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The functional significance of cognitive empathy and theory of mind in early and chronic schizophrenia

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ABSTRACT

Theoretical models suggest that it is the interplay between social cognitive processes that result in adaptive social functioning in schizophrenia. This study explored the relative contributions of, and interplay between, cognitive empathy, affective theory of mind (ToM), neurocognition, and severity of clinical symptoms, in predicting the social functioning of individuals with schizophrenia. Clinical participants (early schizophrenia $n = 26$, chronic schizophrenia $n = 32$) were administered an ecologically valid measure of ToM (viz., the Virtual Assessment of Mentalising Ability or VAMA) and the Empathy Quotient (EQ) as part of a larger neuropsychological and social functioning assessment battery. Results indicated that individuals with early schizophrenia reported significantly better cognitive empathy than individuals with chronic schizophrenia. ToM was found to have added value in predicting both community functioning and functional capacity that was beyond that accounted for by cognitive empathy, clinical symptoms, and neurocognition for both clinical groups. Further, our results indicated that the capacity to demonstrate empathic understanding of another's situation (i.e., cognitive empathy) mediates the relationship between ToM and social functioning. Together, our findings highlight the intricate and compounding nature of social cognition constructs, and their effect on social functioning for individuals with schizophrenia.

1. Introduction

Individuals with schizophrenia often experience severe interpersonal deficiencies that limit independent living, the initiation and maintenance of interpersonal relationships, and vocational functioning (Bellack et al., 2007; Couture et al., 2006; Green et al., 2008). This study extends upon previous research that confirms the individual contributions of theory of mind (ToM) and empathy to social functioning in schizophrenia (e.g., Michaels et al., 2014; Smith et al., 2014; Fett et al., 2011), by exploring the interplay of social cognitive processes in predicting adaptive functioning in early and chronic schizophrenia.

Social cognition is an umbrella term used to collectively describe advanced cognitive functions (including ToM and empathy) that underlie an individual's ability to process, store, and apply information about other people and social situations (Montag et al., 2011). Empathy constitutes a set of distinct processes by which one person attends to the subjective experiences of another person (Bora et al., 2008; Zaki et al., 2012). Affective empathy relies on phylogenetically emotional contagion systems and refers to the vicarious experience of the emotional experiences of others (Decety, 2011; Michaels et al., 2014). In some models, affective empathy can be further broken down into empathic concern (having concerns or worries for another person) and personal distress (discomfort upon witnessing another's difficulty; Davis, 1983). Cognitive empathy, on the other hand, refers to a set of reflective processes that include understanding the emotional state of others, distinguishing another's feelings from one's own, and being able to integrate this information with social knowledge to adaptively guide interpersonal behaviour (Bernhardt & Singer, 2012; Decety, 2011; Shamay-Tsoory, 2011).

ToM refers to the ability to attribute mental states to others (Kalbe et al., 2007; Singer et al., 2009). Cognitive ToM has been defined as the ability to make inferences about another's thoughts/beliefs, while affective ToM is the inference of another's emotional state. Given the theoretical similarities, affective ToM and cognitive empathy have been treated as interchangeable at times (Shamay-Tsoory et al., 2010). The main difference between the two constructs is that, the former only refers to an understanding of another's state, while the latter requires the active engagement of the person in the perspective of another person

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(see Table 1). ToM has been conceptualized as having first- and second-order components. First-order ToM refers to understanding the perspective of an immediate other, and second-order ToM refers to the ability to understand what a third person may be thinking that immediate others is thinking, feeling, or intending.

1.1. Neurocognitive correlates of empathy

Variation in the empathic response may reflect strength of mental flexibility. Decety and Jackson (2004) suggested that the capacity to adopt someone else's point of view requires effortful and controlled diversion of attentional resources away from default self-perspective and egocentricity and the ability to shift a course of thought or action according to the demands of a social situation. This theoretical reasoning has been supported by significant correlations between empathy and measures of cognitive flexibility (Grattan & Eslinger, 1989; Shamay-Tsoory et al., 2003). These results provide an early but promising indication that deficits in specific aspects of empathy (viz., cognitive empathy) may reflect a breakdown in neurocognitive processes. Research on possible relationships between ToM and cognitive abilities has shown mixed results. There are strong bodies of evidence confirming an interplay between social cognitive and cognitive processes (e.g., with executive functions, Greig et al., 2004; memory, Mehl et al., 2010), as well as the influence of cognitive abilities on social functioning in schizophrenia (Bowie et al., 2008; Green, 1996). As such, the current study sought to capture the influence of previously identified cognitive abilities (viz., mental flexibility, attention, verbal fluency, verbal response inhibition, working memory, and estimated IQ) relative to ToM and empathy in predicting social functioning in individuals with schizophrenia.

1.2. Empathy and theory of mind in schizophrenia

The findings from research using samples of individuals with autism spectrum disorder (Mathersul et al., 2013), ventromedial prefrontal cortex (vmPFC) damage (Shamay-Tsoory et al., 2003) and schizophrenia (Shamay-Tsoory et al., 2007b) have provided preliminary support for the theoretical association between empathy and ToM. These results are also consonant with neuroimaging findings, which indicate that ToM and empathy are subserved by a shared neural network (Shamay-Tsoory, et al., 2007a). Several reviews and meta-analyses have confirmed that ToM is disrupted in early (e.g., Green et al., 2012) and chronic stages of schizophrenia (Bora et al., 2009; Fett et al., 2011; Sprong et al., 2007).

Results of previous research have consistently indicated that individuals with chronic schizophrenia report diminished cognitive empathy relative to healthy adults (Achim et al., 2011; Corbera et al., 2013; Haker et al., 2012; Lee et al., 2011; Michaels et al., 2014; Smith et al., 2012; Sparks et al., 2010). The finding that cognitive empathy is impacted in schizophrenia is echoed in studies using other assessment methods, including behavioural performance (Derntl et al., 2009; Dernt et al., 2012; Smith et al., 2014), fMRI (Lee et al., 2010; Smith vvet al., 2014; Horan et al., 2014a) and electrophysiological tasks (McCormick et al., 2012; Corbera et al., 2013; Horan et al., 2014b).

