Journal of
MENTAL
HEALTH

http://tandfonline.com/ijmh
ISSN: 0963-8237 (print), 1360-0567 (electronic)

J Ment Health, 2016; 25(4): 330–337
 DOI: 10.3109/09638237.2015.1124397

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ORIGINAL ARTICLE

Social cognition in schizophrenia: factor structure, clinical and functional correlates

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Abstract

Background: Social cognition is consistently impaired in people with schizophrenia, separable from general neurocognition, predictive of real-world functioning and amenable to psychosocial treatment. Few studies have empirically examined its underlying factor structure.
Aims: This study (1) examines the factor structure of social cognition in both a sample of individuals with schizophrenia-spectrum disorders and non-clinical controls and (2) explores relationships of factors to neurocognition, symptoms and functioning.
Method: A factor analysis was conducted on social cognition measures in a sample of 65 individuals with schizophrenia or schizoaffective disorder, and 50 control participants. The resulting factors were examined for their relationships to symptoms and functioning.
Results: Results suggested a two-factor structure in the schizophrenia sample (social cognition skill and hostile attributional style) and a three-factor structure in the non-clinical sample (hostile attributional style, higher-level inferential processing and lower-level cue detection). In the schizophrenia sample, the social cognition skill factor was significantly related to negative symptoms and social functioning, whereas hostile attributional style predicted positive and general psychopathology symptoms.
Conclusions: The factor structure of social cognition in schizophrenia separates hostile attributional style and social cognition skill, and each show differential relationships to relevant clinical variables in schizophrenia.

Keywords

Cognitive impairment, schizophrenia, social cognition, theory of mind

History

Received 5 December 2014
Revised 30 September 2015
Accepted 18 October 2015
Published online 8 January 2016

Introduction

Social cognition, defined as the ability of persons to think about themselves and others in the context of interactions (Adolphs, 2009; Ochsner, 2008; Penn et al., 2008) is impaired in individuals with schizophrenia (Green & Horan, 2010; Green & Leitman, 2008; Penn et al., 1997). These deficits are related to but separable from neurocognition (Nuechterlein et al., 2004) and negative symptoms (Sergi et al., 2007) and demonstrate strong relationships to functioning (Couture et al., 2006; Fett et al., 2011). Although the importance of this domain is established, questions have been raised about the psychometric properties of these measures (Green et al., 2008; Pinkham et al., 2014) including heterogeneity of tasks (Hoekert et al., 2007; Yager & Ehrmann, 2006) and ceiling effects (Bora et al., 2009). In addition, little is known about the underlying factor structure of social cognition in this population (Silverstein, 1997) as well as its relationships to other similar constructs [e.g. metacognition (Lysaker et al., 2005, 2013b)].

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Most factor analyses in this area have aimed at separating social cognition from related constructs (e.g. neurocognition, social skills and metacognition). Van Hooren et al. (2008) concluded that social cognition is multidimensional and separable from neurocognition, though the discrete factors varied between individuals with psychosis, first-degree relatives, elevated subclinical individuals and controls. Allen et al. (2007) concluded similarly, finding subtests of the Wechsler Adult Intelligence Scale (WAIS-R) with social content loaded on a social cognition factor, separate from the three traditional non-social cognitive factors. Bell et al. (2009) found a four-factor structure that included affect recognition, theory of mind, egocentricity and rapport when examining a combined sample of data on social cognition and social skills in individuals with schizophrenia or schizoaffective disorder. Lysaker et al. (2013a) found a two-factor structure in individuals with a schizophrenia-spectrum disorder when including discrete tasks of social cognition and more complex synthetic metacognition.

Fewer studies have examined the factor structure of ''only'' social cognition without the aim of distinguishing it from a similar or related domain. Mancuso et al. (2011) found evidence for three factors of social cognition in schizophrenia: hostile attributional style, low-level social cue detection and higher level inferential and regulatory processes. Interestingly, the only other study that examined the relationship of these factors with outcomes showed different results. Mancuso et al. (2011) found that their hostile attribution factor was related to clinical symptoms, whereas both higher and lower level skill-based social cognition predicted functional capacity and social functioning; alternatively, Lysaker et al. (2013a) found significant relationships between their social cognition factor and negative symptoms.

