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Impaired Theory of Mind in Psychotic and Affective Disorders

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IMPAIRED THEORY OF MIND IN PSYCHOTIC AND
AFFECTIVE DISORDERS

By

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Bachelor of Arts
University of Nevada, Las Vegas
2009

Master of Arts
University of Nevada Las Vegas
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A dissertation submitted in partial fulfillment
of the requirements for the

Doctor of Philosophy - Psychology

Department of Psychology
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THE GRADUATE COLLEGE

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ABSTRACT
Impaired Theory of Mind in Psychotic and Affective Disorders

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Psychotic symptoms in bipolar I disorder during mood episodes has been associated with several negative outcomes raising the question as to whether psychosis is a risk factor for a more severe form of this chronic and debilitating condition. However, relatively little research has been directed at understanding the relationships among social cognitive functioning in bipolar I disorder with and without a history of psychosis. Impaired social cognition has been identified as a putative endophenotypic markers in schizophrenia and the evidence is mounting as to whether similar impairments also exist in bipolar I disorder. Given the plethora of research supporting the presence of social cognitive impairments in schizophrenia researchers have sought to focus on subdomains and component parts of social cognition, such as theory of mind and the processing of naturalistic social exchanges. Compared to healthy controls, research in this area suggests that individuals with schizophrenia struggle to correctly recognize and interpret naturalistic social exchanges involving linguistically inconsistent inferences (e.g., sarcastic) as opposed to consistent inferences that are sincere. Research in this area involving BP participants has been mixed, which may be explained by heterogeneous bipolar I disorder samples. To date, the theory of mind component involving recognition and interpretation of social exchanges has not been evaluated in individuals with bipolar I disorder with and without a history of psychosis during mood episodes. Hence, the

overarching goal of this project was to evaluate whether a history of psychotic symptoms in bipolar I disorder are associated with impaired recognition and interpretation of naturalistic social exchanges, particularly those involving sincere, lie, and sarcastic exchanges.

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DEDICATION

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CHAPTER 1

INTRODUCTION

Schizophrenia (SZ) is a chronic and debilitating psychiatric condition distinguished from many other psychiatric conditions by the presence of positive symptoms, namely hallucinations, delusions, movement disorders, and thought disorders, and negative symptoms, principally the lack of emotion, pleasure, activity, and speech (APA, 2000). Individuals with SZ often exhibit impaired social and non-social cognitive processing (Heinrichs & Zakzanis, 1998; Nuechterlein, Barch, Gold, Goldberg, Green, & Heaton, 2004). In conjunction with positive and negative symptoms, social and non-social cognitive impairments have been associated with poor functional outcome in SZ (Bowie et al., 2008; Maat, Fett, & Derks, 2012). Individuals with other psychiatric conditions display psychotic symptoms, except such symptoms often occur in the presence of acute mood episodes, substance use, or a neurodegenerative state (APA, 2000).

Bipolar I disorder (BP) is a psychiatric condition characterized by intense and drastic changes in emotion, thoughts, and behaviors. Distinct and temporally associated changes in emotions, thoughts, and behaviors are referred to as “mood episodes.” In BP, mood episodes can be characterized as manic, depressed, or mixed. A manic episode is typified by an abnormally elevated or irritable mood, arousal, or energy level. Clinically significant manic episodes in BP last at least one-week or until the individual experiencing the episode is hospitalized. A depressed episode, on the other hand, represents changes in thoughts, emotions, and behaviors characteristic of major depression: feeling sad, hopeless, worthless, guilty, and even irritable. Lastly, a mixed

episode represents a combination of manic and depressed symptoms (APA, 2000).

Individuals with SZ and BP have received a great deal of attention from the mental health community due to their chronic and debilitating nature, as well as their overlapping symptomatology (APA, 2000; Baethge et al., 2005; Shinn et al., 2012). Similarities with respect to neurocognitive impairment in SZ and BP have also been evaluated and reports suggest that individuals with SZ and BP exhibit impaired learning and memory, attention, and executive function abilities, although often with varying levels and patterns of performance (Allen et al., 2010; Arts, Jabben Krabbendam & van Os, 2008; Burdick et al., 2011, Smith, Barch, & Csernansky, 2009). In BP, the domains of impairment are generally fewer and less severe than those in SZ (Krabbendam, Arts, Van Os, & Aleman, 2005). Neurocognitive impairments in BP have been shown to be more wide-spread and severe in persons who experience psychotic symptoms during mood episodes (Bora et al., 2007; Bora, Yücel, & Pantelis, 2009a; Glahn et al., 2007). Individuals diagnosed with SZ and BP also demonstrate impairments in social cognition.

Social cognition is a multi-dimensional construct composed of cognitive processes necessary to perceive, process, interpret, understand and predict information to make socially-based decisions or judgments (Penn, Sanna, & Roberts, 2008). Advancements in social cognitive research has led to the identification of social cognitive subdomains such as attributional bias, emotion processing, social perception, and theory of mind (Green & Horan, 2010). It has been reported that each subdomain has associated, and sometimes overlapping “subprocesses” or component parts which influence skills in these areas (Green & Horan, 2010; Kern & Horan, 2010). Similar to neurocognitive impairments, individuals with SZ and BP exhibit have been shown to

display impaired social cognitive abilities with varying levels and patterns of performance (Bersani et al., 2013; Caletti et al., 2013; Guastella et al., 2013; Rocca et al., 2008; Samamé, Martino, & Strejilevich et al., 2012; Savitz et al., 2009). Performance by individuals with a history of psychotic symptoms in BP have been associated with poorer social cognitive performance compared to individuals with BP who have no history of psychotic symptoms (Thaler et al., 2013a, 2013b).

One subdomain of social cognition shown to be impaired in SZ and BP is theory of mind (TOM). TOM involves an individual's ability to infer the intentions, desires, dispositions, imagination, emotions, and beliefs of oneself and others (Green & Horan, 2010; Völlm et al., 2006). TOM impairments in SZ and BP are commonly reported (Bora et al., 2009a, 2009b; Sprong, Schothorst, Vos, Hox, & Van Engeland, 2007) and have been shown to be more severe in persons with BP who have a history of psychotic symptoms compared to individuals with BP who do not (Marjoram et al., 2005; Pantelis et al., 2009).

One component part of TOM which has only recently been evaluated in SZ and BP concerns the recognition and interpretation of naturalistic conversational inference such as sincerity, lies, and sarcasm (Adachi et al., 2004; Corcoran & Frith, 2003; Craig, Hatton, Craig, & Bentall, 2004; Langdon, Coltheart, Ward, & Catts, 2002; McDonald, 2003). Recognition and interpretation of social inference likely requires numerous social and non-social cognitive processes, but has been predominately associated with TOM abilities (Corcoran, Mercer, & Frith, 1995; Kaland et al., 2002; McDonald & Flanagan, 2004; Sperber & Wilson, 2002). For instance, Sperber and Wilson (2002) suggest, recognition and interpretation of conversational inference requires TOM because the

participant must ascertain the mental state of at least one other person to correctly perceive other social factors. Others association social inference with TOM abilities due to overlapping neuroanatomical activation (Shamay-Tsoory & Aharon-Peretz, 2007; Völlm et al., 2006). Relative to healthy controls (HC), individuals with SZ exhibit impairments in their ability to correctly recognize and interpret social exchanges involving sarcasm, compared to sincere exchanges (Chang et al., 2011; Horan et al., 2011; Kern et al., 2009; Kosmidis et al., 2008; Lee et al., 2013; Leitman et al., 2006; Mancuso et al., 2011; Rowland et al., 2013; Sparks et al., 2010). In SZ, impairments in recognition and interpretation of sarcastic social exchanges have been associated with more severe psychotic symptoms (Kern et al., 2009), poor social functioning (Mancuso et al., 2011; Sparks et al., 2010) and resilience to social skills training (Horan et al., 2011). Few studies have evaluated recognition and interpretation of naturalist social inference in BP and those study that have reported mixed findings. For example, Lee et al. (2013) found no difference between a BP group and HCs in their ability to correctly recognize and interpret sarcastic conversational exchanges, whereas Rowland and colleagues (2013) found that a BP group performed significantly worse than HCs in their ability to correctly recognize and interpret sarcastic social exchanges. The mixed findings in the aforementioned studies may be partially attributable to heterogeneous BP samples, such that the study samples consisted of BP with and without a history of psychotic symptoms, as well as individuals with bipolar II disorder, a form of bipolar disorder with potentially more pronounced depressive symptoms and less severe manic symptoms (i.e., hypomania). Given that individuals with no history of psychosis, as well as individuals with bipolar II disorder have been shown to exhibit significantly fewer social and non-

social cognitive impairments than BP with a history of psychosis (Bora et al., 2005; Bora et al., 2009a; Glahn et al., 2006, 2007; Lahera et al., 2012; Solé et al., 2012; Torres et al., 2012; Van Rheenen & Rosell, 2013). The findings from Lee and colleagues (2013) and Rowland and colleagues (2013) could be clarified if diagnostically homogenous groups were considered (i.e., if BP samples differentiated, *a priori*, between a history of psychosis and no history of psychosis). Hence, investigating individuals' ability to recognize and interpret naturalistic social exchanges in diagnostically separate clinical samples with overlapping psychiatric symptom may advance the understanding of the relationship between psychotic symptoms and TOM impairments in BP.

This study examined TOM abilities, specifically those involving the recognition and interpretation of naturalistic conversational inferences involving sincerity, lying, and sarcasm, in persons diagnosed with SZ and BP. This investigation focused on the possibility of differential impairment between euthymic BP samples with and without a history of psychotic symptoms during mood episodes. Two euthymic BP samples were used in the study: individuals who experience psychotic symptoms during their mood episodes (BP+) and individuals with BP who deny a history of psychotic symptoms during any mood episode (BP-). Two other groups were utilized in this study: a HC group with no history of psychological conditions and a SZ group. The SZ group was incorporated into this study for two reasons, the first being that substantially more research in the area of recognizing and interpreting conversational inference has been conducted with SZ, and secondly because we anticipated performance by the SZ group to be poor and represent a performance “floor” effect, which would be used as a comparison group for the other groups considered in this study. The overarching goal of this project

was to ascertain the relationship between a history of psychosis in BP and TOM abilities, specifically those involving recognizing and interpreting naturalistic conversational inferences. Also, this investigation was conducted in an effort to understand whether contextual cues aid recognition and interpretation of conversational inferences. A final goal of this study was to ascertain the relationship between functional outcome and in individuals with serious mental illness.

CHAPTER 2

LITERATURE REVIEW

Overview of Schizophrenia and Bipolar Disorder

Schizophrenia (SZ) is a chronic psychotic disorder characterized by positive and negative symptoms. Positive symptoms include hallucinations and delusions, and represent abnormal perceptions or beliefs about normal experiences. Hallucinations may involve hearing voices, seeing objects, or having tactile, gustatory, or olfactory perceptions in the absence of appropriate external stimuli. Delusions represent firmly held beliefs that are based on erroneous inferences about an individual's external or internal reality. Alternatively, negative symptoms represent deficit states and are often manifested as a lack of facial and vocal expression, reduced spontaneous speech, an inability to experience pleasure, lack of motivation, and social withdrawal (APA, 2000).

Symptom onset for SZ in males generally occurs between the age of 18 and 25 years-old and between 25-years and mid-thirties in woman (APA, 2000). There are no significant gender differences for SZ (McGrath, Saha, Chant, & Welham, 2008). The lifetime adult prevalence and incidence rates for SZ range between 0.5 to 1.5 percent and 0.5 to 5.0 per 10,000, respectively (APA, 2000; McGrath et al., 2008). The estimated heritability for SZ ranges between 80 and 85 percent (Cardno & Gottesman, 2000; Craddock, O'Donovan, & Owen, 2006). Individuals with SZ are not the only psychiatric group to experience psychotic symptoms and considering this, categorical diagnostic differentiation is often based on symptom duration, degree of dysfunction, bizarreness of hallucination and delusions, presence of a general medical condition, associated substance use, and the presence of affective symptoms, such as depression or mania

(APA, 2000). Even when considering these factors, symptom overlap exists among psychiatric illness which may complicate diagnosis, pharmacological interventions, and research efforts.

Bipolar I disorder (BP) is a severe affective disorder characterized by marked fluctuations in mood, vitality, and activity level. Mood episodes in BP characterize periods of fluctuating manic, depressive, mixed, and asymptomatic (euthymic) periods that often present in cyclical fashion (APA, 2000). Symptom onset for BP generally occurs between late-adolescence and the middle twenties (Kessler et al., 2005; Merikangas et al., 2007). The estimated lifetime prevalence for BP ranges from 0.4 to 3.3 percent in both males and females (APA, 2000; Kessler et al., 2005; Merikangas et al., 2007), and the estimated heritability for BP ranges from 60 to 93 percent (Craddock et al., 2006; McGuffin, Rijdsdijk, Andrew, Sham, Katz, & Cardno, 2003). Between 8.5 and 15 percent of individuals with BP experience psychotic symptoms in the majority of their mood episodes (BP+) (Baethge et al., 2005; Black & Hasrallah, 1989; Goodwin & Jamison, 1990). This is in contrast to those individuals diagnosed with BP who have never experienced psychotic symptoms (BP-).

The DSM-IV-TR considers psychotic symptoms in BP to include delusions and hallucinations, which can be further characterized as mood-congruent or mood-incongruent. Mood-congruent psychotic features pertain to delusions and hallucinations consistent with the mood state. Alternatively, mood-incongruent psychotic features concern delusions or hallucinations unrelated to the current mood episode. Psychotic symptoms in BP may occur during a depressed, manic, or mixed episodes (APA, 2000). Baethge and colleagues (2005) evaluated the frequency and characteristic features of

psychotic symptoms in persons with BP. Psychotic symptoms were found to be more frequent and intense during manic and mixed episodes compared to those experienced during depressive episodes. Auditory hallucinations, as well as persecutory, referential, and grandiose delusions were present in the majority of BP cases. Prominent hallucinations in BP were associated with longer hospital stay, lower education, higher anxiety severity, and impaired insight (Baethge et al., 2005). In addition to psychotic symptoms, individuals diagnosed with SZ and BP share many syndrome characteristics. For instance, individuals with SZ and BP have been shown to exhibit similar domains of neurocognitive and social cognitive impairments. Also associated with both SZ and BP are increased rates of mortality compared to the general population, as well as increased personal and familial suffering, and increased stress on the health care system relative to the general population (Bryant-Comstock, Stender, & Devercelli, 2002; Fajutrao, Locklear, Priaux, & Heyes, 2009; Leboyer & Kupfer, 2010; Martínez-Arán et al., 2004).

