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Declarative Memory, Theory of Mind, and Community Functioning in Schizophrenia

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DECLARATIVE MEMORY, THEORY OF MIND, AND COMMUNITY FUNCTIONING IN SCHIZOPHRENIA

by

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ABSTRACT

Cognitive impairments are highly prevalent in individuals with schizophrenia and are now considered hallmark features of the disorder. Over the past decade, considerable evidence has demonstrated the functional significance of social and nonsocial cognitive impairments in individuals with schizophrenia. However, the nature of the relationship between specific domains of social and nonsocial cognition and how they relate to functional outcome in this population is less clear. In particular, declarative memory impairment has been suggested to have critical consequences for the everyday life of individuals with schizophrenia and may play a role in their social integration difficulties. Preliminary evidence also indicates that theory of mind (ToM) may be an important intermediary between nonsocial cognition and functional outcome. The current study aimed to better understand the relationships between declarative memory, ToM, and functional outcome in individuals with schizophrenia.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

Cognitive impairments are now considered hallmark features of schizophrenia and are strongly linked to functional outcome in these individuals (Green, Kern, & Heaton, 2004). The importance of cognition in relation to outcome in schizophrenia has recently been recognized with the formation of the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) consensus group, with foundations based on improving outcome by identifying and enhancing cognitive ability in schizophrenia (Green, Nuechterlein, et al., 2004). Initial results from factor analytic studies (Nuechterlein et al., 2004) identified six separable cognitive domains that are reliably impaired and relevant to functional outcome in schizophrenia (i.e., working memory, attention/vigilance, verbal learning and memory, visual learning and memory, reasoning and problem solving, speed of processing).

A seventh cognitive domain – social cognition – was recently added due to emerging evidence demonstrating that social cognition is closely related to functional outcome in schizophrenia and may mediate the relationship between the initial six nonsocial cognitive domains and functional outcome (for a review, see Schmidt, Mueller, & Roder, 2011). Social cognition refers to the mental operations that underlie social interactions, including perceiving, interpreting, and generating responses to the intentions, dispositions, and behaviors of others (Fiske & Taylor, 1991).

It should be noted that there is no consensus on how to aptly label social and nonsocial cognitive constructs. Previous studies have distinguished between these constructs using contrasting terms such as *basic cognition* vs. *social cognition*, *neurocognition* vs. *social cognition*, and *nonsocial cognition* vs. *social cognition*. We have chosen to use the labels of

nonsocial cognition and *social cognition* because these terms do not imply unique neural mechanisms and contributions.

Although cognitive impairments are linked to functional outcome in schizophrenia, the identification of specific cognitive deficits that contribute to functional outcome has been complicated by a growing trend in the research literature to use a general cognitive factor. Ultimately, understanding how specific nonsocial and social cognitive domains relate to functional impairment in schizophrenia is critical to identify intervention targets that may serve to improve outcome. Within the nonsocial cognitive domain, declarative memory impairments have been suggested to exert critical consequences for the everyday life of some individuals with schizophrenia, which may contribute to their social integration difficulties (Green, Kern, Braff, & Mintz, 2000) and overall functional outcome (for a recent quantitative review, see Libby, Yonelinas, Ranganath, & Ragland, 2013). Within the social cognitive domain, a recent meta-analysis identified theory of mind (ToM) as the strongest cognitive correlate of functional outcome (Fett et al., 2011) and may be an important intermediary between nonsocial cognition and functional outcome (for a recent empirical review, see Schmidt et al., 2011). Although evidence clearly demonstrates that functional outcome in schizophrenia is influenced by both social and nonsocial cognition, less clear is the nature of these relationships. The current study aimed to better understand the relationship between declarative memory, ToM, and community functioning in individuals with schizophrenia.

Declarative Memory in Schizophrenia

Nonsocial cognitive impairments are now widely recognized as ubiquitous features of schizophrenia. A vast literature pertaining to nonsocial cognitive deficits has amassed over the

2

past 30 years, which suggest that schizophrenia is associated with impairments across a wide range of higher-order nonsocial cognitive performance domains (e.g., Fioravanti, Carlone, Vitale, Cinti, & Clare, 2005). However, a more recent quantitative evaluation of the literature revealed that the most severe nonsocial cognitive impairments are apparent within the domains of declarative memory and attention, which are evident above and beyond generalized cognitive impairments (Reichenberg & Harvey, 2007).

In some individuals with schizophrenia, declarative memory deficits are observed prior to the onset of the illness (Heaton et al., 2001; Saykin et al., 1994), are not better accounted for by education, gender, or clinical variables such as medication exposure or duration and severity of illness (Censits, Ragland, Gur, & Gur, 1997; Seidman, Stone, Jones, Harrison, & Mirsky, 1998), and appear stable over time (Ekerholm et al., 2012; Hoff, Svetina, Shields, Stewart, & DeLisi, 2005). Interestingly, selective impairments in memory have also been documented in patients with no clinically significant nonsocial cognitive impairment (Holthausen et al., 2002; Kremen, Seidman, Faraone, Toomey, & Tsuang, 2000; Kremen, Seidman, Faraone, & Tsuang, 2001). Along with deficits in attention and executive function, these findings have led some to state that declarative memory is the most promising nonsocial cognitive endophenotype of schizophrenia (Sitskoorn, Aleman, Ebisch, Appels, & Kahn, 2004).

Declarative memory deficits are suggested to produce profound consequences for the everyday life and social integration difficulties commonly observed in some individuals with schizophrenia (Grillon, Krebs, Gourevitch, Giersch, & Huron, 2010). Indeed, meta analytic reviews have demonstrated that memory is a better predictor of functional outcome than both clinical symptoms and other nonsocial cognitive variables (Green, 1996; Green et al., 2000). Furthermore, a longitudinal study following first-episode patients found that declarative memory

3

dysfunction was the best predictor of poor symptomatic outcome one year later (Moritz et al.,

2000). These results highlight the functional impact and potential use of declarative memory as a

target for psychosocial treatments in schizophrenia (McGurk, Twamley, Sitzer, McHugo, &

Mueser, 2007).

Social Cognitive Impairment and Schizophrenia

While nonsocial cognitive deficits clearly contribute to poor functional outcome in

schizophrenia, the amount of variance accounted for by nonsocial cognition in functional

outcome varies greatly across studies, with estimates ranging from 20% to 60% (Green et al.,

2000). More recent studies highlight the unique functional relevance of social cognitive

impairments in schizophrenia. For example, a meta-analysis concluded that social cognition

appears to correlate more strongly with functional outcome than nonsocial cognition in

schizophrenia (Fett et al., 2011). A number of studies also demonstrate that after statistically

controlling for nonsocial cognition, social cognition still accounts for a significant proportion of

variance in functional ouctome (Couture, Penn, & Roberts, 2006; Pan, Chen, Chen, & Liu, 2009;

Penn, Sanna, & Roberts, 2008; Pinkham & Penn, 2006; Roncone et al., 2002; van Hooren et al.,

2008) and may be a better predictor of functional outcome than nonsocial cognition and

psychiatric symptoms combined (Pijnenborg et al., 2009).

Moreover, a recent systematic review examined the complex mechanisms through which

nonsocial cognition influences functional outcome by investigating the mediating role of social

cognition across 15 studies (Schmidt et al., 2011). Although wide variations were evident in the

selection of nonsocial cognitive domains, social cognition was consistently found as a partial

mediator in this relationship. However, it remains largely unclear which social cognitive abilities are the best mediators of which nonsocial cognition domains.

<div align="center">Theory of Mind in Schizophrenia</div>

ToM refers to the social cognitive ability of inferring the intentions, beliefs, and behaviors of others. While meta-analytic reviews conclude that this ability is significantly impaired in schizophrenia (Bora, Yucel, & Pantelis, 2009; Sprong, Schothorst, Vos, Hox, & van Engeland, 2007), far less attention has been devoted to the relationship between ToM and functional outcome in schizophrenia compared to other social cognitive abilities (e.g., social perception or emotion perception). Regardless, a recent meta-analysis found that ToM ability exhibited stronger associations with community functioning than other social and nonsocial cognitive abilities, indicating that ToM may be a specific determinant of real world functioning in schizophrenia (Fett et al., 2011). Results from a systematic review are also suggestive of a relationship between ToM and social skills, community functioning and social behavior, but concluded that more research is necessary to understand the nature of these relationships (Couture et al., 2006).