Questions remain about the structure of this domain and its relationship to outcome. First, no robust factor structure of social cognition has emerged as this procedure has not been sufficiently replicated. Given recent demonstrations of the inconsistency of replication in psychological science (Klein et al., 2015), continued replication is critical in foundational research. It is particularly important in this area, given the subjectivity of measure and model selection in factor analysis. Only one previous study (Mancuso et al., 2011) examined the factor structure of social cognition without inclusion of other related domains (e.g. social functioning or neurocognition). Second, as noted, there exist discrepant findings related to the relationships between social cognition factors and functioning. Finally, a comparison with controls is necessary to better understand what processes differ between individuals with schizophrenia and non-patients. More fine-grained factors may suggest non-independence between subdomains of social cognition, whereas large general factors could suggest that impairments result from impairments of fewer central processes.

In this study, we examined the factor structure of social cognition as well as each factor's relationship to symptoms and functioning in a sample of 65 individuals with schizophrenia and 50 control subjects. Second, this study aims to examine the relationships between social cognition factors and symptoms and functioning. Consistent with previous research in this field, it is hypothesized that performance on measures of social cognition will contribute additional variance beyond measures of neurocognition in predicting real-world functioning.

Methods

Participants

Sixty-five individuals meeting DSM-IV criteria for either schizophrenia or schizoaffective disorder were recruited from mental health facilities in the Raleigh-Durham region. Interviewers reviewed participants' medical charts, confirming diagnosis by administering the Structured Clinical Interview for DSM-IV Patient Edition (SCID-P; First et al., 1996). In order to participate, individuals had to report difficulties interacting with others, as they were participating in a study evaluating the efficacy of social cognition and interaction training (SCIT; Roberts et al., 2014). To meet this criterion, individuals had to receive a score of ≤ 2 on select items of the social functioning scale (SFS; Birchwood et al., 1990: lower corresponds to greater impairment) or be referred by a clinician because of the presence of social functioning impairments. A control group consisting of 50 non-psychiatric controls from the Raleigh-Durham area was recruited with flyers and Internet postings. All non-psychiatric controls were between the ages of 20 and 65 years of age and reported no first-degree relatives with a psychotic disorder, bipolar disorder or autism. Individuals (from both groups) were excluded if they currently met DSM-IV criteria for substance dependence on the SCID-P, or scored an IQ of ≤ 80 on the Wechsler Abbreviated Scales of Intelligence (WASI; Wechsler et al., 1999). Demographic characteristics of both groups can be found in Table 1.

Table 1. Sample characteristics and descriptive statistics.

	Schizophrenia ($N = 66$)		Controls ($N = 50$)		Test statistics	
	n	M (SD)	*n*	M (SD)	*t*, X^2 (df)	*p* Value
Age	66	39.71 (11.44)	50	39.84 (9.84)	0.06 (114)	0.95
Education						
Participant	66	12.26 (1.23)	50	13.40 (1.18)	5.04 (114)	0.000***
Mother	60	12.63 (2.34)	48	12.67 (1.92)	0.08 (106)	0.94
Father	49	13.02 (2.61)	31	12.87 (1.57)	−0.29 (78)	0.78
WASI (IQ)	66	99.15 (11.79)	50	110.80 (15.00)	4.06 (114)	0.000***
Vocabulary	66	46.62 (11.57)	50	56.26 (9.71)	4.76 (114)	0.000***
Matrix Reasoning	66	51.42 (10.77)	50	55.50 (10.14)	2.07 (114)	0.041*
Age of first Hospitalization	65	22.95 (8.06)				
Number of Hospitalizations		6.30 (6.52)				
PANSS Symptoms						
Positive	66	16.50 (4.74)				
Negative	66	14.85 (4.00)				
General	66	33.95 (7.31)				
Total	66	65.30 (12.84)				
Sex (% male)	66	66.7	50	66.0	0.01 (1)	0.55
Race/ethnicity						
Caucasian (%)	66	63.6	50	68.0	0.24 (1)	0.39
African American (%)	66	36.4	50	32.0	0.24 (1)	0.39
Hispanic/Latino						
Hispanic (%)	64	6.3	50	2.0	1.21 (1)	0.27

***p>.001, **p>.01, *p>.05, ^p>.10

Materials

Social cognition

Attributional style. The Ambiguous Intentions Hostility Questionnaire, Ambiguous Items (AIHQ; Combs et al., 2007) consists of five second-person vignettes of negative social situations with ambiguous cause (e.g. ''you are walking by a group of young people who laugh as you pass by''). Participants rate the following on Likert scales: the other's intention, how angry it would make them feel, and how much they would blame the other. These are standardized and totaled for an overall ''blame index''. Following the interview, two independent raters compute a hostility bias related to interpretation of the other's action (a five-point Likert scale) and an aggression bias related to the individual's behavioral response.