Neurocognitive Impairments in Schizophrenia and Bipolar Disorder

Individuals with SZ commonly exhibit impairments in learning and memory (Bearden, Hoffman, & Cannon, 2001; Bilder et al., 2000; Nuechterlein et al., 2004), attention (Bilder et al., 2000; Luck, Ford, Sarter, & Lustig, 2012; Nuechterlein et al., 2004), and executive functions (Bilder et al., 2000; Fioravanti, Bianchi, & Cinti, 2012; Green, Kern, Braff, & Mintz, 2000; Smith et al., 2009). Neurocognitive impairments have been shown to be present in SZ outside the effects of medication, chronicity of illness, illness severity, and psychiatric state, and can be found, albeit to a lesser degree, in unaffected first-degree relatives (Heinrichs & Zakzanis, 1998). While individuals with SZ often exhibit the most severe and pervasive cognitive impairments among the serious

mental illnesses, other psychiatric groups, such as BP commonly exhibit impaired functioning in similar cognitive domains.

It was once believed that cognitive impairments in BP were transient and confined to periods of affective disturbance. Over the last decade, however, researchers have determined that individuals with BP exhibit neurocognitive impairments in learning and memory (Allen et al., 2010; Bora, Yücel, & Pantelis, 2009; Burdick et al., 2011; Glahn et al., 2007; Krabbendam et al., 2000; Martínez-Arán et al., 2004, 2008; Torres et al., 2007), attention (Glahn et al., 2007; Torres et al., 2007; Zubieta, Huguelet, O'Neil, & Giordani, 2001), processing speed (Bora et al., 2009; Glahn et al., 2007), and executive functions (Glahn et al., 2007; Torres et al., 2007) across mood episodes (Arts et al., 2008; Jabbin et al., 2010) and independent of premorbid intellectual functioning and formal years of education (Robinson et al., 2006). Many of these neurocognitive impairments have been found to exist in unaffected first-degree relatives (Clark, Sarna & Goodwin, 2005; Ferrier et al., 2004).

Neurocognitive Deficits in Bipolar Disorder with a History of Psychosis

Compared to BP-, neurocognitive impairments are generally more severe in persons with BP+ across mood episodes (Bora et al., 2009; Daban et al., 2006; Glahn et al., 2006, 2007; Kravariti, Dixon, Frith, Murray, & McGruire, 2005; Rocca et al., 2008; Savitz, van der Merwe, Stein, Solms, & Ramesar, 2009). More specifically, individuals with BP+ have been shown to exhibit impairments in visual-motor processing and attention (Albus et al., 1996), verbal learning (Zubieta et al., 2001), verbal memory (Martínez-Arán et al., 2004), spatial working memory (Glahn et al., 2006, 2007), and executive functions (Glahn et al., 2007; Zubieta et al., 2001). Other investigations have

yielded few significant differences between BP+ and BP- (Martínez-Arán et al., 2008; Selva et al., 2007). The majority of findings allow several inferences to be drawn about differential neurocognitive impairment between BP+ and BP-. Neurocognitive performance appears to be differentially associated with BP+ and BP-, and similar domains of neurocognitive impairment between SZ and BP+ may represent shared underlying mechanism associated with psychosis, which may constitute trait-markers for the disease process (Bora, Yücel, & Pantelis, 2010; Glahn et al., 2007; Krabbendam, Arts, Van Os, & Aleman, 2005; Stefanopoulou et al., 2009). These inferences promote research methodology and hypothesis generation, as they highlight the importance of considering a history of psychosis during the diagnosing process, as well as differentiating between BP+ and BP- in research; individuals with BP+ may represent a group closer on a serious mental illness spectrum to SZ (Bora et al., 2009; de Gracia Dominguez, Viechtbauer, Simons, Van Os, & Krabbendam, 2009; Jabben, Arts, Van Os, & Krabbendam, 2010; Smith et al., 2009; Sole et al., 2012).

Overview of Social Cognition

Description of Social Cognition

Social cognition has become an important domain of investigation for individuals with psychotic and affective disorders. Social cognition is a multi-dimensional construct composed of cognitive processes necessary for an individual to formulate mental representations of relationships, as well as attend to, perceive, process, interpret, understand and predict information within one's self and others to make socially-based decisions or judgments (Adolphs, 2009; Fett et al., 2011; Green et al., 2010; Ochsner, 2008; Penn, Sanna, & Roberts, 2008). There have been several social cognition

subdomains described in the extant literature: attributional bias, emotional processing, social perception, and theory of mind (Green & Horan, 2010; Green et al., 2005, 2008; Kern & Horan, 2010).

Attributional bias refers to how an individual recognize and interpret the cause and meaning of an event (Green & Horan, 2010; Kinderman & Bentall, 1996).

Attributional bias has been broken-down into at least three component parts: internal attributions, external-personal attributions, and external situational attributions. Internal attributions imply that the cause of a situation is directed at oneself. External personal attributions are made when an individual attributes the cause of an event to other individuals or circumstances. Lastly, external situational attributions occur in situations where an individual attributes the cause of an event to external, situational factors (Green & Horan, 2010; Lincoln, Mehl, Exner, Lindenmeyer, & Rief, 2010; Mehl et al., 2010; Wittorf et al., 2012). Impaired attributional bias has been reported in SZ (Aakre, Seghers, St-Hilaire, & Docherty, 2009; Lincoln et al., 2010; Mehl et al., 2010) and BP+ (Lincoln et al., 2010; Lyon, Bentall, & Startup, 1999).

Emotion processing refers to an individual's emotional and cognitive capacity to recognize, interpret and utilize emotions in an adaptive manner (Green & Horan, 2010). Emotional processing can be divided into at least four component parts: identifying emotions, facilitating emotions, understanding emotions, and managing emotions (Green et al., 2008). There is research indicating impaired emotional processing abilities in SZ (Addington & Addington, 1998; Li et al., 2012; Schneider et al., 2006) and BP (Lawrence et al., 2004; Leppanen, 2006; Phillips, Drevets, Rauch, & Lane, 2003). Thaler

and colleagues (2013b) recently found that a history of psychotic symptoms was related to impaired emotional processing abilities in BP.

Social perception reflects an individual's ability to recognize and interpret roles and rules within a social context. Social perception abilities are believed to rely on accurate processing of social cues to make assumptions or judgments about a social situation (Fiske, 1992; Green & Horan, 2010; Green et al., 2005, 2008; Penn, Ritchie, Francis, Combs, & Martin, 2002). Component parts of social perception have been regarded as individual's ability to extrapolate interpersonal characteristics, such as intimacy (Monti & Fingeret, 1987), interpersonal problem-solving (Toomey et al., 1997) and context processing. Social perception impairments have been reported in individuals with SZ (Chung, Mathews, & Barch, 2011; Penn et al., 2002; Silverstein, 1997), but little research has focused on BP.

Theory of Mind (TOM, Premack & Woodruff, 1978) involves an individual's ability to empathize with and infer the mental states (e.g., intentions, desires, dispositions, imagination, emotion, and beliefs) of others (Green & Horan, 2010; Green et al., 2008; Kern & Horan, 2010; Völlm et al., 2006). In the literature, TOM abilities are commonly separated into cognitive and affective processes (Brothers & Ring, 1992; Hynes, Baird & Grafton, 2006; Shamay-Tsoory & Aharon-Peretz, 2007; Shamay-Tsoory, Tibi-Elhanany, & Aharon-Peretz, 2006; Völlm et al., 2006), with distinct neural pathways (Abu-Akel & Shamay-Tsoory, 2011). Broadly, component parts of TOM are believed to include the recognition, interpretation, and reflection of one's own mental state and the mental state of others (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). Social context processing and TOM have demonstrated relationship (Uhlhaas, Phillips, Schenkel, and

Silverstein, 2006). TOM impairments are consistently reported in individuals with SZ and BP (Bora, Yücel, & Pantelis, 2009a, 2009b; Donohoe et al., 2012; Sprong et al., 2007). Differential TOM impairments have been reported in BP+ compared to BP- (Marjoram et al., 2005). TOM in BP was the focus of this study and details regarding TOM impairment in SZ and BP are provided in the following sections.

Theory of Mind

Theory of Mind Impairments in Schizophrenia

Numerous meta-analytic studies have reported the presence of TOM impairments in SZ (Bora, Yücel, & Pantelis, 2009b; Brüne, 2005; Harrington et al., 2005a, 2005b; Sprong et al., 2007). These studies have reported on a variety of procedures and paradigms, including false belief and deception tasks, as well as stories, picture sequences, character intentions, eye reading, and indirect speech tasks, all of which purport to evaluate TOM abilities. According to these large-scale evaluations, the presence of TOM impairments in SZ cannot be simply accounted for by neurocognitive impairments or the effects of medication (Brüne, 2005; Harrington et al., 2005a, 2005b). Impaired TOM has been shown to represent the single best predictor of social behavior problems in SZ (Brüne, 2005). Despite support that significant TOM impairments exist in SZ, not all findings are consistent across studies. For instance, Bora and colleagues (2009b) indicated that IQ, executive functions, and working memory abilities were associated with TOM impairments in medically stable individuals with SZ, whereas other researchers have suggested that impaired IQ is just one of several variables that does not help to explain prominent TOM deficits in SZ (Sprong et al., 2007).

One changing opinion about TOM impairments concerns that of state or trait marker status. Initially, Frith (1992) described TOM impairments as being a state marker in SZ, meaning that individuals with SZ exhibited TOM impairments during acute episodes, but not during periods of symptom remission. Recently, Sprong et al. (2007) found that individuals with SZ who exhibited psychotic symptoms during the evaluation performed worse on TOM tasks than HCs, as well as individuals with SZ who were considered to be in remission; remitted participants also exhibited significant TOM impairment relative to HCs. There was no difference in mean effect size across tasks (i.e., first-order false belief/deception, intention-inference, understanding in-direct, and animated geometric figures task). The overall effect size of TOM impairment in SZ was $d = -1.125$ compared to HCs and was found not to be influenced by gender, age, or IQ (Sprong et al., 2007). These results connote TOM impairments as a trait marker for SZ, which has since been supported by other research groups (Bora, Gökçen, Kayahan, & Vezedaroglu, 2008; Bora et al., 2009b), suggesting that impairments exist across clinical presentations, not simply during acute episodes. Given that psychotic symptom have been shown to influence TOM abilities in SZ, outside symptom episodes, may lead some to conjecture whether other psychiatric conditions, such as BP, also exhibit TOM impairments.

Theory of Mind in Bipolar Disorder

Social cognitive research in BP has become a popular avenue of investigation and the relationship between a history of psychosis and TOM impairments in BP still warrants considerable research. Briefly reviewing the existing literature involving TOM abilities in BP may facilitate methodological and hypothesis generation for future studies.

Kerr et al. (2003) investigated TOM abilities in four groups: bipolar-manic, bipolar depressed, bipolar remitted, and HCs. The research team utilized a false belief task consisting of six stories with concurrently presented contrasting pictures and assessed participants' ability to ascertain the mental state of characters in the story/picture. Results indicated that participants with BP who were experiencing acute symptoms (either manic or depressed) were impaired in their ability to identify first- and second-order TOM questions. Remitted BP participants were only slightly impaired on first-order TOM abilities, whereas performance on second-order TOM questions was consistent with HCs. Kerr and colleagues (2003) also found that group differences in medication dosage and intelligence did not explain differences in TOM performance. Later, Inoue and others (2004) evaluated TOM by requesting persons with BP and euthymic unipolar depression to put a series of cartoon pictures in order, and answering first- and second-order questions. Both clinical groups exhibited TOM impairment relative to HCs. Differences between the clinical groups was not accounted for by age, sex, duration of illness and intelligence (Inoue, Tonooka, Yamada, & Kanba, 2004). Other studies have expanded on these findings. Bora and colleagues (2005) investigated advanced measures of TOM in euthymic BP. The researchers considered advanced TOM tasks to be those not involving first- and second-order TOM question, sequencing cartoon pictures, or comprehending stories or cartoons. Instead, the renowned Eyes test and Hinting task were used. The Eyes test purports to measure social emotion through inference and the latter task evaluates an individual's ability to infer true intention underlying indirect speech utterances. The BP group performed significantly worse on both TOM tasks relative to HCs and poorer performance was not related to clinical

variables (e.g., duration of illness), medication, or clinical symptoms. Impairments in executive function partly accounted for TOM impairments in the BP group (Bora et al., 2005).

As researchers in the field continued to investigate TOM in BP, the relationships between a history of psychotic symptom and TOM impairments became apparent. Similar investigations of TOM abilities in SZ reported that negative and disorganized symptoms were associated with TOM deficits (Bora et al., 2009a; Brüne, 2005) and the association between TOM abilities and positive symptoms was present, but less understood and inconsistently evaluated (Harrington et al., 2005a; Marjoram et al., 2005; Randall, Corcoran, Day & Bentall, 2003). Nonetheless, some investigators affirmed a prominent relationship between a history of psychotic symptoms and TOM impairments (Frith, 1992). Marjoram and others (2005) evaluated TOM abilities using the Hinting task in persons diagnosed with SZ and BP, as well as HCs. While the SZ group performed worse than the BP and HC groups, it was determined that TOM performance was significantly related with positive symptoms, specifically hallucinations and delusions. Individuals who exhibited more positive symptoms, regardless of group, performed significantly worse on the TOM task, which provides a basis for continued investigation into diagnostically homogeneous clinical groups. In another study, Bonshtein and colleagues (2006) found that TOM performance in persons diagnosed with BP+ was only slightly better than performance by a SZ group and significantly worse than others suffering from non-psychotic affective disorders (Bonshtein, Leiser, & Levine, 2006).

Lahera and colleagues (2008) sought to clarify the issue of TOM impairment in BP by evaluating individuals diagnosed with BP+ and BP- who were euthymic at the time of evaluation. The authors used the Theory of Mind Advanced Test (Happé, 1994) to assess TOM abilities. Although the BP+ and BP- groups performed worse than the HC group, the variance was large in the BP+ and after statistical correction only the poorer performance by the BP- group remained significantly different than HCs. TOM impairments were accompanied by deficits in sustained attention and executive functions (Lahera et al., 2008). The scant differences between BP+ and BP- lead the researchers to conclude that TOM deficits, as measured by Happé's test were not associated with psychotic symptoms. This was not to say that other TOM measures would yield similar results. Bazin and colleagues (2009) administered video clips depicting complex real-life social interactions to four participant groups: SZ, BP-manic, depressed, and HCs. The participants were instructed to identify the intentions of a character in the scene. This may have been the first study to administer a video-based, ecologically valid TOM assessment to individuals diagnosed with SZ and BP. Individuals with SZ performed worse than all other groups, but the difference between the SZ and BP-manic groups was insignificant, whereas the difference between the SZ, depressed, and HC groups were significant. The research team also administered a nonverbal measure of TOM that still necessitated mentalizing. Results indicated that all three clinical groups performed worse than HCs. The SZ group performed worse, followed by the depressed group, then the BP-manic group, although there was no significant difference between the three clinical groups (Bazin et al., 2009). This study demonstrated that there are several different ways

to evaluate TOM abilities and that different methods of evaluation may elicit differential performance by clinical groups.