Research exploring affective empathy in schizophrenia has returned mixed results. Although some studies indicate that individuals with schizophrenia are self-reporting similar level of affective responsivity to that reported by healthy adults (Achim et al., 2011; Haker et al., 2012; Michaels et al., 2014; Singh et al., 2011), others have concluded that this clinical group reports diminished empathic concern and/or heightened personal distress (Lee et al., 2011; Shamay-Tsoory et al., 2007a, 2007b; Sparks et al., 2010).

Research has also started to explore the stability of empathic deficiencies across schizophrenia. Montag, Heinz, Kunz, and Gallinat (2007) found that ratings of empathic perspective taking, but not affective empathy, negatively correlated with duration of illness. Similarly, results of a meta-analysis revealed a significantly lower effect size for differences in cognitive empathy between individuals with first episode psychosis and healthy controls relative to those reported in studies comparing healthy controls with individuals with chronic schizophrenia (Achim et al., 2011). These results suggest that cognitive empathy may be less affected in the early stage of schizophrenia, but deteriorates with illness chronicity. Similar findings were reported for ToM; first-order cognitive ToM was found to be preserved in early psychosis (Canty et al., 2017b). Individuals with chronic schizophrenia were found to have poorer performance on all dimensions of a ToM task compared to those with early psychosis (Canty et al., 2017b).

Table 1
Key Difference Between Cognitive Empathy and Affective ToM.

	Understanding another's state	Emotionally engaged in another's perspective
Cognitive empathy	✓	✓
Affective theory of mind	✓	X

1.3. Relationship between empathy, ToM and social functioning

There is preliminary evidence to suggest that empathy (Michaels et al., 2014; Smith et al., 2014) and ToM (Fett et al., 2011; Pijnenborg et al., 2009; Zhu et al., 2007) account for significant incremental variance in social functioning after accounting for relevant neurocognitive and psychopathological variables. The integrative mediation model described by Ofir-Eyal and colleagues (2014) explains the decline in social functioning commonly observed in individuals with schizophrenia. According to this model, the interpersonal problems of persons with schizophrenia may emerge because their interpretation of the goals, intentions, and emotions of others preclude accurate empathic understanding and emotional displays congruent with the other persons' emotional experience. In turn, inaccurate empathising can reduce the fluidity, intimacy, and quality of social interactions (Harvey et al., 2013; Lee et al., 2011).

Only one study to date has attempted to explicitly test whether empathy mediates the relationship between social cognition (viz., emotion recognition and ToM) and social functioning. Utilising a sample of 30 individuals with schizophrenia or schizoaffective disorder, Sparks et al. (2010) found that impairment in the comprehension of sarcasm (viz., ToM) was associated with higher empathic personal distress (i.e., affective empathy), and lower recreational functioning. However, in this study, empathy could not be explored as a mediator of the association between social cognition and functional outcome due to a lack of common associations with functional outcome measures.

1.4. Aims and hypotheses

The primary aim of this study was to examine the added value of cognitive empathy above that of ToM, neurocognition, and severity of clinical symptoms in predicting social functioning in early and chronic schizophrenia. Based on the findings of Michaels et al. (2014) and Smith et al. (2012), it was anticipated that individuals with early schizophrenia will report their cognitive empathy as significantly higher than that of individuals with chronic schizophrenia. It was also expected that cognitive empathy would account for a unique portion of variance in social functioning for both clinical groups, after controlling for cognitive and affective ToM, neurocognition and clinical symptoms.

2. Method

2.1. Participants

All clinical participants had a DSM-5 diagnosis (APA, 2013) of

schizophrenia and were recruited from either an early psychosis intervention or mental health rehabilitation program in Queensland, Australia. Diagnoses of schizophrenia were determined by medical records and consultation with the participant's treating psychiatrist. Clinical participants were stabilised on atypical antipsychotic medications for at least 1 month prior to participation.

The early schizophrenia group included 15 inpatients and 11 outpatients (see Table 1). All participants within this group had experienced their first psychotic episode within two years of participating in this study, with most individuals recovering from their first psychotic episode proximal to the time of participation (i.e., within 3 months of their first treatment by mental health services; Green et al., 2012). The chronic schizophrenia group included 15 inpatients and 18 outpatients. Chronic patients had experienced multiple psychotic episodes and were within 2 to 15 years of illness.

All clinical participants understood spoken English sufficiently to comprehend testing procedures and exhibited no physical or language impairment that could adversely affect task performance. Individuals with schizoaffective, schizophreniform, and bipolar disorder, IQ less than 70, or histories of neurological disorder/brain injury (e.g., epilepsy, brain tumour, previous head trauma requiring hospitalisation) were excluded. Sociodemographic, clinical variables, and medication dosage in terms of chlorpromazine equivalent (i.e., CPZ; Gardner et al., 2010) were gathered from medical records.

Consistent with earlier reports on the demographics of cohorts with schizophrenia (Ochoa et al., 2012), individuals with early schizophrenia were significantly younger than individuals with chronic schizophrenia ($t(39.85) = 5.09, p < .001$). Individuals with early schizophrenia did not differ from individuals with chronic schizophrenia on estimated IQ ($t(57) = -1.98, p = .053$). Symptom levels and CPZ equivalents are comparable to other studies using schizophrenia samples (e.g., Fretland et al., 2015).

All participants provided informed written consent to a protocol approved by the first author's institutional research ethics committee. Participants were individually administered all measures during a 2-hour assessment session. The EQ was administered after the ToM tasks and prior to the neurocognitive assessment battery.

2.2. Measures and procedure

2.2.1. Symptom assessment

Fretland et al's (2015) categorisation of the items of the Positive and Negative Syndrome Scale (PANSS) was used to assess the positive, negative and disorganised symptom severity for schizophrenia (Wallwork et al., 2012). Higher scores indicate higher symptom severity.