Emotion perception. Emotion perception was assessed using two related measures. The Face Emotion Identification Test (FEIT; Kerr & Neale, 1993) asks participants to identify the emotions expressed by 19 faces depicting six basic emotions, and scores are totaled as number correct out of 19. The Face Emotion Discrimination Task (FEDT; Kerr & Neale, 1993) asks participants to determine whether two paired faces are expressing the same or different emotions out of a total of 30 pairs, with performance indexed as number correct out of 30.

Jumping to conclusions. Jumping to conclusions was measured with the ''beads in the jar'' task (Dudley et al., 1997). In this task, which is presented on a computer monitor, the participant is presented with two jars that differ in their proportion of red and blue beads; one jar has 60% red beads and the other has 60% blue beads. The participant is told that the computer will randomly select beads from one jar; the participant's task is to decide from which jar the beads are selected. This measure is included as it is regarded as another assessment of a bias in the social cognition of individuals with schizophrenia (Penn et al., 2008). Performance is indexed as the number of beads the participant asks to see before a decision is made.

Theory of mind. The Hinting Task (HINT; Corcoran et al., 1995) involves participants interpreting 10 brief written stories that require them to identify and make inferences involving others' mental states. Scores range from 0 to 20 on this task, with higher scores indicating better performance.

The Awareness of Social Inference Test – Social Inference: Minimal Subscale (TASIT; McDonald et al., 2003) consists of Yes/No questions related to four video-taped social vignettes requiring participants to infer individual motives that may contradict verbal communication (e.g. sarcasm or ''white lies''). The TASIT is scored based on number of correct responses out of 60 possible, and includes subscales that distinguish between simple sarcasm (sarcastic phrases with a meaning that matches the utterance) and paradoxical sarcasm (phrases that imply the opposite of what they appear to express).

Neurocognition

The WASI (Wechsler et al., 1999) is a brief version of a full assessment of intelligence quotient, comprising four subtests of the full Wechsler Adult Intelligence Scales (WAIS): block design, similarities, vocabulary and matrix reasoning. To minimize the length of long study visits, participants were administered the vocabulary subscale as representative of Verbal IQ, and the matrix reasoning subscale as representative of Performance IQ. Total WASI scores were generated from these two subscales.

Symptoms

The Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987) is an interview-based measure comprising 30 items assessing for positive and negative symptoms of schizophrenia as well as general psychopathology symptoms. In this study, we generated the five-factor solution subscales (Bell et al., 1994).

Social functioning. The Social Skills Performance Assessment (SSPA; Patterson et al., 2001) is an observer-rated assessment of social skill performance in two 3-min videos taped role-play conversations with a confederate. Scores range from 1 to 5 on each subscale, with higher scores indicating better performance. Outcomes of interest for this study included a paralinguistics total (performance on speech fluency and clarity across both role-plays), participation total (performance on interest and focus across both role-plays) as well as total score for affect and social appropriateness (individually rated scales across role-plays).

The Global Social Functioning Scale (GSFS; Cornblatt et al., 2007) is an interview-based global rating of social relationships. Scores range from 1 to 10 and higher scores indicate better functioning.

Role Functioning. The Role Functioning Scale (RFS; McPheeters, 1984) is an interviewer-rated assessment of functioning based on a semi-structured interview covering four domains: independent living, work performance as well as immediate and extended work social relationships. Scores on this scale range from 1 to 7, with higher scores indicating better functioning.

Procedure

Advanced graduate students and staff with experience working with this population conducted all interviews comprising social cognition, symptom and functioning measures. Coders were required to reach acceptable levels of inter-rater reliability (ICCs and $\kappa > 0.70$) on all interview-based measures, as well as the social skill role-play. Psychometric characteristics of all measures here as well as their means and standard deviations in this sample have been reported elsewhere (Healey et al., 2015).