There is also evidence across psychological disciplines to suggest that ToM and declarative memory development are intertwined. Specifically, both abilities appear to develop around the same time in development (i.e., around 3 to 5 years of age) and a free recall task was found to be the best cognitive predictor of ToM ability in children (Naito, 2003; Perner, Kloo, & Gornik, 2007). Beyond a developmental link, evidence suggests that these two processes are also neurobiologically linked. Neuroimaging research of brain circuitry revealed a set of sub-regions that are consistently engaged when individuals are undisturbed and left in a resting state

(Mazoyer et al., 2001; Raichle et al., 2001). Aptly labeled the default network, this network is also engaged during tasks in which individuals are required to remember the past, envision future episodes or events, and consider the thoughts and perspectives of others (Buckner, Andrews-Hanna, & Schacter, 2008; Buckner & Carroll, 2007). Together, these findings indicate that the cognitive processes of declarative memory and ToM may at least partially share neurobiological underpinnings.

Limitations of Existing Research

To date, research examining the relationships among ToM, nonsocial cognition, and functional outcome suffers from a number of critical limitations. The construct of ToM is a complex social cognitive ability that activates different brain networks for different types of ToM tasks (Gallagher et al., 2000; Gobbini, Koralek, Bryan, Montgomery, & Haxby, 2007). Some have suggested that ToM reasoning can be separated into a 2-stage process: *mental state decoding* and *mental state reasoning* (Njomboro, Deb, & Humphreys, 2008; Sabbagh, 2004). Mental state decoding refers to the ability to decipher mental state states based on immediately available information such as facial expression or tone. Mental state reasoning refers to the more complex ability to infer the mental states and intentions of others and requires the consideration of knowledge and facts about the person or contextual circumstances. Although both aspects of ToM typically work together to construct reliable judgments about the mental states of others, the distinction between these components is important because they rely on different kinds of social information processing skills.

Bora, Eryavuz, Kayahan, Sungu, and Veznedaroglu (2006) demonstrated that a mental state decoding task, the Reading the Mind in the Eyes Task (RMET), was a better predictor of

community functioning in schizophrenia than a mental state reasoning task, the Hinting Task. A recent meta-analysis concluded that heterogeneity of methods used to assess ToM contributes to the inconsistencies in findings (Bora et al., 2009). Further research is needed to clarify the *nature* of the relationship among distinct ToM tasks, nonsocial cognition, and community functioning in schizophrenia. The current study adds to the literature by examining the differential impact of distinct ToM abilities on memory functioning in predicting the functional outcome in schizophrenia.

Recent studies have concluded that specific domains of social cognition and some types of verbal memory use common cognitive resources (Kumiko et al., 2015). In fact, particular aspects of nonsocial cognition could form the basic building blocks for social cognitive abilities. For example, the ability to recall previous social experiences could be crucial in the development of social cognitive capacities (e.g., ToM). In support of this hypothesis, evidence indicates that social cognition at least partially mediates the relationship between nonsocial cognition and functional outcome (for a systematic review see, Schmidt et al., 2011), only two studies appear to have examined a role for ToM in this relationship. Horton and Silverstein (2008) found declarative memory (i.e., word memory and visual spatial recall) to be the nonsocial cognitive domain that was most mediated by ToM (i.e., Hinting task) to predict functional outcome in schizophrenia. Similarly, Couture, Granholm, and Fish (2011) found that ToM (also using the Hinting test) mediated the relationship between global nonsocial cognitive ability and functional outcome in patients with schizophrenia. This study, however, may have limited clinical relevance as nonsocial cognition was assessed with a global composite score, rather than specific cognitive domains. Findings from a recent meta-analysis reported that nonsocial cognitive deficits are not as general as previously reported, with areas of preserved cognitive function

(Gold, Hahn, Strauss, & Waltz, 2009). The examination of specific cognitive domains in this relationship is critical for the identification of intervention targets that may serve to improve outcome in schizophrenia patients. Furthermore, because both studies employed the same ToM task, the generalizability of these findings to other ToM abilities is limited. It is imperative for future studies to use multiple measures of ToM in addition to well-defined measures of functional outcome to help elucidate these relationships.

Finally, it remains unclear if this relationship is specific to individuals with schizophrenia or if it operates in nonpsychiatric controls as well. Although sparce, preliminary evidence suggests that no such mediation effect is observed for nonpsychiatric comparison control groups (Addington, Saeedi, & Addington, 2006a, 2006b). While these findings may be partially due to a restriction of range effect, similar findings are reported even after statistically controlling for range restriction in the nonpsychiatric control comparison group (Pijnenborg et al., 2009). Future research is warranted to specify if this relationship represents a universal cognitive profile or reflect specific illness-related deficits.

Hypotheses

The current study aimed to examine the relationships among social cognition (ToM), nonsocial cognition (declarative memory), and functional outcome in schizophrenia. We hypothesized: (1) individuals with schizophrenia would demonstrate impaired performance on tasks assessing both nonsocial cognition (declarative memory) and social cognition (ToM) compared to nonpsychiatric controls; (2) the specific ToM ability of mental state decoding, but not mental state reasoning, would mediate the relationship between declarative memory functioning and functional outcome in individuals with schizophrenia, but not in nonpsychiatric

controls; and (3) separable domains of community functioning would differentially effect these

relationships.

METHODS

Participants

Participants included 28 outpatients with schizophrenia and 23 nonpsychiatric controls (see Table 1 for descriptive characteristics). The patient group was recruited from the Lieber Schizophrenia Research Program at the New York State Psychiatric Institute. Diagnoses were established using the Diagnostic Interview for Genetic Studies (DIGS; Nurnberger et al., 1994), which was based on Diagnostic and Statistical Manual – Fourth Edition (DSM-IV; American Psychiatric Association, 1994) criteria. The DIGS was administered by Masters-level researchers; interrater reliability for diagnosis was > .70. Patients were clinically stable prior to study inclusion (i.e., no medication changes for four weeks with stable symptoms). Nonpsychiatric controls were recruited through the use of flyers posted in the medical center and surrounding community and via online advertisements.

Exclusion criteria for both group included any major medical or neurological disorder, a full scale IQ < 70 (Wechsler Adult Intelligence Scale – Third Edition (WAIS-III; Wechsler, 1997)), significant risk of harm to self or others, and an inability to speak English. Additional exclusion criteria for nonpsychiatric controls included any current Axis I disorder within the past two years and any personal or familial (first-degree relative) history of psychosis.

There was no statistically significant between-group mean difference in age, sex, race, IQ, or level of education (see Table 1).

Wechsler Memory Scale – Revised (WMS-R)

The WMS-R (Wechsler, 1987) is a well-established composite battery for the assessment of memory function, which includes immediate and delayed recall of verbal and visual stimuli, intended for individuals aged 16-74. The General Memory score has a mean of 100 and a standard deviation of 15, and combines the immediate and delayed recall performance from all verbal and visual subtests. The General Memory score has been found to have good construct validity (Wechsler, 1987) and constitutes a useful source of evidence regarding declarative memory performance in schizophrenia (Hawkins, Sullivan, & Choi, 1997). Therefore, the General Memory Score will be used as an overall estimate of declarative memory functioning for the current study. In addition, the Verbal and Visual Memory Indices were examined to assess the effect of memory modality in these relationships.

Theory of Mind Tasks

Mental State Reasoning Tasks

<u>False Belief (FB) Story Tasks</u>

FB stories are tasks of mental state reasoning ability that assess the ability to attribute accurate beliefs to another person. The FB stories consist of a short story (read aloud to the participants) accompanied by a sequence of four cartoon pictures, which are followed by FB test and control questions. FB story tasks have been found to exhibit good test-retest reliability ratings, with an average proportion of agreement of .75 (Mayes, Klin, Tercyak, Cicchetti, & Cohen, 1996).