2.2.2. Empathy

The Empathy Quotient (EQ; Baron-Cohen, 2003; Baron-Cohen & Wheelwright, 2004) was used to provide indices of cognitive empathy (items 25, 26, 44, 52, 54), emotional reactivity (items 4, 8, 12, 14, 35) and social skills (items 6, 27, 32, 50, 59; Muncer & Ling, 2006) using a forced-choice scale (viz., strongly agree to strongly disagree). Higher scores reflect better perceived empathic abilities. The EQ has been shown to be sensitive to variations in empathy abilities in the schizophrenia population (Bora et al., 2008; Didehbani et al., 2012), and the cognitive empathy subscale has a strong internal consistency ($\alpha = .84$, Muncer & Ling, 2006).

2.2.3. Theory of mind

The Virtual Assessment of Mentalising Ablity (VAMA) uses a virtual interface to simulate the demands of real-life social interactions (internal consistency ranged from 0.69 to 0.84; Canty et al., 2017a). Participants are required to navigate a virtual shopping centre and complete a list of errands (e.g., post a letter at the post office), during which they respond to multiple-choice questions about 10 social interactions that occur between the test-taker and his/her virtual 'friends'. Two neutral interactions are presented and are followed by questions that require non-mental state reasoning (e.g., "what size shirt did John want to try on?"). These serve as control questions to check accurate encoding of task content and ability to undertake the VAMA. Performance on the VAMA is divided into indices of first- and second-order cognitive and affective ToM. For the purpose of this study, the first- and second-order ToM scores were pooled. ToM score in this study refers to the total pooled score from both cognitive and affective ToM indices. Higher scores indicate higher accuracy on this ToM task.

2.2.4. Neurocognitive assessment

Considering the effects of neuro-cognitive abilities on empathy (Decety & Jackson, 2004) and ToM (e.g., Greig et al., 2004), commonly used measures with adequate psychometric properties were selected to provide information about separate cognitive domains including attention (Digit Span subtest of the Wechsler Adult Intelligence Scale IV, Wechsler, 2008), mental flexibility (Trail Making Test: Part B; Reitan & Wolfson, 1985), verbal fluency (Controlled Oral Word Association Task; COWAT; Benton et al., 1978), verbal response inhibition (Hayling Test; Burgess & Shallice, 1997), working memory (Letter Number Sequencing subtest of the Wechsler Memory Scale III; LNS; Wechsler, 2003), and estimated IQ (i.e., as measured by the Vocabulary and Matrix Reasoning subtests from the Wechsler Abbreviated Scale of Intelligence II, Wechsler & Hsiao-pin, 2011).

2.2.5. Social functioning assessment

We used two measures of social functioning, a task-based measure of social skills, and a subjective self-report of community functioning. The Social Skills Performance Assessment (Patterson et al., 2001) is a behavioural measure of social skills used to provide an index of functional capacity (i.e., social skill; inter-rater reliability $r = .89$, test-retest reliability $= .91$; McClure et al., 2007). Higher scores suggest better social skills. The Social Functioning Scale (Birchwood et al., 1990) is a 79-item questionnaire that requires subjective ratings within seven domains of community functioning: social engagement, interpersonal functioning, competence for independent living, performance of independent living tasks, engagement in recreational hobbies, and prosocial behaviour. Total scores were used for measure of social functioning ($\alpha = .80$; Birchwood et al., 1990). Higher scores indicate better self-reported community functioning.

2.3. Data analyses

All raw data were screened according to the procedures outlined by Tabachnick and Fidell (2007). Given that IQ and neurocognitive abilities were significantly different between individuals with early and chronic schizophrenia and are dissociable from illness chronicity, a composite measure of neurocognition (including IQ) was used as a statistical control in all analyses. Group differences in empathic abilities, as assessed by the EQ, were explored using univariate ANCOVAs with the composite measure of neurocognition used as the covariate. Separate hierarchical multiple regressions were conducted for individuals with early and chronic schizophrenia to investigate the extent to which ToM and cognitive empathy account for incremental variance in functional capacity and community functioning, after controlling for neurocognitive abilities and severity of clinical symptoms. The composite measure of neurocognitive abilities was entered as Step 1. Positive, negative and disorganised symptoms were entered at Step 2. Total ToM performance on the VAMA (i.e., first- and second-order cognitive and affective ToM) and cognitive empathy on the EQ were entered at Steps 3 and 4, respectively. The mediated effect of affective ToM (i.e., composite of first- and second-order indices) on community functioning and functional capacity, via cognitive empathy, was tested using the Baron and Kenny's (1986) four-step approach, with neurocognition and clinical symptoms entered as covariates. In the absence of a sufficient sample size, tests of indirect effects (e.g., using the 95% bias-corrected bootstrap

procedure; Preacher & Hayes, 2004) were considered inappropriate.

3. Results

3.1. Demographic and clinical variables

The clinical and demographic characteristics of the individuals with early and chronic schizophrenia are presented in Table 2.

3.2. Self-Reported empathy in schizophrenia

Participants' mean ratings of cognitive empathy, emotional reactivity, and social skills, as measured by the EQ, are summarised in Fig. 1. The ANCOVA results indicated that individuals with early schizophrenia rated their cognitive empathy ($F(1, 50) = 10.83$, $p = .002$, $\eta_p^2 = .18$) and their emotional reactivity ($F(1, 50) = 5.59$, $p < .05$, $\eta_p^2 = .10$) significantly better than did individuals with chronic schizophrenia. Significant differences were not observed between the two groups on self-reported ratings of social skills ($F(1, 50) = .29$, $p = .59$).

3.3. Factors associated with empathy in early and chronic schizophrenia

3.3.1. Empathy and theory of mind

Significant moderate correlations were observed between cognitive empathy and second-order cognitive and total ToM for individuals with early schizophrenia, and with first-order cognitive and total ToM for individuals with chronic schizophrenia (Table 3). Significant moderate correlations were also observed between social skills and second-order affective ToM for individuals with early schizophrenia (Table 3).

3.3.2. Social cognitive correlates of social functioning]

Cognitive empathy scores were significantly and moderately associated with indices of functional capacity and community functioning in individuals with early and chronic schizophrenia (Table 3). Moderate significant correlations were observed between first- and second-order cognitive and affective ToM and functional capacity for both individuals with early and chronic schizophrenia (Table 4).