Statistical analysis. Exploratory factor analysis (EFA) was used to examine whether the social cognitive indices load on separable factors. The factor structure was determined by initially reviewing a scree plot and further investigated with model fit indices. Conditional maximum likelihood (PACE) extraction method was used, a noniterative procedure that is less likely to result in Heywood cases related to small sample size (Cudeck, 1991; Browne et al., 1998). Crawford–Ferguson Quartimax, oblique rotation was selected because the factors are likely inter-correlated and not orthogonal. Measures were assigned to factors based on the weight of their loadings. We calculated factor scores by standardizing social cognitive indices and summing z-scores for each factor. Second, we examined correlates of the underlying social cognitive factors, including indices of neurocognition, symptoms and functional outcome. Finally, an incremental validity analysis was performed to examine the relationship of social cognition to functioning beyond the influence of neurocognition. This analysis examined any social cognition factor that had a significant relationship to a functional outcome in the initial analyses. Using hierarchical linear regression, the functional outcome of interest was predicted from the factor score after removing the influence of WASI-2 scores. All data analyses were performed using SPSS version 22.0 (Armonk, NY) and 23.0 and CEFA version 3.04 (Columbus, OH) (Browne et al., 1998).

Results

Factor analyses in schizophrenia

The data were first examined for suitability for factor analysis. The Kaiser–Meyer–Olkin (KMO) Measure of Sampling Adequacy was 0.65 (Kaiser, 1970, 1974). Indices above the recommended value of 0.50 are suitable for factor analytic procedures (Tabachnick & Fidell, 2007). Bartlett's Test of Sphericity was significant [χ^2 (36) = 119.74, $p < 0.01$], also indicating that factor analysis is suitable (Tabachnick & Fidell, 2007).

Demographic and clinical characteristics are summarized in Table 1. Table 2 provides the correlations among the nine social cognitive indices. The FEIT was significantly correlated with the FEDT, the Hinting Task, and the TASIT subscales (better emotion perception with better theory of mind). The FEDT was also significantly correlated with the TASIT subscales (better emotion perception with better theory of mind), and approached statistical significance with AIHQ subscales (poorer emotion recognition correlating with more hostile attributional style). AIHQ Blame and AIHQ Hostility were also significantly correlated with one another.

In participants with schizophrenia, a two-factor solution was the model of best fit (Table 3). The root mean square error of approximation (RMSEA) was within the range of reasonable fit at 0.07 (Confidence Interval, CI: 0.00–0.13) (Brown & Cudeck, 1993). The Tucker–Lewis Index (TLI) was also adequate at 0.91 (Hu & Bentler, 1999). There was consensus between the scree plot and model fit for the selection of a two-factor model. The first factor, labeled ''Hostile Attribution Style'', contained high loadings for AIHQ indices of aggression, blame and hostility. The second factor contained high loadings for indices of emotion perception, theory of mind and jumping to conclusions. Factor 2 was labeled ''Social cognition skill'' as these indices share content involving broad manifestations of social cognitive skills involved in right-or-wrong social determinations about emotions or thoughts of others.

Factor scores were computed by summing raw item scores that correspond to each factor. The factors were not significantly inter-correlated with one another ($r = 0.04$).

Factor analyses in healthy controls

The data were first examined for suitability for factor analysis. The KMO Measure of Sampling Adequacy was 0.60 (Kaiser, 1970, 1974). Indices above the recommended value of 0.50 are appropriate for factor analysis procedures (Tabachnick & Fidell, 2007). Bartlett's Test of Sphericity was significant [χ^2 (36) = 95.95, $p < 0.01$], also indicating that factor analytic methods are suitable (Tabachnick & Fidell, 2007).

Table 2 also provides the correlations among the nine social cognitive indices in healthy controls. The FEIT showed significant correlations with the Hinting Task and the FEDT (i.e. better emotion recognition with better theory of mind skills). The Hinting Task was also significantly correlated with both TASIT subscales (better theory of mind skills with better theory of mind skills). The AIHQ subscales were correlated with one another as well as the TASIT subscales (more hostile attributional style correlated with poorer theory of mind skill). The correlation between the TASIT – Simple Sarcasm scale and the FEDT approached significance. The Beads Task was minimally correlated with the other measures of social cognition.

In healthy controls, the scree plot and model fit indices did not clearly favor a two- or three-factor model; instead, each

Table 2. Correlations between social cognitive indices; patients and controls.