Wolf and colleagues (2010) attempted to further clarify the relationship between neurocognitive function and TOM abilities in persons with BP. The BP group was heterogeneous, such that nearly one-third were depressed at the time of evaluation, another third were manic, and the last third were euthymic. To evaluate TOM, the research team administered six computerized cartoon pictures and asked participants to put the pictures in a logical sequence and then answer first-, second-, and third-order true- and false-belief questions, along with questions pertaining to deception, awareness of cheating, and cooperation. All three groups of BP performed worse than HCs on the sequencing portion of the TOM task, as well as the portion concerning the different types of questions. The euthymic BP group scored significantly lower than the depressed and manic BP groups on first-order TOM. Individuals with euthymic and depressed BP scored poorest on second-order TOM. All patient groups scored poorly on third-order TOM tasks relative to HCs. The TOM deficits remained after controlling for clinical and neurocognitive variables (Wolf, Brüne, & Assion, 2010), suggesting that TOM impairments may be trait dependent, but influenced by mood state. Later, Montag and colleagues (2010) evaluated TOM abilities in euthymic BP and compared results to HCs. This time, the participants were administered the Movie for the Assessment of Social Cognition, in which cognitive and affective TOM scores, mentalizing strategy, and non-social inference scores were derived. The BP group performed worse on this measure of TOM than HCs. Specifically, the BP group scored worse than HCs on measures of cognitive TOM, but not affective TOM. These findings could not be explained by the

presence of cognitive impairment. The results suggested a significant relationship between the number of manic episodes and TOM performance, such that more mood episodes was associated with greater impairment on the TOM task (Montag et al., 2010).

Taken together, numerous studies have been published elucidating the overlapping cognitive characteristics between SZ and BP (Bora et al., 2009). TOM deficits are routinely described in severe psychiatric disorders, such as SZ (Corcoran, 2001) and more recently, BP (Samamé et al., 2012). There are several important points to glean from the above review describing the relationship between BP and TOM abilities. Foremost, individuals with BP exhibit TOM impairments during symptomatic phases of illness, as well as in euthymic phases (Bora et al., 2005; Bazin et al., 2009; Inoue et al., 2004; Kerr et al., 2003; Lahera et al., 2008, 2012; Montag et al., 2010; Wolf et al., 2010). TOM impairments have been more pronounced in cognitive TOM versus affective TOM tasks (Lahera et al., 2012). In most cases, deficits in TOM are not better explained by intellectual difference, neurocognitive deficits, medication, age, or sex (Bora et al., 2005; Inoue et al., 2004; Kerr et al., 2003). These results may lead some to surmise that TOM impairments represent a trait-marker impairment for BP (Bora et al., 2005), yet focused investigation in areas associated with component parts of TOM are warranted.

When considering individuals with a history of psychotic symptoms, the work of many researchers support the notion that domains of neurocognition and subdomains of social cognition are impaired in SZ and BP+ (Pantelis et al., 2009). A recent meta-analysis written by Bora and colleagues (2010) suggested that persons with BP+ exhibit more impairment than their non-psychotic counterparts in planning and reasoning,

working memory, verbal memory, and processing speed. Bora et al. (2010) also found that persons with BP+ had an earlier illness onset and more psychiatric hospitalizations. Of these domains, executive dysfunction appears to be most associated with psychotic symptoms (Bora, Yücel, and Pantelis, 2010). The point here is that many higher-order neurocognitive abilities are considered frontal lobe functions and have been shown to play a significant role in TOM (Abu-Akel & Shamay-Tsoory, 2011; Carrington & Bailey, 2009). In the reviewed literature, psychotic symptoms in BP were associated with impaired TOM abilities (Marjoram et al., 2005). These findings reiterate the importance of conducting research investigating TOM abilities with homogeneous clinical groups: differentiating persons with BP+ from BP-. Furthermore, it might be wise for future studies to continue investigating component parts of TOM as they appear to elucidate differential impairment even within the same categorically defined clinical diagnosis (Mazza, De Risio, Surian, Roncone, & Casacchia, 2001) and hierarchically organized in psychiatric groups (Mancuso et al., 2011). One under-investigated component part of TOM pertains to recognition and interpretation of naturalistic social exchanges portraying sincere, sarcastic, or deceptive remarks with or without the use of contextual cues.

Evaluating Theory of Mind and Related Component Parts

False belief paradigms are commonly employed to evaluate component parts of TOM. False-belief paradigms evaluate an individual's ability to comprehend that at least one other person is capable of forming thoughts and feelings different from their own. Theorists postulate that in order for an individual to recognize and interpret others thoughts and feelings, the participant must understand how someone perceives and makes

sense of internal and external events, as well as understand that an individual's thoughts and feelings are based on their perception of themselves, others, and their environment, that an individual's mental representation may differ from external cues and reality, and that an individual's behavior can serve as an indicator of his or her mental state (Wimmer & Perner, 1983). False-belief tasks take many forms, and for the purpose of this discussion, might be illustrated best in a written scenario:

A man puts his leftovers in the refrigerator with the intention of eating them for dinner later that day. After placing his leftovers in the refrigerator, the man leaves the kitchen and his son opens the refrigerator and moves the leftovers to the cupboard.

To evaluate basic TOM abilities one question might be: Where will the father look for his leftovers? This question represents a 'first-order cognitive TOM' question because it requires an understanding that the father is unaware his son moved the leftovers to the cupboard. A potentially more complicated, 'second-order cognitive TOM' question might be: Where does the son think his father will look for his leftovers? In theory, this question is more difficult because it requires an understanding that the son does not know that his father is unaware the leftovers were moved and are no longer in the refrigerator. Other important questions pertaining to TOM involve affect perception and in this regard, a first-order affective TOM question might be: How might the father feel when he learns his leftovers are not in the refrigerator? A related paradigm used to evaluate TOM are known as 'faux pas' tasks (Gregory et al., 2002; Stone, Baron-Cohen, & Knight, 1998). A faux pas represents a comment or action made by someone that violates social norms (e.g., saying something inappropriate). These tasks generally consist of stories and associated first- and second-order TOM questions about whether a faux pas occurred. First-order TOM abilities have been shown to predict clinical

symptomatology (Abdel-Hamid, Lehmkamper, Sonntag, Juckel, Daum, & Brüne, 2009; Corcoran et al., 1995), as well as clinical severity and level of global functioning in SZ (Stratta et al., 2011). These relationships have not been investigated extensively in BP. Many research groups believe that first-order, second-order, and faux pas TOM tasks assess basic TOM abilities and it are these aspects of TOM that necessitate accurate interpretation of complex social interactions. When the task complexity is increased (e.g., asking questions that involve what an individual might mean or meant to do), differences across diagnostically separate groups emerge (Mancuso et al., 2011; Mazza et al., 2001), but differences in performance between BP+ and BP- have not been thoroughly evaluated.

Many researchers have expressed concern about the array of paradigms used to evaluate TOM. Presently, there is concern about the degree to which paper-and-pencil tasks, or those assessing TOM through still pictures and faces evaluates the complexities of TOM and related component parts. There are numerous ways to evaluate TOM abilities, many of which reflect different and generally more advanced ways to ascertain the component parts of TOM. Several assessments have been created to evaluate more complex forms of TOM. For example, The Assessment of Interpersonal Problem-Solving Skills (Donahoe et al., 1990) and the Hinting Task (Corcoran et al., 1995) are commonly regarded as TOM tasks. Hinting tasks, are used to evaluate an individual's ability to recognize and interpret underlying intentions or meaning in statements within a social context. TOM tasks which utilize "moving shape" paradigms, or animated geometric figures that interact in "social" fashion have also been described in the literature (Blakemore et al., 2003; Russell et al., 2006). These tasks have an added

degree of complexity as they often necessitate higher-order abstraction abilities. Another type of TOM task evaluates individuals' ability for conversational inference, or in other words, a person's ability to understand consistent and inconsistent speech, such as sincerity, deceit, irony, and sarcasm (Corcoran & Frith, 2003; Craig et al., 2004; Langdon et al., 2002; McDonald, 2003). Recognizing and correctly interpreting indirect and inconsistent social exchanges has been considered a component part of TOM because it necessitates that an individual ascertains a least one other individuals mental and emotional state to recognize and correctly interpret an interaction (Sperber & Wilson, 2002). Recently researchers have used video vignettes depicting social situations to evaluate TOM abilities (Brazin et al., 2009; Johnston et al., 2010; McDonald, Flanagan, & Rollins, 2011; McDonald, Flanagan, Rollings, & Kinch, 2003). Certain video paradigms have demonstrated sensitivity to component parts of TOM which involve recognition and interpretation of cognitive and affective states (Abell, Happé, & Frith, 2000; Baron-Cohen et al., 2001; Dziobek et al., 2006; Happé, 1994), in the context of a social or conversational exchange and complicated by the use of irony (Monetta, Grindrod, & Pell, 2009), metaphors, (Adachi et al., 2004; Norbury, 2005) deceit, and sarcasm (Adachi et al., 2004; McDonald et al., 2003, 2011).

Conversational Inference as a Component Part of Theory of Mind

Recognition and interpretation of naturalistic social exchanges, in this case involving sincere, deceit, and sarcasm, have been regarded as a component part of TOM (Leitman et al., 2006; McDonald, 1999; McDonald, Flanagan, Rollings, & Kinch, 2003; McDonald & Pearce, 1996) and served as the basis for this investigation. According to Laval and Bert-Eboul (2005), an individual's ability to recognize sarcasm develops

around the age of 5-years-old and the ability to correctly interpret sarcasm from contextual cues occurs around the age of 7-years-old. While empirical research pertaining to the comprehension of inconsistent social exchanges (i.e., those involving sarcastic utterances) is limited, some researchers have demonstrated that fundamental components of TOM (e.g., 1st Order Cognitive TOM) must be intact for an individual to correctly recognize and interpret sarcasm (Sullivan et al., 1995). Others have suggested that the ability to recognize and interpret sarcasm is acquired after an individual has developed the capacity to detect and comprehend lies, leading to the belief that comprehension of pragmatic interactions is hierarchical organized (Bucciarelli, Colle, & Bara, 2003).

Sarcasm has been described as a less phonologically complex and more flexible means of communication, yet sarcasm often requires more effort and time to interpret than other forms of communication and has demonstrated association with higher-level cognitive processing abilities, such as cognitive flexibility and inferential reasoning (Giora, 1995; McDonald, 1999; McDonald, Bornhofen, Shum, Long, Saunders, & Neulinger, 2006; McDonald & Pearce, 1996). Sarcasm generally involves higher fundamental frequency (f_0) with more fluctuations in tone than might occur in ordinary conversation (Anolli et al., 2000). Some research groups believe that sarcasm is principally detected by fluctuations in prosody, suggesting a strong verbal emotional processing component (Beaucousin et al., 2007; Belin et al., 2000; Wildgruber et al., 2006), yet an understanding on another individuals mental state is believed to facilitate emotion recognition. In other words, the idea that an individual should be able to view static pictures, watched a video clip, listened to a social interaction, or read text of a

social interaction and correctly recognize and interpret an individual's mental state, which suggests that explicit emotional valence is not always necessary for proper comprehension of a social interaction and that formulating a mental representation and activating TOM abilities precedes emotion recognition. Verbal and visual contextual cues, such as a visual aid, overt behavior, and longer social interactions, have been shown to facilitate recognition and interpretation of social exchanges in individuals who have acquired brain damage and SZ, as contextual cues aid in drawing awareness to a certain aspects of an interaction and even a counterfactual belief (McDonald & Pearce, 1996; Chung, Mathews, & Barch, 2011).

Recognition and interpretation of sarcasm and other linguistic expressions has been investigated in health individuals (Lucariello, 1994; McDonald, Flanagan, Rollins, & Kinch, 2003), as well as those diagnosed with pervasive developmental disorders (Adachi et al., 2004), congenital disorders (Symington, Paul, Symington, Ono, Brown, 2010), social anxiety (Sutterby, Bedwell, Passler, Deptula, & Mesa, 2012), traumatic brain injury (McDonald et al., 2006; McDonald & Flanagan, 2004; McDonald, Flanagan, Martin, & Saunders, 2004; McDonald et al., 2003; McDonald & Pearce, 1996; McDonald & Saunders, 2005), neurodegenerative diseases (Blake, 2009; Fournier, Calverley, Wagner, Pooch, & Crossley, 2008; Kipps, Nestor, Acosta-Cabronero, & Hodges, 2009; Kosmidis, Aretouli, Bozikas, Giannakou, & Loannidis, 2008; Rapp & Wild, 2011; Rankin et al., 2009), SZ (Chung et al., 2011; Horan et al., 2011; Kern et al., 2009; Kosmidis et al., 2008; Leitman et al., 2006; Mancuso et al., 2011; Sparks, McDonald, Lino, O'Donnell, & Green, 2010), and recently BP (Lee et al., 2013; Rowland et al., 2013).

The existing literature in the area of recognizing and interpreting conversational inferences for non-psychiatric adult groups suggests that a subset of individuals who acquired brain damage, specifically right-hemisphere and frontal lobe lesion cases, performed similar to healthy controls on tasks involving the recognition and interpretation of social exchanges involving sincerity and lies; however, the brain damaged group displayed significant impairments when it came to comprehending sarcastic social exchanges (Channon, PelliJeff, & Rule, 2005; Channon & Watts, 2003; Leitman et al., 2005, 2006; McDonald et al., 2003, 2004, 2006; McDonald & Pearce, 1996; McDonald & Saunders, 2005). Leitman et al. (2005) suggested that the auditory processing system, particularly the right hemisphere, is activated for simple and complex fluctuations in tone, and is also involved when processing sarcastic utterances. Furthermore, Rankin and colleagues (2009) and others (see Shamay, Tomer, & Aharon-Pertex, 2002; Shamay-Tsoory et al., 2005), have put forth that recognition and interpretation of sarcasm requires activation of the right temporal-frontal network, particularly bilateral posterior parahippocampal gyrus and the right superior frontal gyrus (Rankin et al., 2009; Shamay et al., 2002, 2005) and decreased volume in the right superior temporal gyrus (Pride et al., 2013). Certainly, it stands that the processing of sarcastic social exchanges reflects numerous overlapping neural systems, such as affective cortical networks, as well as those involving auditory processing and high-order TOM processing (Shamay-Tsoory et al., 2002, 2005; Leitman et al., 2005; Völlm et al., 2006). Further, findings suggest that impairments are independent of contextual cues (e.g., emotional, facial, prosodic information, etc.), these cues merely facilitate recognition and interpretation of sarcasm (Dennis, Purvis, Barnes, Wilkinson, & Winner,

2001; Kosmidis et al., 2008; McDonald & Pearce, 1996; Winner et al., 1998). Recent literature suggests that individuals diagnosed with psychotic disorders, such as SZ, are less able than HCs to recognize and interpret inconsistent social exchanges involving sarcasm.