3.4. Regression analyses

3.4.1. Community functioning

When added to the model, cognitive empathy accounted for 9% incremental variance in community functioning for individuals with early schizophrenia (ΔF (1, 16) = 78.73, $p < .001$; Table 5), and 10% for individuals with chronic schizophrenia (ΔF (1, 17) = 98.16, $p < .05$). In the final models, both total ToM performance ($\beta = .39$, $p < .001$) and cognitive empathy ($\beta = .31$, $p < .001$) explained significant variance in community functioning for individuals with early and chronic schizophrenia (ToM $\beta = .43$, $p < .001$; cognitive empathy $\beta = .33$, $p < .001$).

Table 2
Descriptive Statistics for Demographic and Clinical Characteristics of Individuals with Early and Chronic Schizophrenia.

Variable	Early schizophreniaM (SD)	Chronic schizophreniaM (SD)
Male:female	13:13	22:11
Age, years	23.19 (2.84)	31.64 (8.97)
Education, years	12.19 (2.02)	11.30 (1.70)
Estimated IQ (WASI)	99.04 (12.30)	92.79 (11.88)
Duration of illness, years	0.62 (1.21)	10.98 (6.16)
Age of onset, years	22.27 (3.11)	20.91 (5.63)
Number of psychotic episodes	1.62 (1.33)	9.13 (8.56)
PANSS		
Positive symptoms factor	8.00 (3.48)	11.70 (4.48)
Negative symptoms factor	11.76 (4.54)	13.63 (5.29)
Disorganisation symptoms factor	6.16 (2.82)	8.77 (2.88)
Chlorpromazine equivalent (daily)	466.58 (373.49)	627.14 (399.61)

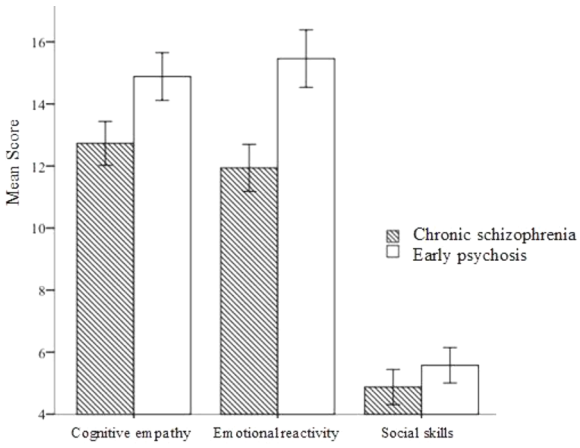

Fig. 1. Mean scores on the Empathy Quotient subscales provided by individuals with early and chronic schizophrenia. *Error bars represent ± 1 SE.*

Table 3
Partial Correlations between the Virtual Assessment of Mentalising Ability and Empathy Quotient Subscales for Individuals with Early and Chronic Schizophrenia.

	Cognitive empathy	Emotional reactivity	Social skills
Early schizophrenia			
First-order cognitive ToM	.39	-.01	.46*
First-order affective ToM	.46*	-.04	.14
Second-order cognitive ToM	.52**	-.01	-.10
Second-order affective ToM	.30	-.21	-.53**
Total ToM	.65***	-.01	.08
Chronic schizophrenia			
First-order cognitive ToM	.65***	.09	.11
First-order affective ToM	.45*	.05	-.12
Second-order cognitive ToM	.44*	.46*	.04
Second-order affective ToM	.48*	.25	.18
Total ToM	.65***	.15	.16

Note. ToM = Theory of mind. Control variable = Neurocognition.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

3.4.2. Functional capacity

When added to the model, cognitive empathy accounted for 5.9% incremental variance in functional capacity for individuals with early schizophrenia (ΔF (1, 16) = 15.96, $p = .001$; Table 6) and 7.9% for individuals with chronic schizophrenia (ΔF (1, 17) = 18.62, $p < .001$). In the final model, both total ToM performance ($\beta = .52$, $p = .005$) and cognitive empathy ($\beta = .48$, $p = .001$) explained significant variance in functional capacity for individuals with early and chronic schizophrenia (ToM $\beta = .49$, $p < .001$; cognitive empathy $\beta = .21$, $p < .01$).

3.5. Mediation models

According to the statistical procedures described by Baron and Kenny (1986), mediation is present when the independent variable (affective ToM) significantly predicts the dependent variable (social functioning), as described in Path C, but this relationship is substantially minimised, or is no longer significant, when the proposed mediator

Table 4
Partial Correlations between Empathy Quotient Subscales and Theory of Mind Subscales with Indices of Social Functioning for Individuals with Early and Chronic Schizophrenia.

	SFS	SSPA
Early schizophrenia		
Cognitive empathy	.66***	.61***
Emotional reactivity	.09	.02
Social skills	.19	.01
First-order cognitive	.55**	.56**
First-order affective	.48**	.52**
Second-order cognitive	.47**	.57**
Second-order affective	.30	.50**
Total ToM	.52**	.66***
Chronic schizophrenia		
Cognitive empathy	.67***	.68***
Emotional reactivity	.27	.21
Social skills	.36	.36
First-order cognitive	.48**	.62***
First-order affective	.42*	.52**
Second-order cognitive	.57***	.47**
Second-order affective	.18	.48**
Total ToM	.56***	.68***

Note. Control variable = Neurocognition. SFS = Social Functioning Scale. SSPA = Social Skills Performance Assessment.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

(cognitive empathy) is added as an independent variable in the multiple regression model.

3.5.1. Community functioning

3.5.1.1. Early schizophrenia. As seen in Fig. 2, results for Path A indicated that affective ToM was positively and significantly associated with cognitive empathy for individuals with early schizophrenia ($\beta = .65$, $p < .001$; $R^2 = .74$). In the second model, which assessed Path B, a significant relationship was observed between cognitive empathy and community functioning ($\beta = .63$, $p < .001$; $R^2 = .64$). Results for Path C (without the mediator) indicated a significant positive association between affective ToM and social functioning ($\beta = .82$, $p < .001$; $R^2 = .67$). In the final model, the third analysis was repeated with the inclusion of the proposed mediator (cognitive empathy) in the model (Table 7) and was found to be a significant predictor of community functioning. The standardised beta-weight for affective ToM decreased from .82 ($p < .001$) to .16 ($p = .23$) in the fourth model, indicating that cognitive empathy mediated the relationship between affective ToM and community functioning for individuals with early schizophrenia.