	FEDT	FEIT	HINT	BEADS	TAS_SSR	TAS_PSAR	AIHQAgg	AIHQBlame	AIHQHost
FEDT	1	0.30*	0.16	0.16	0.25***	0.22	0.16	−0.08	0.01
FEIT	0.39**	1	0.28*	−0.12	0.06	0.00	0.00	−0.07	−0.05
HINT	0.49**	0.44**	1	0.24***	0.43**	0.48**	−0.09	−0.11	−0.26***
BEADS	0.17	0.10	0.12	1	0.02	0.22	0.05	−0.08	−0.17
TAS_SSR	0.27*	0.36**	0.28*	0.24***	1	0.52**	−0.16	−0.38**	−0.48**
TAS_PSAR	0.33**	0.42**	0.42**	0.1	0.5**	1	0.07	−0.06	−0.16
AIHQAgg	−0.22***	−0.1	−0.06	−0.08	−0.19	−0.09	1	0.24***	0.31*
AIHQBlame	−0.22***	0.04	−0.01	−0.16	0.18	0.06	0.08	1	0.61**
AIHQHost	0.13	0.07	0.10	−0.01	0.15	0.07	−0.01	0.56**	1

Shaded cells are healthy controls correlations.
BEADS = Beads Task; TAS_SSR = TASIT Simple Sarcasm; TAS_PSAR = TASIT Paradoxical Sarcasm; AIHQAgg = AIHQ Aggression; AIHQBlame = AIHQ Blame; AIHQHost = AIHQ Hostility.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.10$.

evidenced close fit. The RMSEA was within the range of close fit at 0.04 (CI: 0.00–0.15) (Brown & Cudeck, 1993). The TLI indicates excellent model fit at 1.01 (Hu & Bentler, 1999). Factor 1 in healthy controls is identical to factor 1 in schizophrenia participants, corresponding to the Hostile Attributional Style factor. The second factor contained high loadings for indices of theory of mind (Hinting Task, TASIT) and jumping to conclusions (Beads Task). Factor 2 was therefore labeled ''Higher level inferential and regulatory processes''. A third factor emerged containing high loadings for tasks of emotion perception (FEDT, FEIT). Thus, Factor 3 was labeled ''Lower-level social cue detection''. Given the similarity to the previous work of Mancuso et al. (2011), factors were named in a manner consistent with this prior study.

Hostile attributional style (factor 1) was significantly correlated with higher level inferential processing (factor 3) ($r = 0.29$, $p < 0.05$). Other correlations among factors were non-significant.

Correlations with symptoms, neurocognition and functional outcome measures

Correlations between the factors and symptoms, neurocognition and functional outcome are reported in Table 4. In the schizophrenia sample, hostile attributional style (Factor 1) was significantly associated with PANSS positive and emotional discomfort factors as well as PANSS total score, indicating that higher hostile attribution ratings (e.g. increased tendency to report blame/hostility/aggression in response to ambiguous social situations) were correlated with higher levels of positive symptoms, anxiety, depression and general emotional discomfort. It approached statistical significance in predicting quality of life.

The social cognition skills factor (2) was highly associated with PANSS cognitive symptom factor, suggesting that greater social cognitive skills are associated with lower cognitive symptoms. Interestingly, this factor was uncorrelated with positive, negative, and hostility symptoms. The social cognitive skills factor was also significantly correlated with WASI (IQ), indicating that greater social cognitive skill is associated with higher IQ. This factor is also significantly positively correlated with the GSFS as well as the SSPA, indicating social cognition skills are associated with improved functioning.

In the healthy control sample, higher level social inferences (factor 2) was significantly associated with WASI (IQ), indicating that greater higher level social cognitive abilities are correlated with greater ratings of intelligence ($r = 0.54$, $p < 0.001$).

Incremental validity

Incremental validity analyses were conducted to determine the added variance from the social cognition factors predicting functional outcome beyond neurocognition. Hierarchical linear regressions were conducted using the social cognition factors significantly related to measures of real-world outcome. Two separate hierarchical regressions were then conducted, one with each of the functional outcomes found to be significantly related to the social cognition factors, namely GSFS and SSPA total. For both regressions, at the first step (1) we entered WASI total score, and at the second step (2) we entered the social cognition skill factor. The social cognition factor accounted for a significant model improvement predicting SSPA, $\Delta R^2 = 0.07$, $p = 0.02$, but did not significantly improve model fit for the GSFS above and beyond the influence of WASI, Δ $R^2 = 0.04$, p = 0.14. Full model statistics can be found in Table 5.