First-order FB (FB1) stories assess the understanding of the relation between a character's belief and reality. A variant of the well-known "Sally and Anne" story, developed by Baron-Cohen, Leslie, and Frith (1985), was used in the current study to assess FB1 (see Appendix A: Figure 1 for script, questions, and cartoon sequence). Following the story, participants were asked a memory control question, a reality control question, and a FB test question. Responses for each question was categorical and scored as either correct (1 point) or incorrect (0 points). Of note, only the FB1 test questions were included in the analysis as we were only concerned with ToM performance.

Second-order FB (FB2) stories involve the understanding of one character's belief about another character's beliefs. We used a FB story based on the task developed by Tager-Flusberg and Sullivan (1994) to FB2 (see Appendix A: Figure 2 for script, questions and cartoon sequence). Following the story, participants were asked a memory control question, a reality control, a FB test question, and a justification question in which the participant provides a rationale for their FB test question response. Responses were scored as either correct (1 point) or incorrect (0 points). The FB test question and justification scores were summed to form the FB2 score. Similar to FB1, only the FB2 test questions were included in the analysis.

Strange Stories Task (SST)

The SST (Happe, 1994) is a mental state reasoning task that consists of 12 short verbal vignettes that assess various aspects of ToM ability, including the accurate appraisal of lies, white lies, jokes, figures of speech, and contrary emotions. The participants were verbally presented with each story by the experimenter and asked to answer two questions following each story, a comprehension question (e.g., was the character truthful) and a justification question

(e.g., why would the character say what was said). Scoring relies on giving an inferential response and whether the inference was plausible. The comprehension item is scored as either correct (1 point) or incorrect (0 points). The justification item score is scored as correct (1 point) or incorrect (0 points) and as involving mental states (1 point) or physical states (0 points) for a total of 2 points. A total score for the SST was calculated by summing the these two scores across the 12 stories.

Mental State Decoding Task

Reading the Mind in the Eyes Task (RMET)

The RMET (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001) is a forced-choice, non-verbal mental state decoding task, in which participants examine 36 black and white photos depicting photographs of only the eye region from male and female human actors. Participants select one of four words which they believe best describes what the person in the picture is thinking or feeling. The total score is the number of correctly chosen mental state terms. The RMET has been found to exhibit good internal consistency (Cronbach's alpha of .61) and test-retest reliability ratings (Vellante et al., 2013).

Positive and Negative Symptom Scale (PANSS)

The PANSS (Kay, Fiszbein, & Opler, 1987) is a clinician-administered 30-item semi-structured rating instrument, scored on a seven point Likert scale that assesses negative and positive symptoms of schizophrenia. Each of the 30 items is accompanied by a specific definition and detailed anchor criteria for the seven point Likert scale (1 = Absent, 2 = Minimal, 3 = Mild, 4 = Moderate, 5 = Moderate/Severe, 6 = Severe, 7 = Extreme). Reliability assessment

for the PANSS has shown that each item correlated with the appropriate scale (Kay et al., 1987). The PANSS has also shown strong interrater reliability ratings, with correlations between .89 and .94 (Kay, Opler, & Lindenmayer, 1988). Assessments of validity have shown strong discriminant, convergent, criterion, and predictive validity (Kay, Opler, & Fiszbein, 1992). All individuals administering PANSS ratings received training via DVD and samples provided from the PANSS Institute, LLC.

Social Functioning Scale (SFS)

The SFS (Birchwood, Smith, Cochrane, Wetton, & Copestake, 1990) is a 79-item self-report assessment of social functioning designed to specifically tap those areas of functioning that are crucial to the community maintenance of individuals with schizophrenia. The SFS yields a total score that is comprised of seven domains of functioning: (1) Social Engagement/Withdrawal; (2) Interpersonal Behavior; (3) Pro-social Behavior; (4) Recreation; (5) Independence-competence; (6) Independence-performance; and (7) Employment/occupation. Each subscale score was standardized and normalized using a '*T*' transformation to a mean of 100 and a standard deviation of 15, using the tables normed in the original schizophrenia sample as the reference population (Birchwood et al., 1990). The SFS total score is the average score attained across each transformed domain score. The SFS has been found to be a reliable, valid, and sensitive measure of social functioning that is relevant to the impairments and needs of individuals with schizophrenia (Birchwood et al., 1990).

Statistical Analysis

Data were analyzed using SPSS for Windows (Version 21.0). All ToM, WMS-R, and SFS scores were screened for outliers, which are defined as falling 3.0 SDs above or below the mean within each group. As groups did not significantly differ with respect to age, sex, race or IQ, no covariates were entered in the analysis. As the study utilized an archival dataset, sensitivity analyses using G*Power 3.1 software (Faul, Erdfelder, Lang, & Buchner, 2007) were conducted to estimate the minimum effect size that the study had sufficient statistical power to detect. A sensitivity analysis for an independent samples t-test with two groups of 28 participants, an alpha of .05, and power of .80, revealed estimated statistical power to detect an effect size of Cohen's d of 0.76 or above. A second sensitivity analysis was conducted to determine the effect size required for a linear multiple regression analysis, with an alpha of .05, power of .80, a sample size of 28, and 2 predictors, which estimated statistical power to detect an effect size of f^2 of 0.39 or above. According to Cohen (1988), both estimated effect sizes are considered large, which will increase the likelihood of Type II statistical errors but decrease the likelihood of Type I errors.

Since functional outcome is a multidimensional construct, we conducted a principal component analysis to determine whether discernable factors of functioning can be distinguished from the SFS domain scores. To examine between-group differences (schizophrenia, nonpsychiatric control), a series of independent sample t-tests and chi-square tests were conducted. These analyses were conducted with Bonferroni correction to statistically control for the number of comparisons (i.e., $p < .01$ required for statistical significance).

To determine whether ToM mediates the relationship between declarative memory and community functioning, a series of regression analyses were performed following the method outlined by Baron and Kenny (1986). These analyses require estimating three regression models: (1) regressing the mediator variable (ToM) on the independent variable (WMS-R); (2) regressing the dependent variable (SFS) on the independent variable (WMS-R); and (3) regressing the dependent variable (SFS) on both the independent variable (WMS-R) and the mediator variable (ToM). To establish mediation, the following conditions must occur: (1) the independent variable must correlate significantly with the mediator variable; (2) the mediator variable must correlate significantly with the dependent variable; and (3) when the effects of the mediator are controlled for, a previously significant correlation between the independent and dependent variables is greatly reduced. Using SPSS AMOS, a formal test of the significance of each mediating effect will be employed with a distribution of the product approach (i.e., bootstrapping), a resampling procedure that is particularly useful when power is a concern (Preacher & Hayes, 2004). The point estimate of the mediated effect is the mean effect computed over 1,000 samples using a 95% confidence interval. When zero does not lie within the confidence interval, the mediated effect can be considered significantly different from zero at $p < .05$ (Preacher & Hayes, 2008). Separate mediation analyses will be assessed within each group.

RESULTS

Sample Characteristics

The patient group (mean age = 31.40, SD = 8.33) and nonpsychiatric control group (mean age = 33.28, SD = 12.15) did not differ with regard to age, $t(49) = 0.65$, $p = .52$; sex, $\chi^2(1) = 0.44$, $p = .58$; race, $\chi^2(5) = 4.39$, $p = .50$; or level of attained education, $\chi^2(5) = 6.37$, $p = .27$. Within the patient group, exploratory analyses revealed that age of onset was positively correlated with level of education, $r(26) = .51$, $p = .006$. Refer to Table 1 for demographic and clinical characteristics of the sample.

Principal Component Analysis

Initial factorability of the SFS domain scores was examined. The Kaiser-Meyer-Olkin measure of sampling adequacy was .67, above the recommended value of .60, and Bartlett's test of sphericity was significant ($\chi^2(21) = 51.86$, $p < .01$). The diagonals of the anti-image correlation matrix were all over .50, supporting the inclusion of each domain in the component analysis. Finally, the communalities were all above .30, further confirming that each item shared some common variance with other items.

As the SFS domain scores were intercorrelated, a principal component analysis with oblique rotation was conducted to determine whether discernable factors of community functioning can be distinguished. This resulted in two factors with eigenvalues greater than 1, which accounted for 63.15 percent of the variance in SFS domain scores (see Table 3 for factor loadings). The first factor accounted for 47.21 percent of the variance and consisted of the Social Engagement/Withdrawal, Interpersonal Behavior, Prosocial Behavior, Recreation, and

Employment domains. The second factor accounted for 15.94 percent of the variance and consisted of the Independence Competence and Independence Performance domains. We labeled these two factors SFS Social Activities (SFS SA) factor and Independent Living (SFS IL) factor, respectively.