3.5.1.2. Chronic schizophrenia. The aforementioned steps were repeated for individuals with chronic schizophrenia (see Fig. 3). Results for Path A indicated that affective ToM was positively and significantly associated with cognitive empathy ($\beta = .78$, $p = .002$; $R^2 = .70$). Results for Path B indicated a highly significant relationship between cognitive empathy and community functioning ($\beta = .58$, $p < .001$; $R^2 = .47$). Results for Path C (without the mediator) indicated a significant positive association between affective ToM and community functioning ($\beta = .73$, $p < .01$; $R^2 = .63$). Cognitive empathy remained a significant predictor in the final model, but affective ToM no longer contributed significantly to the variance in community functioning. The standardised beta-weight for affective ToM decreased from .73 ($p < .01$) to .11 ($p = .23$) in the fourth model, indicating that cognitive empathy mediated the relationship between affective ToM and community functioning for individuals with chronic schizophrenia.

3.5.2. Functional capacity

3.5.2.1. Early schizophrenia. As seen in Fig. 4, results for Path A indicated that affective ToM was positively and significantly associated with cognitive empathy for individuals with early schizophrenia ($\beta = .65$, $p < .001$; $R^2 = .74$). In the second model, which assessed Path B, a significant relationship was observed between cognitive empathy and functional capacity ($\beta = .74$, $p < .001$; $R^2 = .76$). Results for Path C (without the mediator) indicated a significant positive association between affective ToM and functional capacity ($\beta = .78$, $p < .001$; $R^2 = .79$). In the final model, the third analysis was repeated with the inclusion of the proposed mediator (cognitive empathy) in the model (Table 8) and was found to be a significant predictor of functional capacity. The

Table 5
Hierarchical Regression Analyses for Incremental Prediction of Community Functioning in Individuals with Early and Chronic Schizophrenia.

	Step 1			Step 2			Step 3			Step 4		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Early Schizophrenia												
Neurocognition	3.99	2.29	.36	.80	2.48	.07	2.93	2.17	.26	.69	.87	.06
Positive symptoms				.05	2.85	.07	2.90	2.33	.32	.25	.95	.03
Negative symptoms				1.75	1.78	.23	.11	1.46	.01	.67	.58	.09
Disorganised symptoms				8.58	4.68	.52	.81	3.61	.48*	.81	1.58	.05
Total ToM[a]							6.13	1.68	.63***	4.13	1.83	.39*
Cognitive empathy										2.41	.76	.31*
R^2		.13			.42			.57			.66	
ΔR^2		.13			.29			.16			.09	
ΔF		3.02			2.98			13.37			78.73	
Chronic Schizophrenia												
Neurocognition	6.30	2.15	.53**	5.01	2.15	.42*	.93	1.79	.08	.66	.62	.07
Positive symptoms				2.28	2.05	.30	.28	1.53	.04	.03	.52	.00
Negative symptoms				1.39	1.68	.17	.33	1.23	.04	.40	.75	.03
Disorganised symptoms				.03	3.0	.00	1.85	2.18	.14	.40	.75	.03
Total ToM[a]							6.28	1.43	.48**	2.75	.16	.43*
Cognitive empathy										3.34	.70	.33*
R^2		.28			.44			.63			.73	
ΔR^2		.28			.16			.19			.10	
ΔF		8.57			1.77			19.27			98.16	

Note.
[a] First- and second-order cognitive and affective ToM as measured by the Virtual Assessment of Mentalising Ability.
* $p < .05$
** $p < .01$.
*** $p < .001$.

Table 6
Hierarchical Regression Analyses for Incremental Prediction of Functional Capacity in Individuals with Early and Chronic Schizophrenia.

	Step 1			Step 2			Step 3			Step 4		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Early Schizophrenia												
Neurocognition	1.58	.55	.53**	.96	.59	.32	.12	.41	.04	.20	.31	.07
Positive symptoms				1.08	.68	.45	.25	.44	.11	.63	.33	.27
Negative symptoms				.13	.42	.07	.40	.27	.20	.29	.20	.15
Disorganised symptoms				.29	1.11	.07	.13	.67	.03	.90	.56	.21
Total ToM[a]							1.23	1.77	.54***	.98	.30	.52**
Cognitive empathy										.96	.27	.48**
R^2		.28			.53			.68			.74	
ΔR^2		.28			.25			.15			.059	
ΔF		8.29			3.15			31.70			15.96	
Chronic Schizophrenia												
Neurocognition	1.58	.46	.47**	1.28	.45	.48	.37	.34	.14	.06	.10	.02
Positive symptoms				.48	.43	.28	.03	.29	.02	.02	.10	.02
Negative symptoms				.35	.35	.19	.11	.24	.06	.13	.07	.07
Disorganised symptoms				.15	.63	.05	.27	.42	.09	.01	.13	.00
Total ToM[a]							1.40	.27	.61***	.87	.13	.49***
Cognitive empathy										.74	.12	.21**
R^2		.35			.52			.71			.79	
ΔR^2		.35			.18			.18			.079	
ΔF		11.65			2.32			26.11			18.62	

Note.
[a] First- and second-order cognitive and affective ToM as measured by the Virtual Assessment of Mentalising Ability.
* $p < .05$
** $p < .01$.
*** $p < .001$.