Table 4. Correlations between social cognitive factors and symptoms, neurocognition and functional outcome, patients ($n = 66$).

	Factor 1 – Hostile attributional style	Factor 2 – Social cognitive skills
Symptoms		
PANSS Positive	0.30*	−0.18
PANSS Negative	0.14	−0.09
PANSS Cognitive	0.04	−0.45***
PANSS Hostility	0.20	0.01
PANSS Emotional Discomfort	0.28*	0.16
PANSS Total	0.30*	−0.17
Neurocognition		
WASI-2	−0.01	0.47**
Social skills and Functioning		
GSFS	0.05	0.27*
SSPA Total	0.19	0.44*
RFS Total	−0.14	0.04
QLS Total	−0.21#	0.03

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; #$p < 0.10$.

Table 3. Factor loadings of the social cognitive indices.

Schizophrenia	Factor 1: Hostile attributional style	Factor 2: Social cognitive skill	Controls	Factor 1: Hostile attributional style	Factor 2: higher− level inferential processing	Factor 3: lower− level social cue detection
FEDT	−0.17	**0.59**	FEDT	0.12	0.18	**0.40**
FEIT	0.02	**0.63**	FEIT	0.02	−0.08	**0.46**
Beads	−0.16	**0.25**	Beads	−0.09	**0.26**	−0.12
Hinting Task	−0.04	**0.62**	Hinting Task	−0.09	**0.51**	0.18
TASIT – Simple Sarc0.	0.17	**0.55**	TASIT – Simple Sarc0.	−0.37	**0.50**	0.14
TASIT− Para0. Sarc0.	0.08	**0.62**	TASIT− Para0. Sarc0.	0.07	**0.84**	−0.04
AIHQ Aggression	**0.10**	−0.22	AIHQ Aggression	**0.41**	0.12	0.06
AIHQ Blame	**0.60**	−0.04	AIHQ Blame	**0.70**	0.10	−0.10
AIHQ Hostility	**0.49**	0.10	AIHQ Hostility	**0.87**	−0.05	0.06

AIHQ = Ambiguous Intentions Hostility Questionnaire; ER40 = Penn Emotion Recognition Task; TASIT = The Awareness of Social Inference Test.

Table 5. Hierarchical linear regression predicting functioning from social cognition skill.

	B	SE B	β
Predicting SSPA Total[a]			
Step 1Neurocognition			
WASI	**0.12**	**0.03**	**0.44*****
Step 2 – Social cognition			
WASI	**0.08**	**0.03**	**0.29***
Social cognition skill factor	**0.32**	**0.13**	**0.30***
Predicting GSFS[b]			
Step 1 – Neurocognition			
WASI	0.02	0.01	0.24^
Step 2 – Social cognition			
WASI	0.01	0.01	0.15^
Social cognition skill factor	0.06	0.04	0.21

[a]$R^2 = 0.19$ ($p < 0.001$) for Step 1, $\Delta R^2 = 0.07$ ($p = 0.02$) for Step 2. Total model $R^2 = 0.26$, $p < 0.001$.
^$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.
[b]$R^2 = 0.06$, $p = 0.06$ for Step 1, $\Delta R^2 = 0.04$ ($p = 0.14$) for Step 2. Total model $R^2 = 0.09$, $p = 0.06$.
^$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Discussion

Consistent with previous work (Mancuso et al., 2011; van Hooren et al., 2008) our results demonstrate a clear separation of attributional style and social cognition skill (like theory of mind and emotion perception) in schizophrenia. This is consistent with conceptual differences between these two constructs. According to this explanation, the key difference is that emotion perception and theory of mind depend upon one's ability to make correct judgments about other's thoughts and emotions, whereas attributional style describes a certain cognitive style when making judgments about others' behavior, regardless of the correctness or incorrectness of said judgments. Interpreting this domain as consisting of separable factors could be informative in understanding deficits on an individual level. For example, there could be meaningful clinical and functional differences between individuals with schizophrenia who have a hostile attributional bias and intact skill-based social cognition and those with the inverse. Our factor analyses did not support a separation between lower level simple judgments about social interactions and higher order inference-making processes in individuals with schizophrenia (Mancuso et al., 2011). Rather, our results produced one factor that subsumed judgments about both emotion perception and theory of mind.