Group Differences in Memory, Theory of Mind, and Community Functioning

We tested for differences in performance on cognitive measures between schizophrenia patients and nonpsychiatric controls using a series of independent sample t-tests. Table 2 presents group means and results of statistical tests. The schizophrenia group performed comparable to nonpsychiatric controls on the WMS GMI, WMS Ver, and WMS Vis scores. The schizophrenia group performed significantly worse on the SST compared to the nonpsychiatric control group. Compared to nonpsychiatric controls, a trend was found for the schizophrenia group to perform worse on the first-order FB task, but performed comparable on the RMET and second-order FB task. The schizophrenia group also performed significantly worse on all measures of community functioning, including the SFS total, SFS IL factor, and SFS SA factor scores.

Within Group Tests of Mediation

Schizophrenia Group

Mediation analyses were conducted within each group separately. Within the patient group, the WMS GMI score was the only predictor of the three WMS scores that was significantly related to any of the SFS outcome variables, although this was only statistically

significant for the Independent Living factor (see Table 4). Thus, of the 12 possible mediating relationships (four social cognition measures by one measure of nonsocial cognition by three functional outcome measures), equations 1 and 2 (see Figure 3 for path diagram) were significant for three. The remaining nine did not meet the conditions for mediation; in particular, three relationships failed to meet the first criteria and six failed to meet the second condition.

The three relationships for which equations 1 and 2 were significant both included the SFS Independent Living factor as the outcome variable, and were as follows:

(1) WMS-G → RMET → SFS IL

(2) WMS-G → SST → SFS IL

(3) WMS-G → FB1 → SFS IL

In model (1) listed above, the predictor variable was the WMS GMI, the mediator was the RMET score, and the outcome variable was the SFS Independent Living factor. This mediational hypothesis was supported (see Table 6 and Figure 4). In this model, the predictor variable (WMS GMI) was significantly related to both the mediator (RMET) and the outcome variable (SFS IL). In addition, the mediator (RMET) was significantly related to the outcome variable (SFS IL).

To test for mediation, we conducted a multiple regression analysis predicting SFS IL score with RMET and WMS GMI and found the overall equation to be significant. When controlling for WMS GMI score, a trend was found for the RMET to predict the SFS IL factor score. More importantly, the relationship between WMS GMI score and SFS IL factor score was weaker in this analysis compared to the direct relationship. The indirect effect of WMS GMI score was .11 with a 95% confidence interval of .01-.35. As the 95% confidence interval does

not include zero, we can conclude that RMET does significantly mediate the effect of WMS GMI score on SFS IL factor.

In model (2), the predictor variable was the WMS GMI score, the mediator was the SST score, and the outcome variable was the SFS IL factor score. This mediational hypothesis was supported (see Table 7 and Figure 5). In this model, the predictor variable (WMS GMI) was significantly related to both the mediator (SST). and the outcome variable (SFS IL). In addition, the mediator (SST) was significantly related to the outcome variable (SFS IL).

To test for mediation, we conducted a multiple regression analysis predicting SFS IL factor score with SST and WMS GMI score and found the overall equation to be significant. When controlling for WMS GMI score, a trend was found for the SST to predict the SFS IL factor. More mportantly, the relationship between WMS GMI score and SFS IL factor score was weaker in this analysis compared to the direct relationship. The indirect effect of WMS GMI score was .08 with a 95% confidence interval of .01-.28. As the 95% confidence interval does not include zero, we can conclude that SST does significantly mediate the effect of WMS GMI score on the SFS IL factor score.

In model (3), the predictor variable was the WMS GMI score, the mediator was FB first-order stories (FB1), and the outcome variable was the SFS IL factor. This mediational hypothesis was supported (see Table 8 and Figure 6). In this model, the predictor variable (WMS GMI) was significantly related to both the mediator (FB1) and the outcome variable (SFS IL). In addition, the mediator (FB1) was significantly related to the outcome variable (SFS IL).

To test for mediation, we conducted a multiple regression analysis predicting SFS IL factor score with FB1 and WMS GMI score and found the overall equation to be significant. When controlling for WMS GMI score, the FB1 score significantly predicted the SFS IL factor

score. More importantly, the relationship between WMS GMI score and SFS IL factor score was weaker in this analysis compared to the direct relationship. The indirect effect of WMS GMI was .14 with a 95% CI of .03-.28. As the 95% confidence interval does not include zero, we can conclude that FB1 does significantly mediate the effect of WMS GMI score on SFS IL factor score.

Nonpsychiatric Control Group

Within the nonpsychiatric control group, a trend-level relationship was found between the WMS Verbal Index score (predictor variable) and the SFS IL factor score (outcome variable; see table 5). However, none of the possible mediating relationships passed equation 2. Thus, mediational analyses were not conducted in the nonpsychiatric control group.

DISCUSSION

The current study aimed to further evaluate the role of specific ToM abilities as mediators between a specific nonsocial cognitive ability (memory) and domains of community functioning in individuals with schizophrenia. As previously noted, ToM may not be a unitary construct but consist of distinct abilities that exhibit differential relationships with community functioning in schizophrenia (Bora et al., 2006). Previous findings also suggest that cognition (both nonsocial and social) differentially relates to specific domains of community functioning (e.g., Pijnenborg et al., 2009). The current study also assessed outcome using separable domains of community functioning. The primary finding was that schizophrenia patients' ToM performance on both mental state reasoning and mental state decoding tasks significantly mediated the relationship between memory and functional skills associated with living independently.

We hypothesized that the specific ToM ability of mental state decoding, but not mental state reasoning, would mediate the relationship between declarative memory functioning and community functioning in individuals with schizophrenia, but not in nonpsychiatric controls. Our data provide partial support for this hypothesis, as we found that mental state decoding (RMET) did significantly mediate this relationship in schizophrenia. Contrary to our hypothesis, our findings also revealed that mental state reasoning (FB1, SST) significantly mediated this relationship. These findings are consistent with a recent study comparing various ToM tasks by conducting PCA within a schizophrenia sample reporting that tasks of emotion recognition (similar to the RMET) and story-based ToM tasks (similar to the SST) loaded on the same component while false-belief tasks loaded on a separate component. Futhermore, the authors reported that visual and verbal memory performance were both strongly related to performance

22

on each type of ToM task, confirming the importance of memory processing and encoding across ToM abilities.

Although Bora et al. (2006) found that mental state decoding was a better predictor of functional outcome than mental state reasoning in schizophrenia, it may be that both abilities are instrinsically related to memory processes that impede community functioning. Previous research indicates that ToM is a complex social cognitive construct that may consist of distinct abilities or domains (e.g., higher-order vs lower-order, mental state reasoning vs mental state decoding) and inconsistencies in the ToM literature may be a result of the heterogeneity of methods used to assess ToM (Bora et al., 2009). Our findings indicate that the construct of ToM appears to influence memory and community functioning through similar mechanisms, regardless of ToM ability or task.

With regard to domains of community functioning, two separable domains were identified in the schizophrenia group: a social/interpersonal factor and an independent living factor. The independent living factor assesses the ability to perform skills necessary for independent living (e.g., washing, grooming, cleaning, budgeting), while the social/interpersonal factor assesses the ability to interact appropriately in various social settings. This finding replicates the factor solution of SFS scale scores obtained in a previous study of schizophrenia patients (Pijnenborg et al., 2009).

In our mediational analyses, ToM significantly mediated the relationship between declarative memory and those community functioning skills associated with living independently, but not those associated with social/interpersonal activities. Our results are consistent with previous research that finds that social cognition explains specific domains of functional outcome better than others. For example, Pijnenborg et al. (2009) found that patients

with impaired social cognition showed significantly poorer independent living skills than patients with unimpaired social cognition, but no difference was found with other domains of functioning. Another study found ToM performance – defined as the composite score of the RMET, the Hinting Task, and a related emotion recognition task – to be more closely related to specific domains of outcome (i.e., employment/occupation) than the composite outcome score (Martinez-Dominguez, Penades, Segura, Gonzalez-Rodriguez, & Catalan, 2015). Thus, it appears that the understanding the beliefs of others (ToM) may form the cognitive building blocks for individuals with schizophrenia to function independently in society.