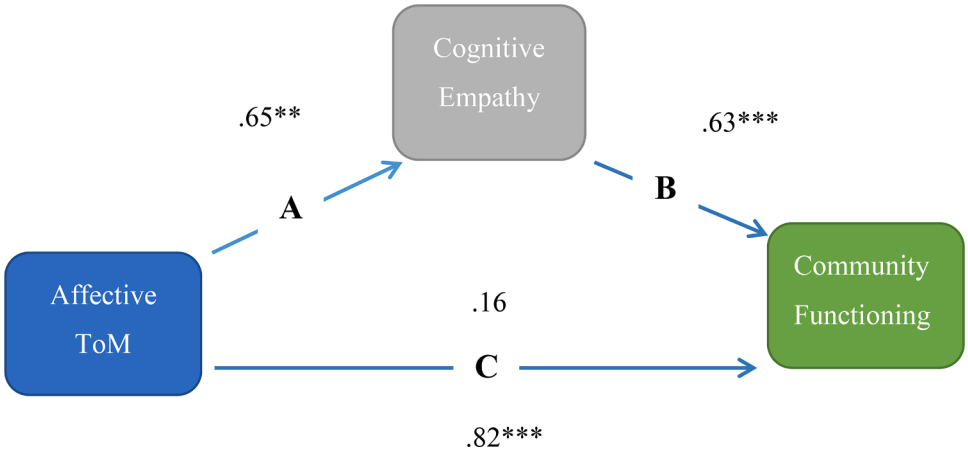

Fig. 2. Path model depicting influence of cognitive empathy on the relationship between affective theory of mind and community functioning for individuals with early schizophrenia. Path coefficients represent standardised beta-weights. The coefficient below the path from affective ToM to social functioning represents the direct effect without the mediator in the model, and the coefficient above the path represents the direct effect when the mediator is included in the model.
** $p < .01$.
*** $p < .001$.

Table 7
Mediating Effect of Cognitive Empathy on the Relationship between Affective Theory of Mind and Community Functioning for Individuals with Early and Chronic Schizophrenia.

Variable	*B*	*B SE*	*β*	*t*	*p*
Early Schizophrenia					
Intercept	58.76	25.49			
Affective ToM	1.97	1.56	.16	1.26	.23
Cognitive empathy	8.59	.85	.74	10.12	< .001
Chronic Schizophrenia					
Intercept	62.87				
Affective ToM	1.31	1.05	.11	1.24	.23
Cognitive empathy	8.28	.58	.78	14.36	< .001

Note. Affective ToM = Composite of first- and second-order VAMA subscales. Dependent variable = Total scores on the Social Functioning Scale. Control variables = neurocognition and clinical symptoms.

standardised beta-weight for affective ToM decreased from .78 ($p <$ .001) to .64 ($p = .001$) but remained statistically significant in the fourth model. Although these results indicate that cognitive empathy may partially mediate the relationship between affective ToM and functional capacity, the inclusion of the mediator in the model did not have a large influence on the predictive value of affective ToM. Thus, the influence of cognitive empathy should be interpreted with caution.

3.5.2.2. Chronic schizophrenia. The aforementioned steps were repeated for individuals with chronic schizophrenia (see Fig. 5). Results for Path A indicated that affective ToM was positively and significantly associated with cognitive empathy ($\beta = .78$, $p = .002$; $R^2 = .70$). Results for Path B indicated a highly significant relationship between cognitive empathy and functional capacity ($\beta = .55$, $p < .001$; $R^2 = .68$). Results for Path C (without the mediator) indicated a significant positive association between affective ToM and functional capacity ($\beta = .75$, $p = .002$; $R^2 = .71$). Cognitive empathy remained a significant predictor in the final model, but affective ToM no longer contributed significantly to the variance in functional capacity. The standardised beta-weight for

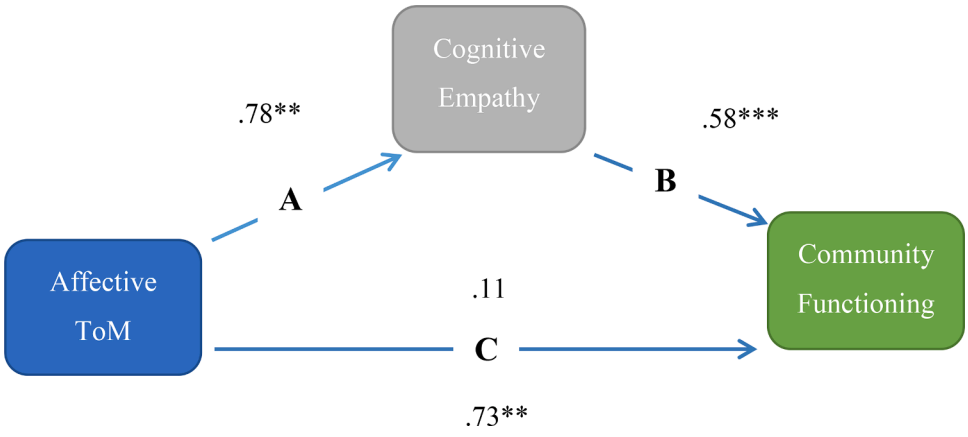

Fig. 3. Path model depicting influence of cognitive empathy on the relationship between affective theory of mind and community functioning for individuals with chronic schizophrenia. Path coefficients represent standardised beta-weights. The coefficient below the path from affective ToM to social functioning represents the direct effect without the mediator in the model, and the coefficient above the path represents the direct effect when the mediator is included in the model.
** $p < .01$.
*** $p < .001$.

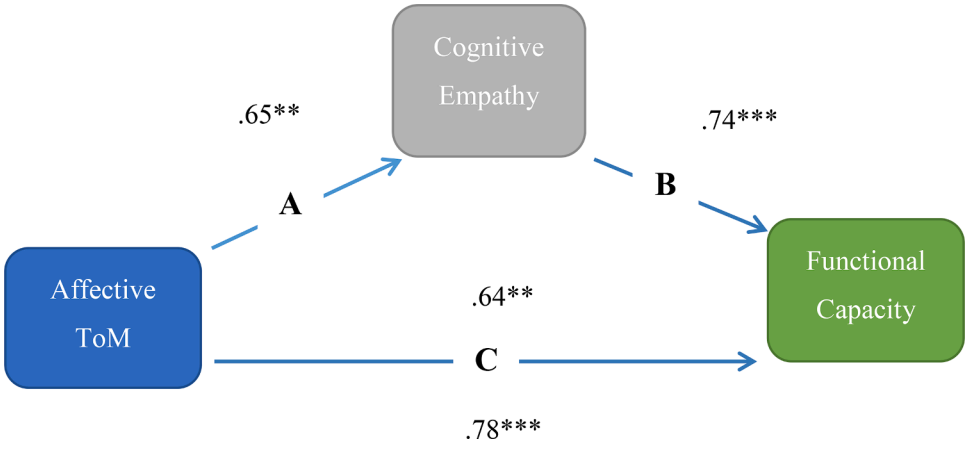

Fig. 4. Path model depicting influence of cognitive empathy on the relationship between affective theory of mind and functional capacity for individuals with early schizophrenia. Path coefficients represent standardised beta-weights. The coefficient below the path from affective ToM to social functioning represents the direct effect without the mediator in the model, and the coefficient above the path represents the direct effect when the mediator is included in the model.
** $p < .01$.
*** $p < .001$.