Regarding the SZ literature, Leitman and colleagues (2006) found that individuals with SZ were impaired in their ability to recognize sarcasm and differentiate it from sincere exchanges. Kosmidis and colleagues (2008) compared this component part of TOM between individuals diagnosed with SZ and those diagnosed with frontotemporal dementia, as well as two age- and education-matched HC samples for each respective clinical group. Kosmidis et al. (2008) presented a series of video-recorded vignettes using the Perception of Social Inferences Test (Kosmidis et al., 2008) and asked participants to identify interactions as either sincere or sarcastic, whereas in a second module, participants were asked to distinguish between sarcastic comments and lies. After each vignette, participants were asked to identify the speaker's mental state and meaning of the message, as well as the speaker's beliefs and intentions for making the comment, and lastly the mental state of the receiver. Results suggested that performance by the clinical groups was impaired across both conditions and also worse than both HC groups. Even though SZ performance was less impaired than the dementia group in identifying sarcasm without contextual cues, introduction of contextual cues in the second condition did not improve identification of sarcastic remarks in the SZ group, but did so in the dementia group. Further, the SZ group struggled to recognize and interpret statements that were paradoxical or lies, but was able to recognize sincere statements (Kosmidis et al., 2008).

Numerous studies have utilized The Awareness of Social Inference Test (TASIT, McDonald et al., 2003) to evaluate higher-order social cognition, predominately associated with TOM. While one part of TASIT was created to assess emotion perception, two other parts of TASIT were designed to evaluate individuals' ability to infer the mental state of others in the context of naturalistic social exchanges. Kern and colleagues (2009) evaluated TOM subprocess abilities for interpretation of naturalistic social exchanges and their relationship to clinical symptoms, community and social functioning in SZ and HCs. Kern et al (2009) found that persons with SZ struggled to comprehend sarcastic and lying utterances relative to HCs. Performance was significantly more impaired in identification of sarcastic than lying remarks, a finding that was not present in the HC group. Impaired abilities to recognize and interpret sarcasm was related to more severe of delusions, positive formal thought disorder, and the overall positive symptom severity, but not negative symptoms. In another study, Sparks and colleagues (2010) utilized Part II and III of TASIT to ascertain the relationship between individuals with SZ ability to correctly recognize and interpret naturalistic social exchanges. Results indicated that persons with SZ were impaired in their ability to recognize and interpret sarcastic and paradoxically sarcastic remarks, but not sincere messages relative to HCs. Results also indicated that individuals with SZ performed significantly worse than HCs in their ability to recognize and interpret sarcastic and untruthful exchanges. The presence of contextual cues did not significantly improve participants' ability to recognize and interpret naturalistic social exchanges (Sparks et al., 2010).

Recently, Mancuso and colleagues (2011) evaluated the factor structure of social cognition using a variety of neurocognitive, social cognitive, clinical symptom, and functional outcome measures in a group of individuals with psychotic disorders (i.e., SZ, schizoaffective disorder, or psychosis not otherwise specified). Part III of TASIT was used to evaluate participants' ability to correctly recognize and interpret naturalistic social exchanges involving sarcasm and lie. The clinical group performed considerably worse than the HC standardization sample. Results further indicated that patients' ability to detect exchanges involving lies loaded on a separate factor than the ability to recognize and interpret sarcasm. Lying was associated with the "lower-level social cue detection" factor, whereas sarcasm loaded on what was deemed the "higher-level inferential and regulatory processing" factor. Each of these factors were significantly associated with functional capacity as measured by the UCSD Performance based Skills Assessment (UPSA; Patterson et al., 2001) and Maryland Assessment of Social Competence (Bellack et al., 1994), as well as the real-world functioning, as measured by the Work and Social domains of the Role Functioning Scale. Only two studies have used TASIT with individuals with BP and the two studies reported mixed findings. In the first, Lee et al. (2013) used TASIT in an exploration of social and non-social cognitive impairments between SZ and BP. Across measures of social cognition including TASIT, Lee and colleagues (2013) found that individuals with SZ performed significantly worse than BP and HCs. Performance by the BP group did not differ from HCs. In another study, Rowland and colleagues (2013) sought to evaluate social cognitive abilities and emotion regulation skills in SZ and BP. Both SZ and BP participants were administered TASIT. Only individuals with SZ performed poorly the emotion evaluation portion of TASIT,

however, both SZ and BP group performed significantly worse than HCs in their ability to correctly recognize and interpret sarcastic social exchanges relative to those involving sincere remarks. In another recent study utilizing TASIT, social cognitive impairments were determined to not be associated with executive function abilities, attention, or visuospatial skills. TASIT was, however, associated with reduced gray matter volume in the right superior temporal gyrus (Pride et al., 2013).

The literature presented above suggests that individuals diagnosed with SZ are impaired in their efforts to recognize and interpret sarcastic remarks compared to their ability to do the same for sincere remarks. Such deficits have demonstrated resilience to social skills training (Horan et al., 2011), and have been associated with poorer functional outcome (Sparks et al., 2010). Sarcasm recognition and interpretation has been associated with several overlapping neural systems, particularly those involving temporal-frontal and affective cortical networks. Impairments in persons diagnosed with BP, particularly those who exhibit psychotic symptoms during mood episodes might also be present in their ability to recognize and interpret sarcasm, compared to sincere or lie exchanges.

Summary and Hypotheses

Investigations into social cognitive functioning have become an important area of research, particularly in relation to psychiatric disorders. At least four subdomains of social cognition have been identified in the extant literature: attributional bias, emotional processing, social perception, and TOM (Green & Horan, 2010; Kern & Horan, 2010). Individuals diagnosed with SZ and BP exhibit significant impairment across these subdomains. One of the most consistent impairments across these groups have been

found in TOM abilities. Research conducted on these subdomains and has identified numerous component parts that can be evaluated separately and might be differentially impaired. A component part which has only recently become an area of interest concerns the ability to correctly recognize and interpret naturalistic social exchanges involving sincerity, lie, and sarcasm. Cognitive components associated with recognizing and interpreting sarcasm has been characterized as a component part of TOM because there are demonstrated associations with inferential reasoning and forming mental representations of oneself and others in a social context (Channon, Pellijeff, & Rule, 2005; Winner & Leekam, 1991). The recent literature suggests that contextual and paralinguistic cues may play role in recognizing and interpreting sarcastic social exchanges (Leitman et al., 2006), but contextual cues do not appear entirely helpful for such endeavors (Kosmidis et al., 2008; Sparks et al., 2010). An individual's ability to correctly recognize and interpret sarcasm occurs several years after general TOM skills develop (Laval & Bert-Eboul, 2005; Sullivan et al., 1995), which might suggest that TOM abilities are hierarchically organized and that comprehension of sarcasm is a complex skills relative to many other TOM subprocesses (Mancuso et al., 2011). Moreover, sarcastic exchanges are common within many social settings. Given the conventional nature of sarcasm and other forms of social exchanges, impairments in this area could negatively impact an individual's capacity to identify genuine interpersonal interactions and engage appropriately in social contexts, which has implications for social functioning and personal well-being. In fact, Sparks and colleagues (2010) found that persons with SZ who struggle to recognize and interpret sarcastic exchanges exhibit greater personal distress in interpersonal situation and are less likely to engage in

pleasurable activities (Sparks et al., 2010). Others have found that impairments in this area are associated with limited functional capacity and real-world functioning abilities (Mancuso et al., 2011). Social skills training has been shown to be relatively ineffective for teaching persons with SZ the skills necessary to improve detection and comprehension of inconsistent paralinguistic cues (Horan et al., 2011), reiterating the importance of continued investigation in this area. Research presented above highlights the growing fund of literature in support of impaired abilities for recognition and interpretation of social exchanges in SZ and highlights the need for increased investigation in BP, particularly after separating BP+ and BP-. In addition, further investigation of associations between TOM and functional outcome are needed. The present study seeks to address these matters using a large cohort consisting of individuals diagnosed with SZ, BP+, and BP-, as well as HCs. The primary instrument use to evaluated participants ability to correctly recognize and interpret naturalistic social exchanges involving sincerity, lies, and sarcasms will be TASIT. Functional capacity and social functioning will be evaluated by the UCSD Performance-Based Assessment (UPSA) and the Social Functioning Scale (SFS). A detail explanation of these assessments as well as the data analysis techniques used to ascertain the relationship between groups' performance and TOM abilities, as measured by TASIT, as well as the relationship between TOM abilities and functional outcome, as measured by the UPSA and SFS. Based on the reviewed literature, the following hypotheses were made:

1. Clinical groups who exhibit psychotic symptoms (SZ and BP+) will exhibit impaired emotion recognition compared to the BP- and HC groups.

2. Compared to HCs, all clinical groups (SZ, BP+, and BP-) will demonstrate impaired ability to recognize and interpret naturalistic social exchanges portraying sarcasm, without added aid of contextual cues (Part II of TASIT). All clinical groups will exhibit better performance in their ability to correctly recognize and interpret sincere social exchanges compared to sarcastic exchanges, with SZ and BP+ performing significantly worse than BP-. It was predicted that the clinical groups would perform worse in their ability to correctly recognize and interpret inconsistent (paradoxical) usage of sarcasm compared to consistent (simple) usage of sarcasm.
3. Compared to HCs, all clinical groups (SZ, BP+, and BP-) will demonstrate impaired ability to recognize and interpret naturalistic social exchanges portraying sarcasm, with contextual cues (Part III of TASIT). The BP groups will exhibit better performance in their ability to correctly recognize and interpret social exchanges involving lies compared to sarcastic exchanges, with SZ and BP+ performing significantly worse than BP-. It was anticipated that individuals with SZ would perform no better in their ability to recognize and interpret remarks involving lies versus those involving sarcasm. The addition of visual and verbal contextual information was predicted to have no influence on participants' ability to correctly identify sarcastic social exchanges across groups. Moreover, it was hypothesized that performance on emotion recognition would not account for any impairments found in participants' ability to correctly recognize and interpret social exchanges involving sarcasm.

4. Finally, correct recognition and interpretation of social exchanges involving sarcasm will predict functional capacity and social adjustment in individuals diagnosed with severe mental illness.

CHAPTER 3
METHODOLOGY

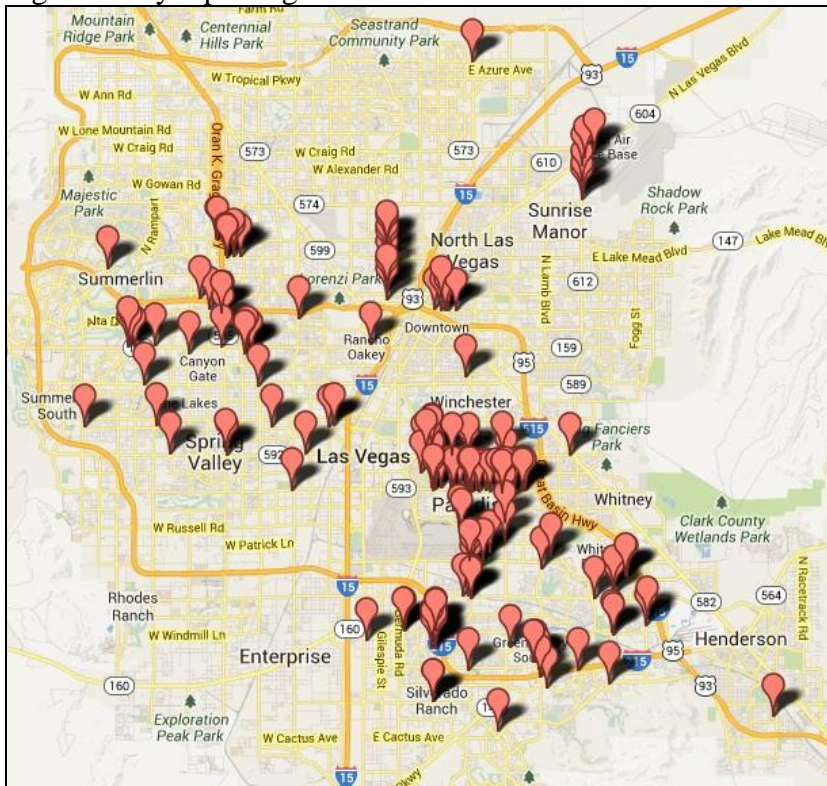
Participants

Eighty-five individuals were included in this study: twenty-two with schizophrenia (SZ), forty-one bipolar I disorder (BP), and twenty-two healthy controls (HCs). The BP group was subdivided into twenty individual with a history of psychotic symptoms during mood episodes (BP+) and twenty-one others who denied ever experiencing psychotic symptoms during mood episodes (BP-).

Recruitment Procedures

All recruitment methods were approved by the Institutional Review Board at UNLV. The primary method of participant recruitment was via paper flyers, which were posted throughout the greater Las Vegas community (Figure 1). In addition to posting paper flyers, oral presentations were given to the Depression and Bipolar Support Alliance group of Southern Nevada, as well as to the Southern Nevada Adult Mental Health Systems board of mental health professionals. Participant recruitment also occurred at Mojave Mental Health. Mental health professional in support of this study were encouraged to avoid advocating for the study or coercing any consumer to participate in the study.