While this finding may seem counterintuitive as ToM is a social cognitive construct, it may be that self-reports of independent living functioning are more objective and more valid for use with individuals with schizophrenia than are self-reports of social and work functioning. For example, Bowie et al. (2007) reported convergence between case manager and schizophrenia patient ratings of personal care skills, but not ratings related to interpersonal skills, activities in the community, or work skills. This suggests that patient ratings related to social activities may be less reliable than non-social domains of community functioning.

Examination of between group difference scores revealed that individuals with schizophrenia show impairments in all aspects of community functioning and some aspects of ToM. Inconsistent with previous research (e.g., Cirillo & Seidman, 2003; Heinrichs, 2005; Reichenberg & Harvey, 2007), we did not find declarative memory impairments in individuals with schizophrenia compared to nonpsychiatric controls. Furthermore, no significant between-group differences were found for intelligence or level of education, which may suggest that this sample of schizophrenia patients may be somewhat atypical.

Although atypical, studies have reported that a distinct subgroup of individuals with schizophrenia showing preserved or "normal-range" nonsocial cognitive function does exist (Kremen et al., 2000; Weickert et al., 2000). In fact, a recent study observed that cognitively impaired and normal-range cognition patients were equally disadvantaged relative to nonpsychiatric controls in independent living skills (Muharib et al., 2014). Another study found that schizophrenia patients who have previously contemplated suicide outperformed those who have never contemplated suicide on neuropsychological tests (Delaney et al., 2012). These results indicate that preserved nonsocial cognition fails to translate into enhanced community functioning and may carry an increased psychological burden in schizophrenia. The results of the present study indicate that despite relatively intact nonsocial cognitive abilities, patients with schizophrenia may still exhibit significant impairments in community functioning and ToM. Thus, the assessment and treatment of social cognition (e.g., ToM) may be critical for the improvement of functional outcome in schizophrenia patients, particularly those with preserved nonsocial cognitive functions.

Furthermore, we found no evidence to suggest that these type of mediational relationships exist in the nonpsychiatric control group. In fact, the nonpsychiatric control group exhibited a distinctly different correlation matrix, in which none of the ToM tasks were significantly correlated. These results are consistent with previous research that have examined relationships between scores on different ToM tasks in a nonpsychiatric control population (Addington et al., 2006b). This suggests that ToM ability exhibits unique relationships with nonsocial cognition and outcome in individuals with schizophrenia, as compared with nonpsychiatric adults. In other words, these findings may serve to provide informative insight

25

into the functional mechanisms of specific impairments in cognition, both social and nonsocial, in individuals with schizophrenia.

The current study has some methodogical limitations. As the sample size is small, the statistical power is lower and the type II error of statistical tests becomes larger. Additionally, both groups performed at or near the ceiling level on the FB1 and FB2 tasks, which limits variability and the likelihood that those scores will relate to outside factors. This further increases the liklihood of a type II error on relationships with the FB scores in particular. As previously mentioned, our schizophrenia sample may be somewhat atypical, as no differences were found compared to a nonpsychiatric control group for level of education, FSIQ, and other nonsocial cognitive variables. Therefore, our sample may not be representative of all individuals with schizophrenia, as our schizophrenia participants appear to be relatively higher functioning in nonsocial cognition and educational achievement. Furthermore, our regression analyses accounted for only 24-36% of the variance in community functioning, which indicates that a substantial amount of the variance is left unexplained. Future studies should include models that include other constructs highly associated with outcome, including clinical symptomatology (Mehta, Thirthalli, Kumar, Kumar, & Gangadhar, 2014), working memory (Smith et al., 2014), and attention (Rassovsky, Horan, Lee, Sergi, & Green, 2011). Lastly, as we did not use a longitudinal design, inferences cannot be made about the causal direction of the relationships found. Future research should use a longitudinal design to determine the order of causality suggested by the mediational model.

Our results are consistent with the previous studies demonstrating the mediational role that ToM (as assessed with the Hinting test) plays in the relationship between nonsocial cognition and functional outcome in schizophrenia (Couture et al., 2011; Horton & Silverstein,

2008). While most other studies use composite scores to assess nonsocial cognition, ToM, and community functioning, the current study expands upon previous research by assessing distinct aspects of ToM, a specific nonsocial cognitive variable, and separable domains of community functioning.The findings of the current study provide further evidence to indicate that schizophrenia patients' performance on ToM tasks significantly mediates the relationship between nonsocial cognition and a specific domain of community functioning. More specifically, we found that tasks of mental state reasoning and mental state decoding both significantly mediated the relationship between declarative memory and independent living skills in individuals with schizophrenia. Focusing on which domains of functioning are more sensitive to impairments in specific domains of social cognition would be an important step for rehabilitation by allowing more targeted approaches to treatment. For example, cognitive therapy aimed at improving ToM related skills may be an important component of treatment focused on improving skills related to living independently (e.g., medication management). Futher, investigating potential mediator variables allows for the identification of aspects critical for improving therapy and community functioning in schizophrenia.

APPENDIX A: TABLES

Table 1. Demographic and Clinical Charachteristics of Schizophrenia and Nonpsychiatric Control Groups

Variable	Schizophrenia Group (n = 28)			Nonpsychiatric Control Group (n = 23)			Statistic	p
	Mean	SD	% (n)	Mean	SD	% (n)		
Age (years)	31.4	8.33		33.28	12.15		t(49) = 0.65	.52
Sex							χ2 = 0.44	.51
Males			57.1 (16)			50.0 (11)		
Females			42.9 (12)			50.0 (12)		
Race							χ2 = 4.39	.50
White			39.3 (11)			47.8 (11)		
Black			25.0 (7)			30.4 (7)		
Hispanic			17.9 (5)			13.0 (3)		
Asian Pacific Islander			7.1 (2)			4.3 (1)		
American Indian/Alaskan			0.0 (0)			4.3 (1)		
Other			10.7 (3)			0.0 (0)		
WAIS-III FSIQa	102.81	16.86		103.73	12.42		t(46) = -0.21	.83
Education							χ2 = 6.37	.27
Did Not Complete High School			10.7 (3)			0.0 (0)		
Completed High School			14.3 (4)			4.3 (1)		
Tech School			0.0 (0)			4.3 (1)		
Some College			35.7 (10)			30.4 (7)		
College or University Degree			28.6 (8)			47.8 (11)		
Post Graduate Degree			10.7 (3)			13.0 (3)		
PANSS								
Total Positive	10.68	4.19						
Total Negative	11.64	3.33						
Total General	23.2	4.91						
Age at onset (years)	23.81	7.36						
Duration of Illness (years)	7.81	8.29						

Note: WAIS-III FSIQ = Wecshler Adult Intelligence Scale-III Full Scale Intelligence Quotient. PANSS = Positive and Negative Syndrome Scale.

[a] FSIQ data is missing for two participants in the schizophrenia group and one in the nonpsychiatric control group.

Table 2. Means, Standard Deviations, and Between-Group Differences on all Study Variables

Variable	Schizophrenia Group ($n = 28$)		Nonpsychiatric Control Group ($n = 23$)		t	p	Cohen's d
	Mean	SD	Mean	SD			
WMS-R General Index	93.18	16.68	99.70	14.09	1.49	.14	0.42
WMS-R Verbal Index	91.07	14.48	96.95	13.21	1.42	.25	0.42
WMS-R Visual Index	103.36	18.89	101.04	14.07	0.48	.64	0.14
First-Order False Belief Story	5.71	0.76	6.00	0.00	1.79†	.08	0.70
Second-Order False Belief Story	5.75	0.84	5.91	0.42	0.84	.40	0.25
Reading the Mind in the Eyes Task	23.32	6.93	25.96	4.90	1.53	.13	0.44
Strange Stories Task	30.14	4.75	32.83	2.77	2.39*	.02	0.70
SFS Total Score	112.00	8.90	121.92	5.30	4.70	< .001	1.36
SFS Independent Living Factor	111.58	9.19	119.40	4.81	3.69**	.001	1.08
SFS Social Activities Factor	112.17	10.94	122.92	6.73	4.11**	< .001	1.19

Note. WMS-R = Wechsler Memory Scale-Revised. SFS = Social Functioning Scale. SD = Standard deviation.