Table 8
Mediating Effect of Cognitive Empathy on the Relationship between Affective Theory of Mind and Functional Capacity for Individuals with Early and Chronic Schizophrenia.

Variable	*B*	*B SE*	*β*	*t*	*p*
Early Schizophrenia					
Intercept	3.48	8.46			
Affective ToM	2.05	.52	.64	3.94	.001
Cognitive empathy	.78	.28	.35	2.78	.01
Chronic Schizophrenia					
Intercept	16.84	3.25			
Affective ToM	.02	.18	.01	.08	.94
Cognitive empathy	1.64	.10	.75	16.66	< .001

Note. Affective ToM = Composite of first- and second-order VAMA subscales. Dependent variable = Total scores on the Social Skills Performance Assessment. Control variables = neurocognition and clinical symptoms.

affective ToM decreased from .75 ($p = .002$) to .01 ($p = .94$) in the fourth model, indicating that cognitive empathy mediated the relationship between affective ToM and functional capacity for individuals with chronic schizophrenia.

4. Discussion

This study examined the functional impact of cognitive empathy relative to that of ToM, neurocognition, and severity of clinical symptoms in early and chronic schizophrenia. Results indicated three key findings, which supported our hypotheses. First, individuals with early schizophrenia self-reported significantly better cognitive empathy than individuals with chronic schizophrenia. Second, total ToM emerged as a stronger predictor of social functioning than cognitive empathy, neurocognition, and clinical symptoms. Third, there was evidence to suggest that affective ToM is a prerequisite of cognitive empathy, and that cognitive empathy mediates the association between affective ToM and social functioning.

4.1. Self-reported empathy abilities in schizophrenia

The findings that individuals with early schizophrenia report their cognitive empathy and emotional reactivity significantly higher than do individuals with chronic schizophrenia are consistent with the results reported by Achim et al. (2011) and Montag et al. (2007) and may indicate that cognitive empathy is less impacted in the early stage of illness. Furthermore, these findings are consonant with evidence that individuals with chronic schizophrenia show diminished performance on behavioural and physiological measures of emotional reactivity, such as spontaneous mimicry of others' observable emotional expressions or behaviours (Sestito et al., 2015; Varcin et al., 2010).

4.2. Empathy and social functioning

Previous studies in the schizophrenia area suggest that some aspects of social cognition, particularly ToM, distinctly contribute to poor social functioning above and beyond the contributions of cognitive dysfunction and clinical symptoms (e.g., Roncone et al., 2002; Pinkham & Penn, 2006; Brüne et al., 2011). The current study extended this research by indicating that cognitive empathy, a key social cognitive process that has received relatively limited attention in schizophrenia, is a valuable

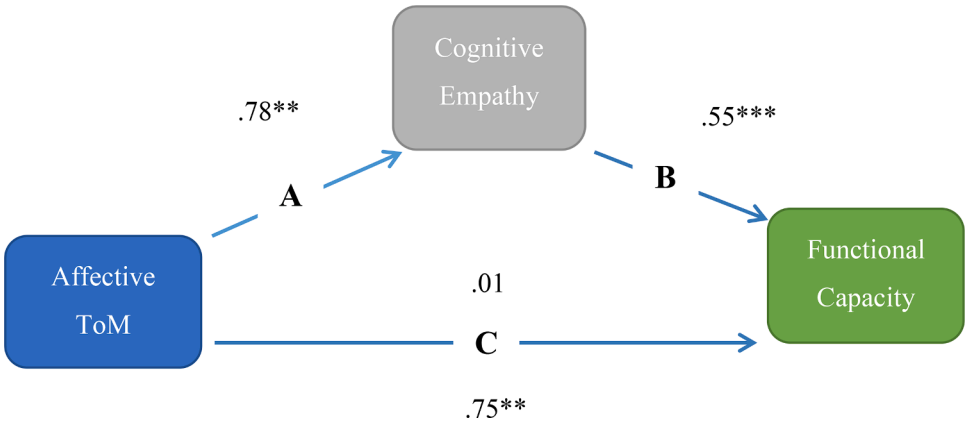

Fig. 5. Path model depicting influence of cognitive empathy on the relationship between affective theory of mind and functional capacity for individuals with chronic schizophrenia. Path coefficients represent standardised beta-weights. The coefficient below the path from affective ToM to social functioning represents the direct effect without the mediator in the model, and the coefficient above the path represents the direct effect when the mediator is included in the model.
** $p < .01$.
*** $p < .001$.

consideration when explaining social functioning in early and chronic schizophrenia. Consonant with previous research (Michaels et al., 2014; Smith et al., 2012; Smith et al., 2014), cognitive empathy was found to account for incremental variance in social functioning (viz., community functioning and functional capacity) in early and chronic schizophrenia after controlling for neurocognition and clinical symptoms.

Although cognitive empathy was found to contribute significantly to social functioning in schizophrenia, ToM emerged as the strongest predictor of social functioning in the final models for both clinical groups. This result may reflect an advantage for ToM versus cognitive empathy in predicting social functioning. Previously it was proposed that ToM, or the ability to infer another's state, is a pre-requisite to other social cognitive abilities, including empathy (Kalbe et al., 2007; Singer et al., 2009). It may therefore be speculated that the ability to make such inferences about another is fundamental for social functioning.