Figure 1. Flyer posting locations around southern Nevada



In addition to paper flyer postings, research participants were recruited through other media sources, such as through public service announcements (PSA) in a local Las Vegas magazine, *The View*. Announcement in *The View* were disseminated to all district areas in the greater Las Vegas area. The same PSA was listed in the *Las Vegas Review Journal* and published over the radio on 91.5 KUNV-FM. Lastly, recruitment ads were regularly posted on the community volunteers section of Craigslist. All methods of recruitment provided an email address and phone number so persons interested in the study could learn more about the study or decide to participate in a phone screening procedures. Persons who inquired about the study were provided general information (e.g., general study procedures, benefits and risks, compensation, etc.), and were then encouraged to contact the telephone number if their interest persisted. Once an individual

called the number, he or she was prompted by a voice recorded message to leave a voice mail with general contact information (e.g., first name, phone number, and what study he or she is calling about). The primary telephone screener (A.F.) would then check telephone messages, contact the individual, and conduct a telephone screening to ascertain whether an individual was eligible or ineligible for the study. Participant screening and full battery assessments were also conducted at Mojave Mental Health, and generally carried out by the second author (S.V.). Mojave Mental Health is an outpatient mental health care facility governed by the University of Nevada, Reno (UNR). Therefore, it was required that all practices and procedures detailed in this study be submitted and approved by the UNR IRB prior to conducting work at Mojave Mental Health. All procedures conducted in this study were approved by the UNR IRB. See Appendix A for the decision tree pertaining to screening, exclusion, and inclusion procedures.

Phone Screening

As a result of the various recruitment procedures, 457 persons (49.9% male; 57.5% BP, 30.6% HC, and 11.8% SZ) called the study number. Phone screening for the study was standardized and involved a verbal consent and inquiry about psychiatric and medical history. Please refer to Appendix B for the screening protocol. For individuals who participated in phone screening, this procedure lasted an average of 20 minutes. Participants were informed prior to the screening that no monetary compensation would be given for completing the telephone screening. Of the 457 individuals who called the study telephone number, 357 (78.1%) were excluded from the study. Exclusionary criteria for all participants were the following: English as a secondary language, as

determined by self-report; current or past diagnosis of bipolar II disorder; Previous brain injury, as determined by self-report and/or medical record review; Neurological or seizure disorder, as determined by self-report and/or medical record review; History of electro-convulsive therapy; Previous brain surgery, as determined by self-report and/or medical record review; Diagnosis of a chronic medical condition which may, by account of peer-reviewed literature, adversely affect central nervous system functioning (e.g., liver disease, HIV, etc.). Additional exclusionary criteria were current or recent (i.e., within the previous 6 months) diagnosis of a substance use disorder, determined by administration of the Structured Clinical Interview for the DSM-IV-TR (SCID; First, Spitzer, Gibbon, & Williams, 2002); Current (i.e., within the past week) use of prescribed or non-prescribed medication, which by account of peer-reviewed literature, has the capacity for CNS effects. Individuals with a psychiatric illness who were adhering to their medication regimen were exempt from these exclusionary criteria; Healthy participants were excluded if they endorsed a family history (i.e., first- or second-degree relative) of a psychotic or affective disorder; and lastly, participants were excluded from the study if they were unable to comprehend the consent form. Please refer to Table 1 for a list of the exclusionary characteristics for the 357 prospective research participants.

Table 1. Exclusionary characteristics of the overall sample

Reasons for Exclusion following phone screening (n = 357)	Frequency	%
Failed attempt to contact after he/she LM or was screened	108	23.63
Criteria not met for Bipolar I Disorder	48	10.50
Reported head injury with loss of consciousness	35	7.66
Waitlisted	34	7.44
English second language	29	6.35
Other (e.g., No longer interested)	27	5.91
Neurological Condition (e.g., Seizure disorder & Stroke)	17	3.72
Endocrine condition (e.g., hypo/hyper-thyroidism)	11	2.41
Hearing problems or Color blind	11	2.41
Current alcohol/substance abuse or dependence	7	1.53
Developmental or Genetic disorder (Asperger's, Klinefelters)	6	1.31
Reported history of electroconvulsive therapy	5	1.09
Reported history of mood or psychotic symptoms	5	1.09
Unique circumstances (e.g., jail)	5	1.09
Persons calling as HC with pre-existing Axis I disorder	4	0.88
Chronic medical condition (e.g., HIV, HepC, Fibro)	3	0.66
Did not meet criteria for SZ	2	0.44

Information acquired during the phone screening portion of the study related to the excluded persons was destroyed. As can be seen from Table 1, there was a high percentage of individuals who were excluded from the study due to failed attempts to contact. A number of factors could have contributed to these data and were noted during the phone screening procedure (e.g., exclusion if unable to reach after five attempts at contact, telephone ran out of minutes, unstable housing conditions which made calling difficult, number change, no personal phone, etc.), but were not included in the analysis. Future studies may benefit from taking measures to mitigate the number of failed attempts to re-contact. Of the 457 persons who called and participated in the phone screening procedure, 100 individuals (21.9%) were deemed eligible for the study and subsequently scheduled for the evaluation.

Clinical Interview with Eligible Participants

Once participants were schedule and completed the consenting processes, a clinical interview was conducted by the assessor to evaluate for a lifetime Axis I psychological conditions. Based on this interview, 15 of the 100 participants were deemed ineligible for the study and were subsequently excluded. Table 2 provides information about the characteristics of those 15 individuals who participated in the phone screening and deemed appropriate for the study, but who, upon more specific clinical evaluations measures, were deemed ineligible for the study and excluded.

Table 2. Participant exclusion characteristics following clinical evaluation

Sex	Age (years)	Ethnicity	Reason for Exclusion
Male	29	Caucasian	Full criteria for BP not met
Female	27	African American	Full criteria for BP not met
Male	51	Caucasian	Full criteria for BP not met
Male	34	African American	Full criteria for BP not met
Male	45	Caucasian	Full criteria for BP not met
Male	24	Caucasian	Full criteria for BP not met
Male	49	Caucasian	Current alcohol or substance abuse
Male	51	Caucasian	Current alcohol or substance abuse
Female	19	African American	HC reporting significant Axis I symptoms
Male	47	Caucasian	HC reporting significant Axis I symptoms
Female	45	Caucasian	Chronic medical condition
Female	31	Caucasian	Chronic medical condition
Male	32	Biracial	Seizure Disorder
Male	44	Caucasian	Brain surgery
Male	51	Caucasian	Hearing problems

As seen in Tables 2, the majority of persons who were originally determined to be eligible for the study, but who were subsequently excluded did not meet full diagnostic criteria for BP. Table 2 also shows that the majority of individual excluded were male and the ages of persons excluded ranged from 19-years-old to 51-years-old. Phone

screening data on these individuals suggested that these prospective participants may have over-reported symptoms associated with psychopathology or endorsed non-clinical, but unique or idiosyncratic behavior as pathological that was ultimately determined to be unassociated with true Axis I psychopathology. As a result of the recruitment and screening procedures 85 individuals were deemed appropriate for the study and completed all assessments. Demographic and clinical data pertaining to the sample of 85 individuals is presented below. If a participant does not meet for the present study, he/she will be monetarily compensated for his/her time participating and will subsequently be dismissed from the study.

Procedure

The clinical interviews, questionnaires and measures used in this study were administered as part of a larger battery of tests being conducted in the Neuropsychology Research Lab at the University of Nevada Las Vegas. No data used in this study were collected in previous studies. Administration of the test battery, discussed below, ranged between four hours and seven hours (including breaks). Administration of clinical and neuropsychological measures will be broken down into two parts. The initial administration consisted of the consenting process, clinical interview, and clinical symptom measures. The Informed Consent (Appendix C) was read aloud to each participant in its entirety. Following the consenting process, the evaluator and participant collaboratively completed the demographic questionnaire (Appendix D). A structured clinical interview was conducted after the consenting process. The primary purpose of the structured clinical interview was to ascertain whether the participant met diagnostic criteria (or any exclusionary criteria) for the study. A second, semi-structured interview

was conducted to answer questions related to current and most recent symptoms. When diagnostic and inclusion criteria were met, the neurocognitive measures were administered. All assessment procedures were conducted by doctoral level graduate students who had been extensively trained in psychopathology, symptoms ratings, research methods, and psychometrics. Throughout the evaluation, several breaks were scheduled to minimize fatigue and maintain participant motivation. All participants were monetarily compensated at a rate of \$10 per hour for their participation in the study.

Measures

The initial clinical interview was conducted using the electronic Structured Clinical Interview for DSM-IV-TR Disorders (eSCID). Symptom rating measures included the following: 1) Young Mania Rating Scale (YMRS); 2) Brief Psychiatric Rating Scale (BPRS); 3) Schedule for the Assessment of Positive Symptoms (SAPS); 4) Schedule for the Assessment of Negative Symptoms (SANS); and 5) Hamilton Depression Rating Scale (HDRS). Following a semi-structured clinical interview, the researcher completed all symptom measures. Each participant was administered five subtests from the Wechsler Adult Intelligence Scale – Third Edition (WAIS-III) to obtain an estimated premorbid intelligence and estimated current intelligence: 1) Vocabulary (VO; Wechsler Subtest); 2) Block Design (BD; Wechsler Subtest); 3) Information (IN; Wechsler Subtest); 4) Digit Span (DS; Wechsler Subtest); and 5) Digit Symbol-Coding (CD; Wechsler Subtest). The Awareness of Social Inference Test (TASIT) was administered to each participant as a criterion-referenced, norm-based measure of TOM and emotion identification. The University of California San Diego, California Performance-based Skills Assessment (UPSA) was administered as a performance-based measure of

functional outcome. Lastly, the Social Functioning Scale (SFS) was used to evaluate social adjustment in a variety of contexts. Each measure employed in the present study is detailed below. Collectively, these symptom rating instruments, performance-based assessments, and clinician-rates measures of function make up the present battery used to evaluate the relationship between a history of psychotic symptoms in BP and TOM abilities.

Psychiatric Diagnostic Measure

Electronic Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research Version, Patient Edition with Psychotic Screen (eSCID). The eSCID is a semi-structured clinical interview used to ascertaining the presence or absence of a DSM-IV-TR Axis I disorder (First et al., 2002). There are 10 modules in the eSCID, which collectively evaluate for the presence of mood episodes, mood disorder, psychotic symptoms, psychotic disorders, substance use disorders, anxiety disorders, somatoform disorders, eating disorders, adjustment disorders, and optional disorders. Administration began with the screening module, which consisted of 12 questions used to elicit information use to inform the evaluator about potential areas of clinical relevance. Following administration of the screen module, the evaluator completed the mood, psychotic, substance, and anxiety disorders modules. Each module included semi-structured questions designed to singularly evaluate diagnostic criterion for the psychiatric domains mentioned above. Each criterion was rated on a scale of 1 to 3 (i.e., 1 = symptom is absent; 2 = symptom is sub-threshold; 3 = symptom is present). Axis I diagnoses were made after the clinical interview and scoring process. Psychometric properties of the SCID have been shown to be robust, making this assessment tool

optimal for Axis I diagnosis (Fennig, Craig, Lavelle, Kovasznay, & Bromet, 1994; Steiner, Tebes, Sledge, & Walker, 1995; Ventura, Liberman, Green, Shaner, & Mintz, 1998). This semi-structured interview was used to establish the presence (or absence) of DSM-IV Axis I psychiatric disorders. A shorter (15-20 minute) interview was conducted to facilitate answering the clinical symptom measures. For the clinical group, the clinical interview will be conducted twice to ascertain symptoms over the past two weeks, as well as symptoms during the most recent psychotic episode.

Clinical Symptom Measures

Hamilton Depression Rating Scale (HDRS). The HDRS (Hamilton, 1960) is a 17-item depression rating scale used to assess the presence and severity of symptoms of depression, such as thoughts, feelings, suicidal ideation, insomnia, anhedonia, anxiety, changes in weight, and somatic complaints. The HDRS has been shown to accurately estimate symptoms associated with depression. Scores of 13 and greater indicate moderate to severe depressive symptoms.

Young Mania Rating Scale (YMRS). The YMRS (Young, Biggs, Ziegler, & Meyer, 1978) is an 11-item rating scale used to assess symptoms of mania. Items on the YMRS evaluate presence and severity of symptoms associated with mania (e.g., elevated mood, disruptive behavior, speech, etc.). The YMRS has seven items graded on a 0-4 scale (elevated mood, increased motor activity-energy, sexual interest, sleep, language-thought disorder, content, appearance, and insight), whereas the remaining four items are scored on a 0-8 scale (irritability, speech, thought content, and disruptive/aggressive behavior); authors of the YMRS suggest that double weighted items account for poor cooperation from severely ill individuals. On this rating scale, higher ratings indicate

more prominent manic symptoms. A baseline total score of 12 or greater was used to indicate the presence of clinically significant manic symptoms.

The Brief Psychiatric Rating Scale (BPRS). The BPRS (Overall & Gorham, 1962) is an 18-item rating scale used to rate the presence of psychiatric symptoms. Symptoms assessed by the BPRS include somatic concern, anxiety, emotional withdrawal, conceptual disorganization, guilt feelings, tension, mannerisms and posturing, grandiosity, depressive mood, hostility, suspiciousness, hallucinatory behavior, motor retardation, uncooperativeness, unusual thought content, blunted affect, excitement, and disorientation. Each symptom is assessed on a 7-point Likert scale, with the following ratings: 1 = not present; 2 = very mild; 3 = mild; 4 = moderate; 5 = moderately severe; 6 = severe; and, 7 = extremely severe. Some of the items in the BPRS were rated according to participant self-report while others are based on clinician observation. Psychometric properties of the BPRS are robust and support its utility in measuring psychotic symptoms (Andersen, Larsen, Schultz, & Nielsen, 1989; Engelsmann & Formankova, 1967; Ligon & Thyer, 2000).

Schedule for the Assessment of Positive Symptoms (SAPS). The SAPS (Andreasen, 1984) is a 30-individual and 4-global item rating scale used to evaluate the presence and severity of positive symptoms (e.g., hallucinations and delusions). SAPS ratings were based on a semi-structure interview, patient self-report of symptoms, and clinician observation. Broad categories of the SAPS pertain to hallucinations, delusions, bizarre behavior, and formal thought disorder. Item ratings are made on a 6-point rating scale. General criterion symptom anchor points for each item are: 0 - None; 1 - Questionable; 2 - Mild; 3 - Moderate; 4 - Marked; and 5 - Severe. The global rating

section used to assess the overall presence, severity, duration, bizarreness, functional impairment, and level of symptom preoccupation subsumed by the items within a category. Global rating items are: Severity of Hallucinations, Severity of Delusions, Severity of Bizarre Behavior, and Positive Formal Thought Disorder. Psychometric properties of the SAPS are robust and can be found in the extant literature (e.g., Norman et al., 1996). The SAPS total score and the four global ratings scores were used in the present study.

