes the need for further replication studies investigating how performance in social cognitive tasks translates to real-world functioning, and how this is grounded in the psychopathology of schizophrenia. In designing new therapeutic strategies to target deficits in social cognition, it is important to consider the relationship between the domains of social cognition and how these specifically relate to symptomatology. This will determine how valid it is to target separate pathways for remediation of presumably independent social cognitive domains.

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