4.3. Mediation model

As noted previously, the only previous study we are aware of, that attempted to assess the mediating influence of cognitive empathy on the relationship between social cognition and social functioning in schizophrenia found no evidence of common associations between these variables, and thus could not proceed with the mediation analysis (Sparks et al., 2010). According to Baron and Kenny's (1986) criteria, the present results indicated that cognitive empathy qualified as a mediator of the relationship between affective ToM and community functioning in early and chronic schizophrenia, and between affective ToM and social functioning for individuals with chronic schizophrenia. These results provide support for the adapted version of the integrative mediation model (Ofir-Eyal et al., 2014) and indicate that affective ToM is a pre-requisite of cognitive empathy. That is, the capacity to understand and adapt one's affective behaviour to the subjective experience of those with whom we interact is secondary to being able to predict their thoughts, beliefs, and intentions. Although accurate mental state reasoning may promote appreciation and understanding of another's subjective experience, it is the latter social cognitive process that translates into positive functional outcomes. This idea is in line with results in the psychopathy literature, which suggests that mental state reasoning is dissociable from appreciating or having concerns for another person (van Dongen, 2020). Together, these results raise the hypothesis that affective ToM is a 'purer' ability, while cognitive empathy is at least partly driven by a need or desire to appreciate another's state. This motivational aspect may be a crucial link in translating ToM ability into positive social functioning.

4.4. Implications and limitations

Research that explores the relationships between social cognitive domains can develop clinical and theoretical understanding of the nature and functional impact of these abilities in psychotic illnesses. The present results indicate that cognitive empathy and ToM may have similar value as treatment targets to neurocognition, and possibly clinical symptoms, for functional recovery-oriented interventions. The consistency of findings across measures of community functioning (i.e., what a person actually does) and functional capacity (i.e., what a person can do) indicates that cognitive empathy may be a strong predictor of the extent to which an individual with schizophrenia can function adaptively and independently (Smith et al., 2012). Emerging evidence indicates that social cognitive deficits are amenable to psychosocial intervention in schizophrenia (Kurtz & Richardson, 2012). There is also growing interest in psychopharmacological approaches to enhancing social cognition (Carter al., 2009; Goldman et al., 2011; Rosenfeld et al., 2011). The inclusion of cognitive empathy and ToM in these treatment development efforts may achieve greater improvements in social cognition and overall functioning in early and chronic schizophrenia. Although our findings provide insight into the relationship between social cognitive domains and social functioning, they must be interpreted in the context of some limitations. First, the absence of a healthy control group within the design of the present study precludes discussion of whether the self-reported empathy of individuals with early and chronic schizophrenia is clinically impaired. However, because the focus of the study was on examining the predictive contributions of cognitive empathy and affective ToM on social functioning of individuals with schizophrenia, we believe that the current patient data has the clinical and research implications as described above.

Second, it is important to note that the current findings are based on self-reported levels of empathy. Specifically, the EQ measures individuals' beliefs about their own empathic skills, and the ratings of people with deficits in awareness or knowledge of their cognitive abilities (meta-cognition) could be unreliable. Nevertheless, the EQ was identified as the most theoretical and psychometrically sound measure of cognitive empathy available at the time that this study was conceived and executed. Furthermore, studies using alternative methods, such as behavioural and functional neuroimaging tasks, suggest that individuals with schizophrenia show impairments in multiple processes that underlie empathy, including emotional contagion, emotion attribution, and empathic accuracy (Benedetti et al., 2009; Brüne et al., 2011; Derntl et al., 2009; Lee et al., 2011). It remains to be determined how the cognitive empathy subscale and other subscales of the EQ relate to these processes in schizophrenia. Considering that people with schizophrenia may have impaired insight and in turn under or over-represent their empathic abilities, it is important for future studies to measure their performance on behavioural tasks of empathy, in addition to traditional self-report measures such as the EQ.

Third, although significant associations were observed between cognitive empathy and indices of social functioning, the modest sample

sizes may have limited the ability to detect meaningful relations between these indices and other processes assessed by the EQ. Notwithstanding, previous researchers have acknowledged the difficulties inherent in recruiting large samples of clinical participants, and proceeded to perform mediational analyses with less than optimal sample sizes ($n = 41$, Chung, Matthews, & Barch, 2011; $n = 27$, Ownsworth et al., 2009).

Comprehensive and reliable assessment measures that capture the nature of ToM impairment have the potential to tailor treatment protocols for individuals with schizophrenia. The VAMA could be used to identify a person's strengths and weaknesses within ToM sub-processes (Canty et al., 2017b), as well as be used to assess clinical change. Expanding on earlier research (Bechi et al., 2013) which demonstrated that individuals with schizophrenia benefit from ToM training, future studies should examine how ToM assessment results and training translate into real-world outcomes (e.g., quality of relationships, employment, and community integration).

4.5. Conclusion

In conclusion, findings of our study provide further support for the functional significance of cognitive empathy in early and chronic schizophrenia. These findings also contribute to emerging evidence that cognitive empathy is less affected in the early stage of schizophrenia. There is evidence to suggest that affective ToM is a prerequisite of cognitive empathy, and that cognitive empathy mediates the relationship between affective ToM and social functioning. Efforts to target these processes in social cognitive training programs for schizophrenia may be a useful way to enhance the generalisability of these interventions to real-life settings. Further clarification of how cognitive and affective empathy are impacted, and continued efforts to develop theoretical, multidimensional measures of empathy, will contribute to a more sophisticated understanding of empathy processes in schizophrenia.

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CRediT authorship contribution statement

Allana L. Canty: Conceptualization, Data curtion, Formal analysis, Investigation, Methodology, Project administration, Software, Validation, Writing – original draft, Writing – review & editing. **Yuan Cao:** Conceptualization, Investigation, Methodology, Validation, Writing – review & editing. **David Neumann:** Conceptualization, Investigation, Methodology, Project administration, Software, Validation, Supervision, Writing – original draft, Writing – review & editing. **David H.K. Shum:** Conceptualization, Investigation, Resources, Methodology, Project administration, Software, Validation, Supervision, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

We have no conflict of interest to declare.

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