Schedule for the Assessment of Negative Symptoms (SANS). The SANS (Andreasen, 1983) is a 25-individual and 5-global item rating scale designed to evaluate the presence and severity of negative symptoms (e.g., affective flattening, avolition, etc.). SANS ratings are based on the completion of a semi-structured interview, patient self-report of symptoms, and clinician observation. There are several broad categories of the SANS and they concern affective flattening or blunting, avolition/apathy, anhedonia/asociality, and attention. The SANS have 25 ratings of individuals symptoms and 5 global ratings. The SANS total and global ratings scores will be used in the present study. Item ratings are made on a 6-point rating scale. General criterion symptom anchor points for each item are: 0 - None; 1 - Questionable; 2 - Mild; 3 - Moderate; 4 - Marked; and 5 - Severe. The global rating section used to assess the overall presence, severity, duration, bizarreness, functional impairment, and level of symptom preoccupation subsumed by the items within a category. Global rating items are: Affective Flattening, Avolition, Anhedonia-Asociality, and Attention. According to previous studies psychometric properties of the SANS are moderate to good (Andreasen & Olsen, 1982; Norman et al., 1996).

Premorbid and Current Intelligence Estimate

Wechsler Adult Intelligence Scale – Third Edition (WAIS-III). Select subtests from the WAIS-III (Wechsler, 1997) battery were used to calculate an estimated premorbid and current full-scale intelligence quotient (FSIQ). Subtests used in the current study were: Vocabulary (VO), Matrix Reasoning (MR), Block Design (BD), Digit Span (DS), and Digit Symbol-Coding (CD). Specifically, the VO subtest contains 33 items and is used to measure verbal comprehension abilities. The MR subtest contains 26 items and is made up for four types of nonverbal reasoning tasks: pattern completion, classification, analogy, and serial reasoning. The BD subtest is used to evaluate spatial perception, visual abstract processing, and problem solving. The DS subtest is used to evaluate attention/concentration and working memory. Lastly, the CD subtest was used to evaluate information processing and visual working memory (Wechsler, 1997).

Estimated premorbid FSIQ will be calculated using the OPIE-3(2ST) regression equation developed by Schoenberg and colleagues (2002) from the Oklahoma Premorbid Intelligence Estimate (OPEI) initiative (Schoenberg, Scott, Duff, & Adams, 2002). The VO and MR were selected for use in the regression equation for several reasons: they have strong correlations with WAIS-III FSIQ scores. Each subtest has demonstrated reliability and validity (Wechsler, 1997); the subtests have minimal demand on motor and processing speed functioning relative to other WAIS-III subtests and have demonstrated resistance to neurological insult (Donders, Tulsky, & Zhu, 2001). Raw scores from the WAIS-III subtests were added to the regression equation developed along with an individual's age in years, ethnicity, education, and gender. According to Schoenberg and colleagues (2007), when using this regression equation to estimate premorbid

intelligence, 88.8% of individuals fall within 10 points of their actual WAIS-III FSIQ score. The regression equation used in the current study to calculate an estimated premorbid FSIQ can be found in Appendix AE. Current FSIQ was estimated by employing a regression equation derived by Ringe and colleagues (2002). According to Ringe and colleagues (2002), when using this regression equation to estimate current intellectual functioning, between 81 and 935 of a mixed neurological/psychiatric sample were classified within 10 points of their actual FSIQ score (Ringe et al., 2002). The regression equation used to estimate current FSIQ in the present study can also be found in Appendix E.

The Awareness of Social Inference Test (TASIT)

TASIT (McDonald, Flanagan, & Rollins, 2011; McDonald et al., 2003) is an ecologically valid, norm-based, criterion-referenced test of social cognition that has three parts, each with sound psychometric properties and equivalent alternate forms: 1) Emotion Evaluation Test; 2) Test of Social Inference (Minimal); and 3) Test of Social Inference (Enriched). TASIT was developed to evaluate emotion processing, TOM, and conversational inference.

TASIT Part I: Emotion Evaluation Test (EET). Part I of TASIT comprises 24 video vignettes of ambiguous monologues or dialogs that lack emotional content. During each vignette, professional actors portray one of six basic emotions: happiness, sadness, anger, fear, disgust, and surprise. Emotion processing in this task was evaluated by prompting participants to identify and select the correct emotion depicted in the vignette from a laminated form with six emotions and a neutral expression. Evaluating emotional expression was not the primary focus of this project. Part I of TASIT was administered

to ascertain whether possible deficits in recognizing and interpreting naturalistic social exchanges was better accounted for by group differences in identification of emotional expression, as opposed to impaired TOM.

TASIT Part II: Social Inference-Minimal (SI-M). Part II of TASIT uses 15 video vignettes to evaluate an individual's ability to recognize and interpret the underlying meaning and intentions of a social interactions. In these 15 vignettes, there are instances when the actors' mental state is consistent with a situation and other times scenarios are inconsistent or contradictory, such that an optimistic and cheerful verbal message might be coupled with a speaker rolling his/her eyes. In Part II of TASIT the vignette takes place in a room with no external or supplemental information that might facilitate interpretation of the social situation. Part II is characterized by three types of social exchanges: sincere, where the speaker means what he/she is saying; sarcastic, where the actions or verbal message of the speaker is incongruent with the message; and, paradoxical sarcasm, where the verbal message makes no sense unless it is understood that the speaker is being sarcastic.

TASIT Part III: Social Inference-Enriched (SI-E). Part III of TASIT uses 15 socially-oriented vignettes to evaluate an individual's ability to draw inferences about the thoughts, intentions, beliefs, and feelings of individuals involved a social exchange. Half of the exchanges in Part III are sarcastic, whereas the remaining half the speaker is lying. Part III of TASIT uses either verbal or visual cues to enrich the situation and provide evidence for the meaning of the social exchange.

Performance on TASIT Part II and Part III. In order to evaluate performance on TASIT Part II and Part III, participants were asked four standardized questions with

forced-choice (yes/no) answers. Each vignette had a question related to: 1) whether the listener believes or knows the speaker statements to be true (1st Order TOM); 2) what the speaker means by what has been said (Meaning); 3) what the listener intends to do in the situation (2nd Order Cognitive TOM); and 4) how the listener feels as a result of the social exchange (Affective TOM).

TASIT and Schizophrenia and Bipolar Disorder. Numerous studies, discussed above, employed TASIT to evaluate TOM abilities in SZ and fewer have used TASIT to explore TOM in BP. In short, Sparks and colleagues (2010) found that individuals with SZ struggled to correctly identify negative emotions from Part I of TASIT (Sparks, McDonald, Lino, O'Donnell, & Green, 2010). Other studies have demonstrated that persons diagnosed with SZ struggle to identify sarcastic exchanges, but performed similar to unimpaired, HC participants, during vignettes where sincere exchanges predominated (Horan et al., 2011; Kern et al., 2009; Kosmidis et al., 2008; Sparks et al., 2010). Others have reported that persons with SZ struggled to correctly interpret social exchanges involving lying relative to HCs (Kosmidis et al., 2008; Sparks et al., 2010), but these findings have been mixed; insofar as Kern and colleagues (2009) reported that individuals with SZ did not performed differently than HCs in their ability to recognize and interpret social exchanges involving lying. Mancuso and others (2011) found that detection and correct interpretation of lying and sarcasm loaded on different factors, with lying being a “lower-level” process and sarcasm perception being a “higher-level” process. With regard to psychiatric symptoms, lower TASIT scores have been associated with greater positive symptoms (Kern et al., 2009). Also, with respect to social functioning, lower TASIT scores have also been associated with reduced recreational

functioning (Sparks et al., 2010), as well as reduced functional capacity and real-world functioning (Horan et al., 2011). Recognizing and correctly identifying conversational inferences has been shown to be more resistant to social skills training than other TOM and emotional processing subprocesses, as well as neurocognitive abilities (Horan et al., 2011). Recently, Rowland and colleagues (2013) found that a SZ group performed significantly worse than HCs on all three parts of TASIT. The BP sample included in Rowland's study performed significantly worse than HCs on part III of TASIT. Results from a study conducted by Lee et al (2013) found that individuals with SZ performed significantly worse than BP and HC participants on their ability to evaluate emotions. Both SZ and BP participants were impaired relative to HCs in their ability to recognize and interpret sarcastic social exchanges compared to sincere exchanges. Finally, Baez and colleagues (2013) found that individuals with SZ performed significantly worse than HCs on part I of TASIT in identification of fear, sadness, disgust. BP participants performed significantly worse than the HC sample on identifying fear items and the total score. To our knowledge, TASIT has never been employed with individuals diagnosed with BP distinguished by a presence or absence of psychotic symptoms during mood episodes. TASIT has never been used to predict functional capacity and social functioning in a mixed group of individuals with SZ and BP.

Measures of Functional Outcome

University of California, San Diego Performance-based Skills Assessment (UPSA). The UPSA (Patterson, Goldman, McKibbin, Hughs, & Jeste, 2001) is a performance-based measure originally designed for middle-aged to elderly community-dwelling individuals diagnosed with schizophrenia. The UPSA was created to evaluate

persons' independent functional capacity in real-world settings by assessing for problems common to individuals with severe mental illness (e.g., making a call to reschedule a medical appointment). There are five functional areas assessed by the UPSA: household chores (e.g., creating a shopping list of necessary ingredients to prepare a meal), communication skills (e.g., making a phone call to cancel and reschedule an appointment), finance management (e.g., writing a check to pay a utility bill), transportation (e.g., evaluating a bus schedule for transfer information and associated cost), and planning recreational activities (e.g., determining what items are necessary to bring on a specific outing). Each of the five areas measured yields a different raw score and raw scores can then be transformed to a 0 – 20 scale, which also yields a summary score that ranges from 0 – 100, with higher numbers equating to better performance (Patterson et al., 2001). The UPSA total and subscale scores have demonstrated sensitivity to psychiatric groups other than SZ, such as schizoaffective disorder, mood disorder with psychotic features, and BP (Bowie et al., 2006, 2008; Depp et al., 2009; Twamley et al., 2002).

Social Functioning Scale (SFS). The SFS (Birchwood, Smith, Cochrane, Wetton, & Copestake, 1990) is a 79-item self-report questionnaire used to evaluate areas of functioning adjudged that are often regarded as important for community maintenance in individuals with severe mental illness. The SFS inquires about the presence and frequency of specific functional skills. Specifically the SFS evaluates seven areas: 1) social engagement/withdrawal (e.g., time spent by oneself, frequency of initiating conversations, interaction with unfamiliar people); 2) interpersonal communication (e.g., number of current friends, frequency of interpersonal dialogue, comfort with

communication); 3) independent-performance (e.g., frequency of carrying out skills required for independent living); 4) independence-competence (e.g., ability to perform skills essential for independent living); 5) recreation (e.g., frequency and ability to partake in common activities and pastimes); 6) prosocial (e.g., involvement in social activities); and 7) occupation/employment (e.g., associated with regular employment or a structured day program). All seven areas of the SFS have been shown to load on one ‘social adjustment’ factor (Birchwood et al., 1990). Raw scores from each of the seven areas can be converted to scaled score equivalents with a mean of 100 and standard deviation of 15. Psychometric properties of the SFS are robust and can be found in the existing literature (Birchwood et al., 1990). This measure has been shown to be unrelated to neurocognitive functioning (Addington & Addington, 1999; Dickerson, Boronow, Ringel, & Parente, 1996, 1999), which supports its utility as a measure of social adjustment in psychiatric groups with putative neurocognitive impairments as trait markers. While the SFS is regarded as a self-report instrument, in the current study, it was administered by the researcher as a verbal interview to insure item understanding and that all questions are answered.

Data Analyses

Data Entry and Data Screening

All measures will be scored according to standardized procedures by two trained individuals. In the event that a disagreement occurs regarding the scoring of a measure, a third opinion (Daniel N. Allen, Ph.D.) will be used to resolve the discrepancy. Data was entered twice into a database. SPSS version 21 was used to analyze the data. All variables were evaluated for outliers during the preliminary data screening process. Box

plots were used to facilitate this process. In the present study, outliers were defined as having a score ± 3.0 standard deviations above or below the mean. Outlying data were examined to ensure proper scoring and entry into the database. In the process of inspecting the data for outliers, skewness and kurtosis were evaluated in an effort to ensure normal distribution. For the predetermined variables selected for the regression analyses, predictor variables were first be examined in a correlation matrix to evaluate for the presence of multicollinearity. Residuals scatterplots produced during the multiple regression procedure were used to evaluate the presence of normality, linearity, and homoscedasticity between the obtained and predicted variable scores.

Preliminary Analyses

Preliminary analyses were run before the primary hypotheses were evaluated. First, descriptive statistics were calculated for each group on demographic variables, including age, education, estimated current intelligence quotient (IQ), estimated premorbid IQ, gender, handedness, ethnicity, and marital status. Provisional descriptive analyses were conducted to ascertain the nature of clinical variables, including number of lifetime hospitalizations, duration of illness, Global Assessment of Functioning (GAF), current severity of psychiatric symptomatology and severity of symptoms during the most recent episode, and medication status at time of testing. Pearson's correlational analyses were run in order to establish the relationship between the variables listed above.

Primary Analyses

Group Differences in Emotion Identification

Positive emotions (happy and surprise) were summed and a percent correct score was calculated. Similarly, negative emotions (sad, angry, fear, and disgust) were

summed and a percent correct score was calculated. Main analyses included a repeated measures ANOVA with group membership (SZ, BP+, BP-, and HC) representing the between subjects factor and percent correct for positive and negative emotion on TASIT representing the repeated measures. It was hypothesized that a significant group x TASIT Part I interaction effect would be present, indicating that participants with BP- have spared emotion recognition abilities compared to the BP+ and SZ groups. It was also hypothesized that the recognition of negative emotions would differentiate the groups who experience psychotic symptoms (i.e., BP+ and SZ) from those who do not (i.e., BP- and HCs), such that individuals with BP+ and SZ would perform significantly worse from BP- and HCs.

Identification of Naturalistic Social Exchanges without Contextual Cue

A repeated measures ANOVA with group membership serving as the between subjects factor (SZ, BP+, BP-, HC) and type of exchange (sincere, simple sarcasm, paradoxical sarcasm) serving as the within-subjects factor was used to evaluate the presence of group differences on the basis of type of social exchange. It was hypothesized that a significant group x type of exchange interaction would be present, indicating poor performance by the SZ and BP+ relative to the BP- and HC groups in their ability to correctly identify social exchanges involving sarcasm and paradoxical sarcasm, but not sincere. No group differences were expected with regard to the identification of sincere remarks, but it could be that the SZ group performs significantly worse on all types of social exchange. A second repeated measures ANOVA with group membership serving as the between subjects factor (SZ, BP+, BP-, HC) and type of inference (i.e., Meaning, 1st Order Cognitive TOM, 2nd Order Cognitive TOM, and

Affective TOM) serving as the within-subjects factor were used to evaluate group differences on the basis of ability to comprehend naturalistic social inference. It was expected that a significant group x type of interaction effect would be present, indicating poor performance by those individuals who experience psychotic symptoms (i.e., BP+ and SZ) relative to BP- and HCs in their ability to comprehend naturalistic social inference without contextual cues. It was also anticipated that performance by SZ and BP+ would be worse than BP- with respect to measures of cognitive and affective TOM.