† $p < .10$. * $p < .05$. ** $p < .01$.

Table 3. Pattern Matrix Factor Loadings of Social Functioning Scale

	Component	
	Social Activities (eigenvalue = 3.30)	Independent Living (eigenvalue = 1.12)
Social Withdrawal	**.767**	.090
Interpersonal Behavior	**.835**	-.044
Prosocial Behavior	**.883**	-.255
Recreation	**.643**	.184
Independence-Performance	.359	**.650**
Independence-Competence	-.090	**.899**
Employment	**.609**	.111

Note. Principal component analysis using oblique rotation method. Rotation converged in 3 iterations.

Bolded values represent factor loadings greater than .60.

Table 4. Pearson Correlations of Variables Within the Schizophrenia Group (n = 28)

	WMS Gen	WMS Ver	WMS Vis	RMET	SST	FB1	FB2	SFS Total	SFS S/A	SFS IL
WMS Gen		.952**	.713**	.583**	.410*	.461*	.108	.268	.181	.371*
WMS Ver			.547**	.545**	.422*	.351†	-.002	.190	.122	.281
WMS Vis				.511**	.116	.501**	.166	.270	.213	.282
RMET					.560**	.677**	.198	.149	.006	.486**
SST						.451*	.295	.076	-.065	.448*
FB1							.345†	.294	.092	.593**
FB2								.177	.032	.391*
SFS Total									.959**	.537**
SFS S/A										.276
SFS IL										

Note. WMS Gen = Wechsler Memory Scale General Memory Index. WMS Ver = Wechsler Memory Scale Verbal Memory Index. WMS Vis = Wechsler Memory Scale Visual Memory Index. RMET = Reading the Mind in the Eyes Task. SST = Strange Stories Task. FB1 = First-Order False Belief Story. FB2 = Second-Order False Belief Story. SFS Total = Social Functioning Scale Total. SFS S/A = Social Functioning Scale. Social/Activities factor. SFS IL = Social Functioning Scale Independent Living factor.

** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed). † Correlation is significant at the 0.10 level (2-tailed).

Table 5. Pearson Correlations of Variables Within Nonpsychiatric Control Group (n = 23)

	WMS Gen	WMS Ver	WMS Vis	RMET	SST	FB1ᵃ	FB2	SFS Total	SFS S/A	SFS IL
WMS Gen		.819**	.764**	.381†	.215		.072	-.010	.070	-.284
WMS Ver			.371†	.300	.086		.060	-.147	-.019	-.499*
WMS Vis				.324	.218		.001	-.026	-.021	-.026
RMET					.136		-.046	-.196	-.195	-.073
SST							-.014	-.144	.157	.075
FB1ᵃ										
FB2								-.147	-.131	-.117
SFS Total									.968**	.472*
SFS SA										.235
SFS IL										

Note. WMS Gen = Wechsler Memory Scale General Memory Index. WMS Ver = Wechsler Memory Scale Verbal Memory Index. WMS Vis = Wechsler Memory Scale Visual Memory Index. RMET = Reading the Mind in the Eyes Task. SST = Strange Stories Task. FB1 = First-Order False Belief Story. FB2 = Second-Order False Belief Story. SFS Total = Social Functioning Scale Total. SFS SA = Social Functioning Scale. Social/Activities factor. SFS IL = Social Functioning Scale Independent Living factor.

** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed). † Correlation is significant at the 0.10 level (2-tailed).

ᵃ Cannot be calculated because variable is constant (no variance)

Table 6. Reading the Mind in the Eyes Task: Test for its Mediation of General Memory on SFS Independent Living Factor, Equations 1, 2 (Bivariate Regressions) and 3 (Multiple Regression) (n = 28)

	Equation 1				Equation 2				Equation 3							
IV	DV RMET b	t	(p)	R^2	DV SFS IL b	t	(p)	R^2	IV	DV SFS IL b	t	(p)	$F\Delta$	(p)	$R^2\Delta$	df
WMS Gen	.24	3.36** (.001)		.34	.21	2.04* (.05)		.14	Block 1							
									1. WMS Gen	.21	2.04* (.05)		4.16* (.05)		.14	26
									Block 2							
									1. WMS Gen	.07	0.62 (.54)		4.13* (.03)		.25	25
									2. RMET	.54	1.92† (.07)					

Note. RMET: Reading the Mind in the Eyes Task. SFS IL: Social Functioning Scale Independent Living Factor. WMS Gen: Wechsler Memory Scale General Memory Index.

** $p < .01$. * $p < .05$. † $p < .10$.

Table 7. Strange Stories Task: Test for its Mediation of General Memory on SFS Indepdent Living Factor, Equations 1, 2 (Bivariate Regressions) and 3 (Multiple Regression) (n = 28)

	Equation 1				Equation 2			Equation 3						
IV	DV SST b	t	(p)	R^2	DV SFS IL b	t (p)	R^2	IV	DV SFS IL b	t	(p)	$F\Delta$ (p)	$R^2\Delta$	df
WMS Gen	.12	2.29*	(.03)	.17	.21	2.04* (.05)	.14	Block 1						
								1. WMS Gen	.21	2.04*	(.05)	4.16* (.05)	.14	26
								Block 2						
								1. WMS Gen	.12	1.18	(.25)	4.02* (.03)	.24	25
								2. SST	.69	1.87†	(.07)			

Note. SST: Strange Stories Task; SFS IL: Social Functioning Scale Independent Living Factor; WMS Gen: Wechsler Memory Scale General Memory Index.

* $p < .05$. † $p < .10$.

Table 8. FB1: Test for its Mediation of General Memory on SFS Independent Living Factor, Equations 1, 2 (bivariate regressions) and 3 (multiple regression) (n = 28)

	Equation 1				Equation 2			Equation 3					
IV	DV FB1 b	t (p)	R^2		DV SFS IL b	t (p)	R^2	IV	DV SFS IL b	t (p)	$F\Delta$ (p)	$R^2\Delta$	df
WMS Gen	.02	2.65* (.01)	.21		.21	2.04* (.05)	.14	Block 1					
								1. WMS Gen	.21	2.04* (.05)	4.16* (.05)	.14	26
								Block 2					
								1. WMS Gen	.07	0.69 (.50)	7.14** (.004)	.36	25
								2. FB1	6.45	2.98** (.006)			

Note. FB1: False Belief First Order Task; SFS IL: Social Functioning Scale Independent Living Factor; WMS Gen: Wechsler Memory Scale General Memory Index.
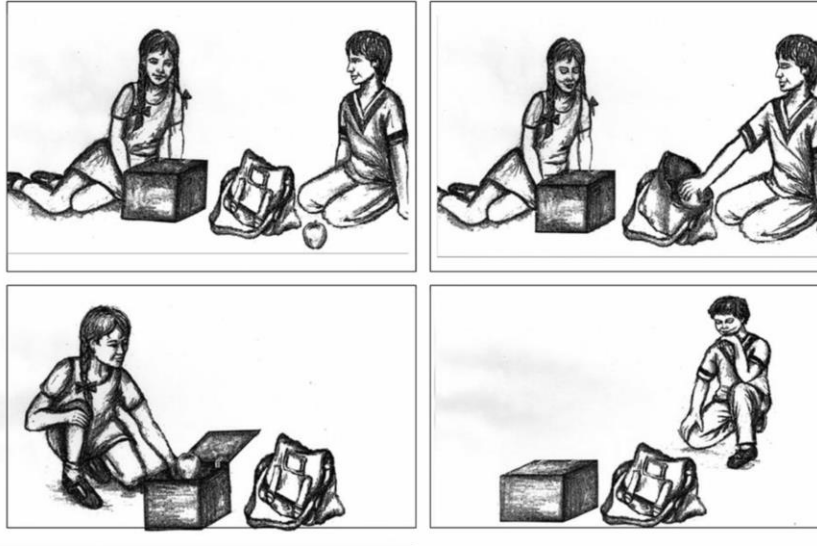
* $p < .05$. † $p < .10$.

APPENDIX B: FIGURES

Figure 1. First Order False Belief Task – Sally and David Task

Read the following aloud to the participant.