Conversely, our factor analysis in the control sample was consistent with the two-factor model or a three-factor model similar to the clinical sample in Mancuso et al. (2011): hostile attributional style, lower level social cue detection and higher level inferential and regulatory processes. This suggests that social cognition abilities are more specialized/differentiated in a control sample than they are in a sample of individuals with schizophrenia. The specific reasons for this are unknown, but it is notable that right-or-wrong social cognitive judgments loaded on one factor separately from attributional biases. It is plausible that individuals with schizophrenia suffer from a general performance deficit in these right-or--wrong areas (e.g. theory of mind and emotion perception) and this impairment cuts across both lower level and higher order social cognitive judgments.

The two factors in the schizophrenia sample were also examined for their relationships to measures of symptoms, functioning and neurocognition. Our first factor, hostile attributional style, was significantly correlated with positive and emotional discomfort symptoms and it approached statistical significance in predicting quality of life. It was uncorrelated with neurocognition, social skills performance and role functioning. The second factor, social cognition skill, was significantly correlated with cognitive symptoms, general neurocognition, social skills and a global assessment of social functioning. It added variance in predicting social skills above and beyond the influence of neurocognition.

The correlations of the social cognition factors with symptoms are consistent with definitions of each domain. Taken together, the hostile attributions factor appears to show relationships with psychopathology, but does not correlate with one's ability to understand others. The second factor, social cognition skills, might have more influence over individuals' ability to understand and interact with others, given its relationship to functioning. This same pattern was demonstrated in Mancuso et al. (2011), in which skill-based social cognition domains significantly correlated with functioning and hostile attributional style was more closely related to symptoms but less predictive of functioning. Our results replicate that of Lysaker et al. (2013a), who demonstrated a single social cognition skill factor (separate from metacognition in that study).

The separation of (and lack of correlation between) these two areas could be of clinical importance. Individuals with general social cognition impairments could be better served by interventions that aim to compensate or remediate these weaknesses, and these interventions could be aimed at reducing negative symptoms and improving functioning. Alternatively, individuals with primary hostile attribution biases could be better served by cognitive interventions that target the frequency with which they interpret circumstances with these negative biases. These deficits and biases are not only separable, but appear unrelated to one another, and thus should be regarded as separate clinical phenomena, rather than a social cognition impairment monolith. Also, specifically in comparison with the control sample, results among patients suggest that social cognition skills may be more fine grained in controls, whereas individuals with schizophrenia are affected by general deficits that obscure specificity of social cognition abilities.

This study has several limitations. First, it examined factor structure in a small sample, particularly in the control group. Second, as these are baseline data, no conclusions can be drawn about the stability of these domains or their ability to predict functioning prospectively. Third, one continued complication in factor analytic work in social cognition in schizophrenia relates to the specific methods of the instruments. Particularly, most measures in this study are skill-based tasks, whereas others (e.g. the AIHQ) are questionnaires. Additionally, attribution measures examined here were subscales of a single instrument. Although this may also be a characteristic that distinguishes these domains, future research should aim to separate differences related to social cognitive domains from those related to the method of delivery. Further, whereas The Beads Task is a functional measure of jumping to conclusions, other JTC measures specific to social content may add value in future studies. Factor analytic studies are affected by both measures selected and population sample; some of these attributes could account for differences between this study and previous work. And finally, based on recent psychometric research, the optimal battery of neurocognitive tests for this population is the MATRICS battery (Nuechterlein et al., 2008); this study only was able to examine relationships to neurocognition as measured through a brief IQ measure.

Conclusions

This study provided further evidence for the clear separation of attributional style from other skill-based domains of social cognition in both individuals with schizophrenia and non-clinical controls. Results suggested a two-factor structure of social cognition in individuals with schizophrenia (social cognition skill and hostile attributional style) and the same two- or a different three-factor structure in non-clinical controls (lower level social cue detection, higher level inferential processing and hostile attributional style). In individuals with schizophrenia, the hostile attributional style factor predicted general and positive symptoms, whereas the social cognition skill factor predicted negative symptoms and social functioning. Ultimately, this study contributes to the growing evidence in schizophrenia research suggesting disjunction between performance-based measures of social cognition and assessments of hostile attributional style. Further research should continue to replicate the factor structure of social cognition to examine its stability, and do so using tasks with the strongest psychometric properties, such as measures recommended by the SCOPE study (Pinkham et al., 2014).

Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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