Identification of Naturalistic Social Exchanges with Contextual Cue

A repeated measures ANOVA with group membership serving as the between subjects factor (SZ, BP+, BP-, HC) and type of exchange (lie, sarcasm) serving as the within-subjects factor were used to evaluate the presence of group differences on the basis of type of social exchange. It was anticipated that a significant group x type of exchange interaction effect would be present, indicating poor performance by the SZ and BP+ relative to the BP- and HC groups in their ability to identify sarcasm, but not lies. Individuals with SZ were anticipated to perform significantly worse than all other groups on the lie exchange. Analyses were also expected to elucidate differential group performance in Cognitive and Affective TOM questions, such that SZ and BP+ would display similarly impaired performance, while performance by the BP- group would be similar to the HCs.

A second repeated measures ANOVA with group membership serving as the between subjects factor (SZ, BP+, BP-, HC) and type of inference (i.e., Meaning, 1st Order Cognitive TOM, 2nd Order Cognitive TOM, and Affective TOM) serving as the within-subjects factor would be used to evaluate group differences on the basis of ability

to correctly recognize and interpret naturalistic social inference. It was expected that a significant group x type of inference effect would be present, indicating poor performance by the SZ and BP+ relative to the BP- and HC groups. Analyses were also expected to elucidate differential group performance in cognitive TOM and affective TOM questions, such that SZ and BP+ would display similarly impaired performance, while performance by the BP- group would be spared and similar to the HCs. Finally, a series five one-way repeated measures ANOVA were planned to systematically evaluate whether group performance differed from Part II to Part III of TASIT, or in other words, if visual or text loaded cues influenced performance. For this series, the between-subjects variable was always participant groups (SZ, BP+, BP-, and HC). For the first one-way repeated measures ANOVA, the within-subjects factor, titled PART, consisted of two levels: 1) Correct responses for all sarcasm items in Part II of TASIT and 2) Correct responses for all sarcasm items in Part III of TASIT. Importantly, we planned to halt the series of ANOVAs if the first and most broad was not significant. In the event that significance was determined, the second one-way repeated measures ANOVA would have the following within-subjects factors: 1) Part II Simple Sarcasm, and 2) Part III Visual Sarcasm. The third one-way repeated measures ANOVA would have the following within-subjects factors: 1) Part II Simple Sarcasm, and 2) Part III Text Sarcasm. The fourth one-way repeated measures ANOVA would have the following within-subjects factors: 1) Part II Paradoxical Sarcasm, and 2) Part III Visual Sarcasm. The fifth and final one-way repeated measures ANOVA would have the following within-subjects factors: 1) Part II Paradoxical Sarcasm, and 2) Part III Text Sarcasm. Conducting the analysis in this way allowed us to ascertain if visual or text loaded

vignettes enhanced correct recognition and identification of sarcastic exchanges. The within-subjects variables were summed, dividing by the combined maximum raw score, and multiplied by 100 to yield a percent correct score. All within-subjects data were entered into the analysis as percent correct scores. It was anticipated that contextual cues would not influence recognition and interpretation of sarcastic exchanges and that performance by the SZ and BP+ groups were remain impaired when compared to the BP- and HC groups. Multivariate analysis of covariance was employed to ascertain whether correct recognition and interpretation of sarcasm items on TASIT Part II and Part III might be better accounted for by participants' performance on TASIT Part I, EET. In this analysis the dependent variables consist of total sarcasm scores on TASIT Part II and III, as well as scores on Part II simple and paradoxical sarcasm and Part III contextual cue scores. Group membership served as the between-subjects variable and performance on TASIT Part I served as the covariate.

TASIT Performance Predicts Functional Outcome

Pearson's correlations were used to identify which variables of the UPSA and SFS would associated with TASIT subscale performance in a combined serious mental illness group. Because significant correlations would be considered putative predictors for the regression procedure, Type I error were not controlled. These correlations were also anticipated to show the relationship between TASIT subscales. All three Parts of TASIT were simultaneously inserted as predictors in the multiple regression model. Individual regression analyses were conducted for the five UPSA subtests and total score with the same three predictor variables. Based on recent studies, it was anticipated that the communication skills and finance management domains of the UPSA would be

predicted by TASIT performance. Based on other findings, it may be that the Planning subscale of the UPSA will be best predicted by TASIT performance (Mancuso et al., 2011). Similarly, separate multiple regression analyses would be conducted for seven subscales of the SFS and the total score. The three TASIT subscales would be used in each of these calculations as predictor variables. It was hypothesized that TASIT performance would best predict social engagement/withdrawal and interpersonal communication.

CHAPTER 4

RESULTS

Demographic and Clinical Variables

All individuals considered in the analyses were compared across demographic and clinical variables to ascertain the presence of group differences. Table 3, represents a comparison among groups on age, education, socioeconomic status (SES) as defined by the Hollingshead Index, estimated current IQ, and global assessment of functioning (Axis V of the DSM-IV-TR). There were no group differences in age or education. There were differences among groups on SES, IQ, and GAF scores. Results indicated that the HC group had lower Hollingshead scores, which translates to higher SES than the SZ group, but not the BP groups. Estimated current IQ was significantly lower in the SZ group than the other three groups. Finally, higher GAF scores which suggests greater functioning in such areas as social, occupational, and psychological functioning, and fewer symptoms of psychopathology were seen in the HC group. There were no differences in GAF scores for the BP groups and the GAF score SZ was significantly worse than all other groups. The demographic results present in this sample were expected and are consistent with existing literature. In other words, severe mental illness has been associated with lower SES, IQ, and GAF scores, particularly in SZ. Primary analyses were first conducted with no covariates, as controlling for such variables (i.e., SES, IQ, and GAF) could inadvertently neutralize salient characteristics of severe mental illness. Given differences in IQ between the SZ group and all other groups, however, we also conducted primary analyses using IQ as a covariate, expected IQ to have an effect, but for the hypotheses to hold.

Table 3. Demographic descriptives of the sample

	Groups								<i>F</i> (3,81)	<i>p</i>	<i>Post hoc Tukey's B</i>
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Age (years)	41.18	14.76	36.90	12.64	40.57	12.10	37.05	15.41	0.57	> .05	No Differences
Education (years)	12.86	1.70	13.90	2.15	13.81	1.75	14.05	1.86	1.80	> .05	No Differences
Hollingshead Index	56.05	10.03	43.50	11.68	41.38	12.27	36.86	12.94	10.68	< .01	SZ>BP+,BP-,HC
Current IQ Est.	84.43	11.56	101.30	12.27	100.84	15.49	108.23	10.71	14.07	< .01	SZ<BP-,BP+,HC
GAF Overall	42.68	14.68	60.70	9.77	62.38	10.74	82.86	11.14	45.81	< .01	SZ<BP+,BP-<HC

Note. SZ = Schizophrenia; BP+ = Bipolar with Psychotic Features; BP- = Bipolar without Psychotic Features; HC = Healthy Control.

Note. Socioeconomic status was quantified by the Hollingshead Index and is represented in the table by Hollingshead Class.

Note. Current IQ Estimate was calculated from Wechsler Adult Intelligence Scale - Third Edition using the regression equation developed by Ringe et al., 2002.

Note. GAF Overall = Global Assessment of Functioning, overall considers functioning and symptoms.

The groups were then compared across sex, ethnicity, handedness, and medication status (Table 4). Results indicated there were no group differences on sex, ethnicity, or handedness. When the clinical groups were compared across medication type, there were no significant group differences. Potential medication effects on illness chronicity, symptom expression, IQ, and TASIT were evaluated and are discussed below.

Table 4. Demographic and medication descriptives of the sample

	Groups				φ_c	<i>p</i>
	SZ (n = 22)	BP+ (n = 20)	BP- (n = 21)	HC (n = 22)		
	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)		
Sex					0.16	> .05
Male	12 (54.5)	8 (40.0)	8 (38.1)	12 (54.5)		
Ethnicity					0.43	> .05
Caucasian	11 (50.0)	16 (80.0)	18 (85.7)	11 (50.0)		
African American	6 (27.3)	0 (0.0)	2 (9.5)	6 (27.3)		
Hispanic/Latino	3 (13.6)	2 (10.0)	1 (4.8)	1 (4.5)		
Other (e.g. Asian, Biracial)	2 (9.1)	2 (10.0)	0 (0.0)	4 (18.2)		
Handedness					0.23	> .05
Right hand dominant	19 (86.4)	16 (80.0)	18 (85.7)	22 (100.0)		
Medication Status						
Antipsychotic	18 (81.8)	13 (65.0)	7 (33.3)		1.07	> .05
Anticonvulsant	7 (31.8)	3 (15.0)	6 (28.6)		0.59	> .05
Antidepressant	10 (45.5)	7 (35.0)	7 (33.3)		0.73	> .05
Lithium	3 (13.6)	7 (35.0)	3 (14.3)		0.48	> .05

Note. SZ = Schizophrenia; BP+ = Bipolar with Psychotic Features; BP- = Bipolar without Psychotic Features; HC = Healthy Control.

Next, the groups were compared across clinical symptom rating scores (see Table 5). The symptom patterns correspond to the groups evaluated and align with assumptions made in this study that also parallel the extant literature. Symptoms associated with depression, as measured by the HDRS, did not differ significantly among clinical groups and suggest that none of the clinical groups exhibited clinically significant symptoms of depression at the time of evaluation. All three clinical groups exhibited more depressive symptoms than the HC group. As expected, symptoms associated with mania, as measured by the YMRS, were rated as slightly more in participants with BP. Importantly, manic symptoms did not differ significantly from the SZ group, all clinical groups were rated as exhibiting more symptoms than the HCs, and the symptom severity was not clinically significant. Regarding the other clinical symptom measures, individuals with SZ demonstrated more positive, as measured by the BPRS and SAPS, and negative symptoms, as measured by the SANS. The results also suggest that the BP+ group exhibited more delusions the last psychotic episode (SAPS Psych in Table 5).

Table 5. Symptoms rating scores for the sample

	Groups								<i>F</i> (3,81)	<i>p</i>	<i>Post hoc Tukey's B</i>
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)				
	M	SD	M	SD	M	SD	M	SD			
HDRS Total	8.95	6.04	8.55	5.53	8.76	6.25	1.86	2.40	9.33	< .01	SZ,BP-,BP+>HC
YMRS Total	2.36	3.23	3.85	3.22	4.38	3.65	0.36	1.05	7.97	< .01	HC<SZ,BP+,BP-
BPRS											
Thought Disturbance	11.95	5.19	4.65	1.09	4.29	0.90	4.27	0.63	41.16	< .01	SZ>BP+,BP-,HC
Anergia	7.91	3.64	5.10	1.48	5.24	1.95	4.23	0.61	11.14	< .01	SZ>BP+,BP-,HC
Affect	10.64	4.10	10.25	2.88	12.43	5.29	6.45	1.71	9.78	< .01	SZ,BP+,BP->HC
Disorganization	5.14	2.44	3.65	0.81	3.67	1.16	3.23	0.69	7.14	< .01	SZ>BP-,BP+,HC
SANS											
Affective Flattening	9.68	9.85	3.95	5.46	3.71	6.79	1.00	2.66	6.45	< .01	SZ>BP+,BP-,HC
Alogia	3.45	4.27	0.25	0.91	0.33	1.16	0.41	1.40	9.20	< .01	SZ>BP-,BP+,HC
Avolition	4.86	4.32	3.80	4.36	2.81	3.86	0.45	1.01	5.85	< .01	SZ,BP+>HC; BP+,BP-; BP-,HC
Anhedonia/Asociality	5.32	5.45	4.60	4.96	5.95	6.95	0.77	1.63	4.51	< .01	SZ,BP-,BP+>HC
Inattention	3.82	3.20	1.55	1.85	1.67	2.31	0.68	1.21	7.57	< .01	SZ>BP-,BP+,HC
SAPS Current											
Hallucinations	7.27	6.67	0.00	0.00	0.05	0.22	0.00	0.00	24.79	< .01	SZ>BP-,BP+,HC
Delusions	8.86	9.51	0.70	1.34	0.19	0.87	0.09	0.29	16.54	< .01	SZ>BP+,BP-,HC
Bizarre Behavior	0.77	1.19	0.75	1.21	0.24	0.77	0.05	0.21	3.31	< .05	No Differences
Formal Thought Disorder	3.64	4.41	0.80	1.15	0.81	1.44	0.00	0.00	9.50	< .01	SZ>BP-,BP+,HC
SAPS Psych											
Hallucinations			3.95	4.71							
Delusions			15.5	7.77							

Note. SZ = Schizophrenia; BP+ = Bipolar with Psychotic Features; BP- = Bipolar without Psychotic Features.

Note. HDRS = Hamilton Depression Rating Scale; YMRS = Young Mania Rating Scale; BPRS = Brief Psychiatric Rating Scales; SANS = Scale for the Assessment of Negative Symptoms; SAPS = Scale for the Assessment of Positive Symptoms.

Note. SAPS Current = Symptom ratings for the two weeks prior to interview; SAPS Psych = Retrospective participant self-report of hallucinations and delusions during the most recent psychotic episode, excluding global ratings.

The three clinical groups were compared on several additional clinical variables, including age of symptom onset, number of psychotic episodes for the SZ and BP+ group, number of months since the last psychotic episodes in BP+, as well as the total number of depressed and manic episodes across clinical groups, number of psychiatric hospitalizations, and the number of suicide attempts.