"You will be shown a series of pictures. While you view them, I will describe what is happening in each. Then I will ask you some questions.

Read each of the following lines aloud with the corresponding picture.

Picture 1: "This is David and this is Sally. David has a bag and Sally has a box."
Picture 2: "David has an apple. David puts his apple away in his bag to keep it safe while he plays outside. Then David goes out to play."
Picture 3: "But look, while David is outside, Sally takes the apple out of David's bag, and she puts it in her box, here. Then Sally goes outside to play."
Picture 4: "David comes in from playing. He's hungry and he'd like to have a bite of his apple."

Ask each of the following questions aloud to participant.

Question 1 (false belief test): Where will David look for his apple?
      Bag = 2 points   Box = 0 points   Other = 1 point

Figure 2. Second Order False Belief Story: The Chocolate Task

Script:

Picture 1: "This is Mary and her brother John. Their grandfather has given them some chocolate to share. "Put it away now," says their grandfather, "you can have some when Mom says so."
Picture 2: "John and Mary go inside and put the chocolate in the fridge. Then they go out to play in the garden."
Picture 3: "Later, John comes in for a glass of water. He goes to the fridge and sees the chocolate. He wants to keep the chocolate all to himself. So he takes the chocolate out of the fridge and puts it in his bag."

Ask the following question aloud to the participant.

Question 1 (false belief test): Where does Mary think the chocolate is?
      Fridge = 2 points   Bag = 0 points   Other = 1 point

Read the following aloud with the corresponding picture.

Picture 4: "But look, Mary is playing by the window now and she can see everything that John is doing. She sees him put the chocolate in his bag. John is so busy hiding the chocolate that he doesn't see Mary watching him through the window."
Picture 5: "Later, Mom comes to call John and Mary in for lunch. She says they can have some of the chocolate now. John and Mary come running into the kitchen."

Ask the following question aloud to the participant.

Question 3 (false belief test): Where does John think Mary will look for the chocolate?
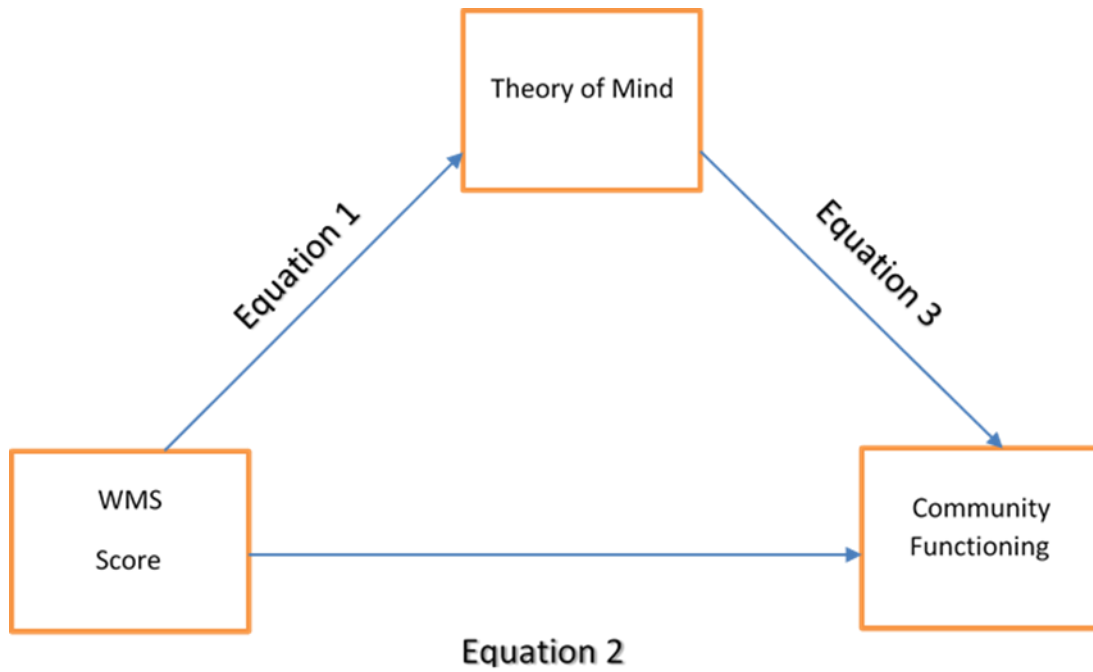   Fridge = 2 points   Bag = 0 points   Other = 1 point

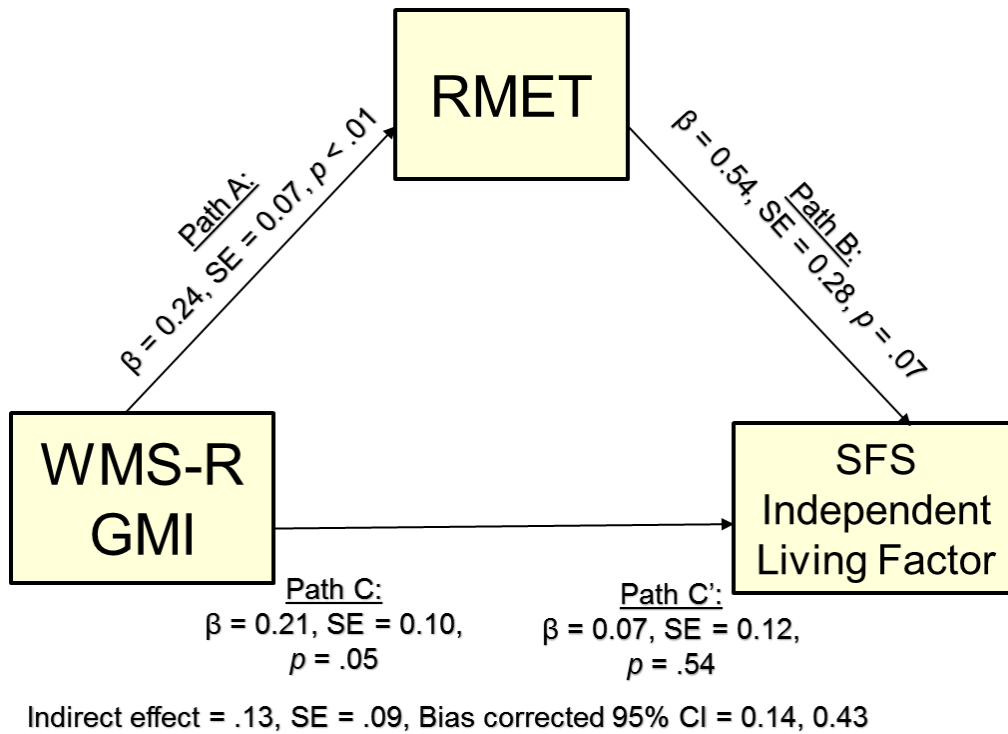Figure 3. Mediation Path Analysis and Equation Schematic

Figure 4. Path coefficients in mediation analysis of schizophrenia group with Reading the Mind in the Eyes as the mediator.

Note. WMS-R GMI = Weschler Memory Scale-Revised General Memory Index; RMET = Reading the Mind in the Eyes Task; SFS = Social Functioning Scale; SE = Standard Error; CI = Confidence Interval.
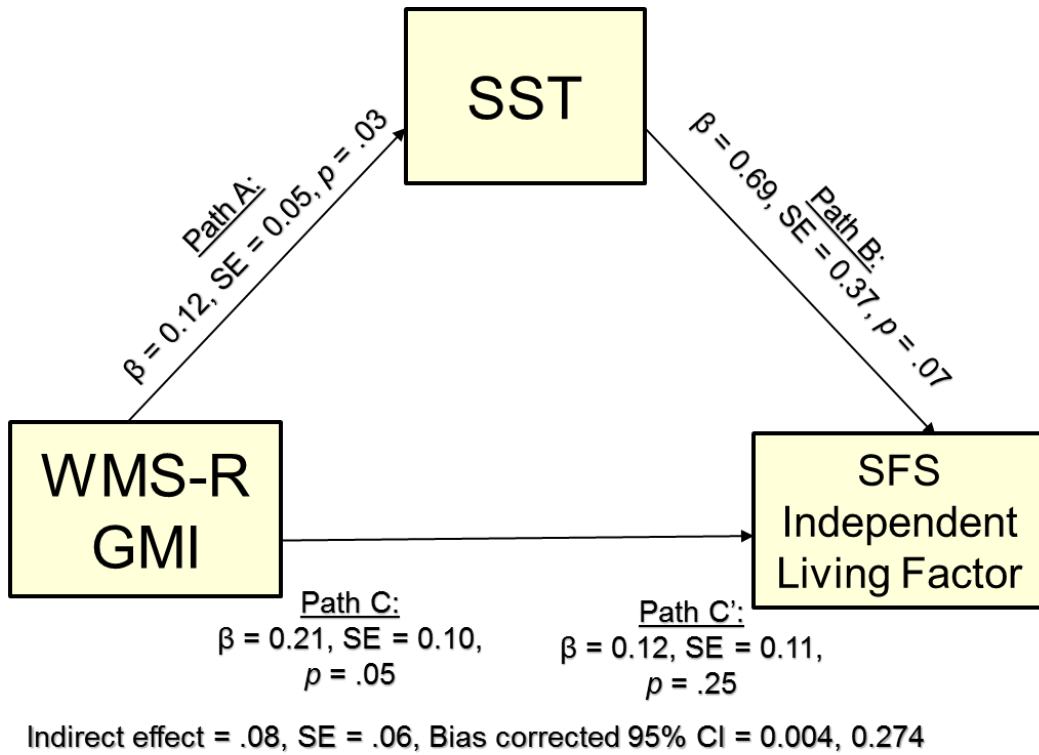
Figure 5. Path coefficients in mediation analysis of schizophrenia group with Strange Stories
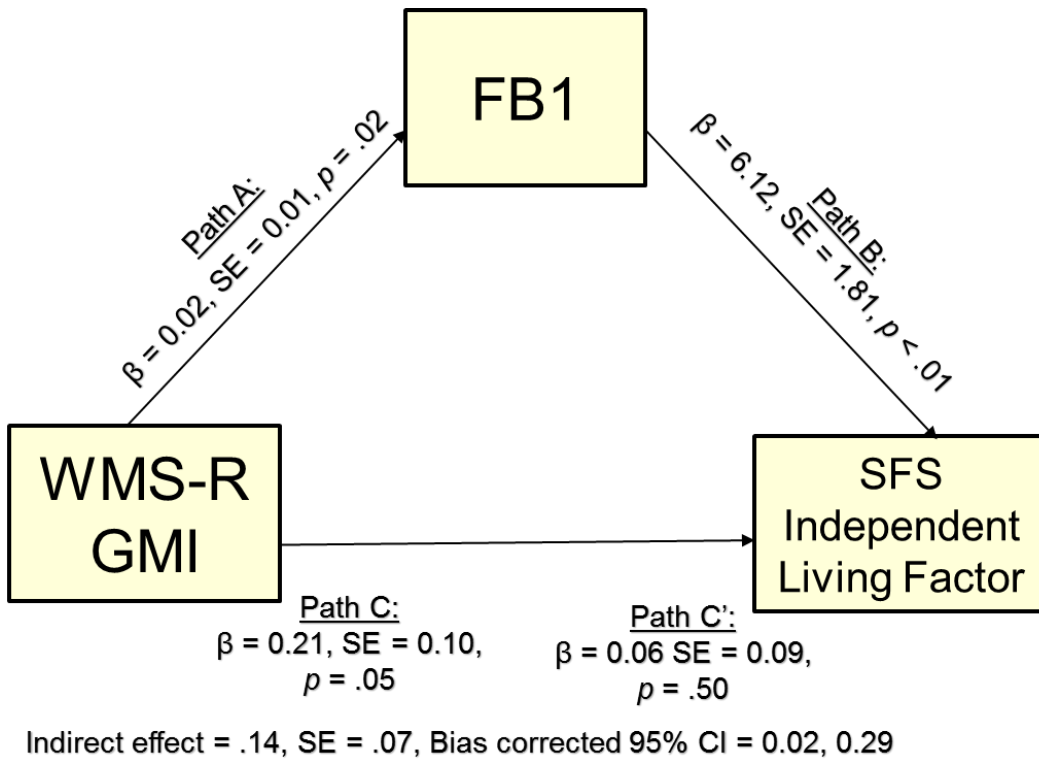Task as the mediator.

Figure 6. Path coefficients in mediation analysis of schizophrenia group with First Order False Belief Task as the mediator.

APPENDIX C: IRB APPROVAL LETTER

Institutional Review Board
NYU School of Medicine

Veteran's Administration Hospital
Physical Address: 423 East 23rd Street | 10th Floor, West Wing | NY, NY 10010
Mailing Address: 550 1st Avenue | #VET 10th Floor, West Wing | NY, NY 10016

NYU
Medical
Center

Initial Review: Expedited | Approved   04-Dec-2006

Olfaction and Social Function in Schizophrenia

Principal Investigator	Dolores Malaspina	Review Type	Expedited (4,7)	Initial Review
		Submitted	20-Nov-2006
Phone		Email	
IRB#	06-850	Perf. Period	28-Nov-2006 – 27-Nov-2007
Location(s) Used	OTHER (specified in Overview)		
Review Date	28-Nov-2006	Board/Meeting	Board B on 19-Dec-2006
Sponsor	Departmental~	Subjects	(total) (approved)

The current IRB status of your study is: Approved

The study has been granted Expedited approval in accordance with 45 CFR 46.110:
Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving x-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing. (Studies intended to evaluate the safety and effectiveness of the medical device are not generally eligible for expedited review, including studies of cleared medical devices for new indications.)

Examples: (a) physical sens

Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation or quality assurance methodologies.

The Following Documents have been approved for use in this study:

Protocol (vd 5/16/06)
Consent/Authorization-AudioTape Release (nd)
Consent/Authorization-VideoTape (nd)
Paid Research Volunteer Flyer (nd)

_____ 04-Dec-2006
RE: H#06-850
Elan Czeisler
Director, Institutional Review Board (IRB)
OHRP #FWA00004952

Notes:

APPENDIX D: EMAIL FROM UCF IRB

TO: Andrew Deptula

Thank you for contacting the IRB and providing details about your dissertation research. As I explained yesterday, because you are a Doctoral student at UCF, you should have submitted your study to the UCF IRB for a determination before you began your analysis of the data. The NYU IRB approved the previous collection of the data, but that is not the issue here.

We cannot review research after the fact and a reliance agreement with NYU is not appropriate. That said, if you had submitted a protocol to us with the information provided below, our determination would have been "not human subjects research."   You are conducting secondary data analysis on de-identified data provided to you by a third party.

I hope this response is sufficient for the thesis editor. In the future, please check with the IRB, at UCF or your future institution, before beginning human subjects research.

If you have questions, please let me know.

Regards,

Joanne Muratori, M.A., CIP
IRB Manager

University of Central Florida
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APPENDIX E: DEFENSE ANNOUNCEMENT

Announcing the Final Examination of Mr. Andrew E. Deptula for the degree of Doctor of Philosophy.

Date: July 9, 2015
Time: 11:00 a.m.
Room: PSY 301H
Dissertation Title: Declarative Memory, Theory of Mind, and Community Functioning in Schizophrenia

This study examined the relationship among declarative memory, theory of mind, and functional outcome in schizophrenia. Participants included 28 outpatients with schizophrenia and 23 nonpsychiatric controls who completed tasks assessing theory of mind, memory, and community functioning. Findings revealed that the relationship between memory scores and specific domains of community functioning (i.e. independent living skills) was mediated by theory of mind in individuals with schizophrenia. The results suggest that the relationship between memory and community functioning in schizophrenia is mediated by specific, rather than general, aspects of social cognition. Implications of these findings inform psychosocial treatment for individuals with schizophrenia that may improve functional outcome in these individuals.

Major: Clinical Psychology

Educational Career:
B.A., 2006, Syracuse University
M.S., 2013, University of Central Florida

Committee in Charge:
Dr. Jeffrey S. Bedwell
Dr. Valerie K. Sims
Dr. Daniel Lee Paulson
Dr. Stephen M. Fiore

Approved for distribution by Jeffrey S. Bedwell, Committee Chair, on July 1, 2015.

The public is welcome to attend.

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