Table 6. Illness characteristics of the clinical groups

	Clinical Groups						<i>F</i> (3,81)	<i>p</i>	<i>Post hoc Tukey's B</i>
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)				
	Mean	SD	Mean	SD	Mean	SD			
Age of Symptom Onset (years)	23.00	11.34	17.80	8.31	16.90	3.11	3.33	< .05	No Differences
Number of Psychotic Episodes	90.14	24.82	18.35	29.01			74.65	< .01	SZ>BP+
Last Psychotic Episode (months)			15.5	16.2					
Total Number of Depressed Episodes	3.55	6.76	25.15	34.83	32.24	39.20	5.28	< .05	BP-,BP+>SZ
Depressed w/ Psychotic symptoms	3.27	6.74	1.45	3.09			1.23	> .05	No Differences
Total Number of Manic Episodes	6.50	22.34	27.80	34.49	33.14	37.73	4.17	< .05	SZ,BP+<BP-; BP+,BP-
Manic w/ Psychotic symptoms	6.50	22.34	17.15	28.95			1.80	> .05	No Differences
Psychiatric hospitalizations	7.27	8.80	3.50	2.78	2.67	2.92	4.01	< .05	BP-,BP+<SZ; BP+,SZ
Suicide Attempts	1.09	1.23	1.35	1.93	1.43	2.38	0.19	> .05	No Differences

The data presented in Table 6 suggest that there were no group differences among groups for age of onset or number of suicide attempts. As expected, individuals with SZ had significantly more psychotic episodes than the BP group; for the purpose of this study, consistent symptom expression was recorded as “99”. In this sample, the SZ group was medically and psychiatrically stable, but often still exhibited psychotic symptoms (e.g., a transient auditory hallucination, mild paranoia, or mild negative symptoms). The data also suggest that persons with SZ had more hospitalizations than the BP groups. The BP groups reported experiencing more depressive and manic episodes than the SZ group.

Effects of Antipsychotic Medication on Demographic and Clinical Variables

Considering the clinical groups, 18 individuals with SZ were prescribed at least one antipsychotic medication at the time of evaluation, 13 individuals with BP+ provided evidence of current antipsychotic medication prescription, and 7 persons with BP- were taking antipsychotic medication. Multivariate analysis of variance (MANOVA) was used to ascertain the relationship between antipsychotic medication and demographic and clinical variables such as IQ, SES, GAF, clinical symptoms, number of psychiatric hospitalizations, and onset of psychiatric illness. For this analysis, group membership (e.g., SZ, BP+, and BP-) and status of antipsychotic medication usage (e.g., taking versus not taking) served as the between-subjects variables, and demographic and clinical variables represented dependent variables. Results from the MANOVA indicated no significant effect for group or medication usage on any of the variables assessed, IQ ($p = .47$), SES ($p = .66$), GAF ($p = .82$), SAPS ($p = .57$), SANS ($p = .85$), number of psychiatric hospitalizations ($p = .22$), and illness onset ($p = .19$).

Data Screening

Normality of TASIT variables were evaluated by the skewness and kurtosis statistics. Skewness and kurtosis values with range between -1 and +1 are generally considered to be within an acceptable range, and considered normally distributed. However, since TASIT is a criterion-referenced test where it is possible to obtain the maximum score, we did not expect normal distributions among TASIT variables. Table 7 provides mean, median, standard deviation (*SD*), skewness, and kurtosis scores for all TASIT values considered for analysis. Median scores were provided to facilitate interpretation of the criterion-reference test data.

Table 7. Skewness and kurtosis values of TASIT raw scores

TASK	Mean	Median	SD	Skewness	Kurtosis
The Awareness of Social Inference Test (TASIT)					
Part 1 Total: EET	20.02	21.00	3.61	-1.29	1.37
Positive Emotions	6.72	7.00	1.46	-1.39	1.67
Happy	3.31	4.00	0.87	-1.19	1.27
Surprised	3.41	4.00	0.90	-1.52	1.83
Negative Emotions	13.31	14.00	2.43	-1.12	0.68
Sad	3.38	4.00	0.76	-0.92	-0.02
Angry	3.25	3.00	0.84	-0.87	-0.06
Anxious	3.38	4.00	1.05	-1.71	2.03
Revolted	3.31	4.00	0.94	-1.36	1.38
Part 2 Total: SI-M	50.21	52.00	8.56	-1.19	1.09
<i>Sincere Total</i>	17.48	19.00	2.94	-1.34	1.40
Meaning	4.41	5.00	0.89	-1.64	2.50
1st Order TOM	4.22	4.00	0.92	-1.22	1.70
2nd Order TOM	4.52	5.00	0.72	-1.35	1.10
Affective TOM	4.33	5.00	0.89	-1.02	-0.17
<i>Simple Sarcasm Total</i>	16.48	18.00	4.26	-1.25	0.76
Meaning	4.05	5.00	1.24	-1.20	0.40
1st Order TOM	4.01	4.00	1.21	-1.26	0.68
2nd Order TOM	4.14	5.00	1.17	-1.30	0.74
Affective TOM	4.28	5.00	0.98	-1.29	0.92
<i>Paradoxical Sarcasm Total</i>	16.25	18.00	4.13	-1.47	1.91
Meaning	4.19	5.00	1.24	-1.44	1.24
1st Order TOM	3.82	4.00	1.25	-1.21	1.02
2nd Order TOM	3.92	4.00	1.22	-1.06	0.51
Affective TOM	4.32	5.00	1.09	-2.07	4.23
Part 3 Total: SI-E	50.24	52.00	7.76	-0.77	-0.10
<i>Lie Total</i>	25.68	26.00	4.19	-0.46	-0.49
Meaning	6.15	6.00	1.61	-0.47	-0.95
1st Order TOM	6.42	7.00	1.07	-0.39	-0.45
2nd Order TOM	6.91	7.00	1.09	-1.29	1.69
Affective TOM	6.20	7.00	1.63	-0.79	-0.16
<i>Sarcasm Total</i>	24.55	25.00	4.97	-1.05	0.99
Meaning	6.13	6.00	1.60	-0.63	-0.59
1st Order TOM	6.78	7.00	1.34	-1.89	4.96
2nd Order TOM	5.64	6.00	1.77	-0.89	1.20
Affective TOM	6.01	6.00	1.36	-0.99	1.43
Lie					
Visual Load	12.98	13.00	2.38	-0.44	-0.43
Text Load	12.71	13.00	2.45	-0.88	0.37
Sarcasm					
Visual Load	11.16	12.00	3.11	-0.61	-0.15
Text Load	13.39	14.00	2.78	-1.94	4.97

Several skewness and kurtosis values were greater than ± 1 . The data which diverged significantly from the recommended skewness and kurtosis values were examined for outliers. Outlying scores were all deemed to be a result of actual participant performance rather than administration or data entry error. Data that fell more

than 2.5 *SDs* below or above the mean were considered outliers and corrected by adding the minimum number of points to the raw score to equal the next closest score minus one. For examples arbitrary scores of 20, 19, 17, and 10 would become 20, 19, 17, and 16. Adjusting scores in this way not only decreases the influence on variance and measures of central tendency, it also maintains participants' performance in the overall distribution (Tabachnick & Fidell, 2007). Table 8 provides the mean, median, *SD*, skewness, and kurtosis values for TASIT after correcting for scores 2.5 *SD* beyond the mean.

Table 8. Skewness and kurtosis values of TASIT raw scores after correcting outliers

TASK	Mean	Median	SD	Skewness	Kurtosis
The Awareness of Social Inference Test (TASIT)					
Part 1 Total: EET	20.05	21.00	3.54	-1.21	1.05
Positive Emotions	6.72	7.00	1.46	-1.39	1.67
Happy	3.31	4.00	0.87	-1.19	1.27
Surprised	3.41	4.00	0.90	-1.52	1.83
Negative Emotions	13.33	14.00	2.37	-1.05	0.41
Sad	3.38	4.00	0.76	-0.92	-0.02
Angry	3.25	3.00	0.84	-0.87	-0.06
Anxious	3.40	4.00	0.98	-1.51	1.02
Revolted	3.31	4.00	0.94	-1.36	1.38
Part 2 Total: SI-M	50.28	52.00	8.41	-1.14	0.96
<i>Sincere Total</i>	17.49	19.00	2.91	-1.29	1.13
Meaning	4.42	5.00	0.85	-1.42	1.22
1st Order TOM	4.22	4.00	0.92	-1.22	1.70
2nd Order TOM	4.52	5.00	0.72	-1.35	1.10
Affective TOM	4.33	5.00	0.89	-1.02	-0.17
<i>Simple Sarcasm Total</i>	16.48	18.00	4.26	-1.25	0.76
Meaning	4.05	5.00	1.24	-1.20	0.40
1st Order TOM	4.01	4.00	1.21	-1.26	0.68
2nd Order TOM	4.14	5.00	1.17	-1.30	0.74
Affective TOM	4.28	5.00	0.98	-1.29	0.92
<i>Paradoxical Sarcasm Total</i>	16.31	18.00	3.98	-1.35	1.31
Meaning	4.19	5.00	1.24	-1.44	1.24
1st Order TOM	3.82	4.00	1.25	-1.21	1.02
2nd Order TOM	3.92	4.00	1.22	-1.06	0.51
Affective TOM	4.38	5.00	0.91	-1.50	1.42
Part 3 Total: SI-E	50.27	52.00	7.68	-0.73	-0.23
<i>Lie Total</i>	25.68	26.00	4.19	-0.46	-0.49
Meaning	6.15	6.00	1.61	-0.47	-0.95
1st Order TOM	6.42	7.00	1.07	-0.39	-0.45
2nd Order TOM	6.91	7.00	1.09	-1.29	1.69
Affective TOM	6.20	7.00	1.63	-0.79	-0.16
<i>Sarcasm Total</i>	24.59	25.00	4.87	-0.97	0.73
Meaning	6.13	6.00	1.60	-0.63	-0.59
1st Order TOM	6.81	7.00	1.21	-1.32	1.85
2nd Order TOM	5.64	6.00	1.77	-0.89	1.20
Affective TOM	6.01	6.00	1.36	-0.99	1.43
Lie					
Visual Load	12.98	13.00	2.38	-0.44	-0.43
Text Load	12.71	13.00	2.45	-0.88	0.37
Sarcasm					
Visual Load	11.16	12.00	3.11	-0.61	-0.15
Text Load	13.42	14.00	2.63	-1.60	2.78

Adjusting outlying scores changed skewness and kurtosis scores closer to ideal values and minimally impacted TASIT mean and median scores. Next, measures of current symptom expression of the three clinical groups were correlated with total raw scores of the three TASIT subtests. Table 9 indicates the presence of moderate negative

association between all three TASIT subtests and symptom measures typically used to evaluate psychotic and negative symptoms, the BPRS, SAPS, and SANS. These data provide evidence toward greater symptom expression being related to poorer performance on all three parts of TASIT. There were no significant associations between measures of depression and mania with performance on any TASIT subtest.

Table 9. Association among TASIT subtests and current symptoms of clinical groups

TASIT	Symptom Measures				
	HDRS	YMRS	BPRS	SAPS	SANS
EET	-0.01	0.03	**-.044	**-.043	**-.055
SI-M	-0.05	-0.02	**-.045	**-.050	**-.044
SI-E	-0.04	-0.02	**-.030	**-.038	**-.040

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

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

Primary Analyses

Group Differences in Emotion Identification

A repeated measures ANOVA was used to assess participants' ability to correctly identify positive and negative emotions displayed in the Emotion Evaluation Test (EET) of TASIT. Scores related to correct identification of positive (i.e., happy and surprise) and negative (i.e., sad, angry, anxious, and disgust) emotions served as the within-subjects variables, titled EMOTION. The between-subjects variable was participant groups (i.e., SZ, BP+, BP-, and HC), titled GROUP. Given the different number of emotions comprising the positive and negative variables, two and four emotions respectively, raw scores from the EET were summed, dividing by the combined maximum raw score of the emotions, and multiplied by 100 to yield a percent correct score (Sparks et al., 2010).

Results indicated that the EMOTION x GROUP interaction was significant, Wilks' $\lambda = .95$, $F(3, 81) = 1.38$, $p = .25$, nor was the main effect for EMOTION, Wilks' $\lambda = .99$, $F(1, 81) = .41$, $p = .52$. There was a significant main effect for GROUP, $F(3, 81) = 11.32$, $p < .001$, multivariate partial $\eta^2 = .29$, with K Matrix Contrast statistics indicating the SZ group had more difficulty than all other groups in their ability to correctly identify emotions. Univariate ANOVA of EET indicated significant between-group differences in participants' ability to identifying positive emotions $F(3,81) = 8.79$, $p < .001$, multivariate partial $\eta^2 = .25$. K Matrix Contrast statistics provided further support that the SZ group performed significantly worse than all other groups in their ability to correctly identify positive emotions. There were no differences in performance among the BP groups and HCs. A second univariate ANOVA of EET showed significant between-group difference with respect to participants' ability to correctly identify negative emotions $F(3,81) = 9.91$, $p < .001$, multivariate partial $\eta^2 = .27$. While the SZ group performed worse with respect to identifying negative emotions, results also indicated that the BP+ group struggled significantly more than HCs. When considering correct recognition of individual emotions, results did not yield differences between the BP groups nor did they yield significant differences between BP participants from HCs (Table 10 & Figures 2).

Table 10. Emotional Evaluation Test performance by group

	Groups												F(3,81)	p	η_p^2	Contrast	Post Hoc Tukey B
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)										
	M	SD	M	SD	M	SD	M	SD									
Part 1 Total: EET (24)	16.95	4.17	20.25	3.31	21.33	2.11	21.73	1.98	11.18	<.01	0.29	SZ<BP+,BP-,HC					
Positive Emotions (8)	5.55	1.87	6.95	1.23	7.29	1.01	7.14	0.83	8.25	<.01	0.23	SZ<BP+,BP-,HC					
Happy (4)	2.64	1.09	3.40	0.68	3.57	0.68	3.64	0.58	7.50	<.01	0.22		SZ<BP+,BP-,HC				
Surprised (4)	2.91	1.19	3.55	0.83	3.71	0.56	3.50	0.74	3.58	<.05	0.12		SZ<HC,BP+,BP-				
Negative Emotions (16)	11.41	2.81	13.30	2.25	14.05	1.50	14.59	1.37	9.92	<.01	0.27	SZ<BP+; BP+,BP-; BP+<HC					
Sad (4)	3.18	0.85	3.35	0.81	3.48	0.60	3.50	0.74	0.81	0.49		No Differences					
Angry (4)	3.05	1.00	3.20	0.77	3.29	0.85	3.45	0.74	0.89	0.45		No Differences					
Anxious (4)	2.64	1.18	3.30	1.08	3.81	0.51	3.86	0.35	9.72	<.01	0.27		SZ<BP+,BP-,HC				
Revolted (4)	2.55	1.18	3.45	0.76	3.48	0.68	3.77	0.53	9.02	<.01	0.25		SZ<BP+,BP-,HC				

Note: EET = Emotion Evaluation Test.

Figure 2. Performance on EET by group

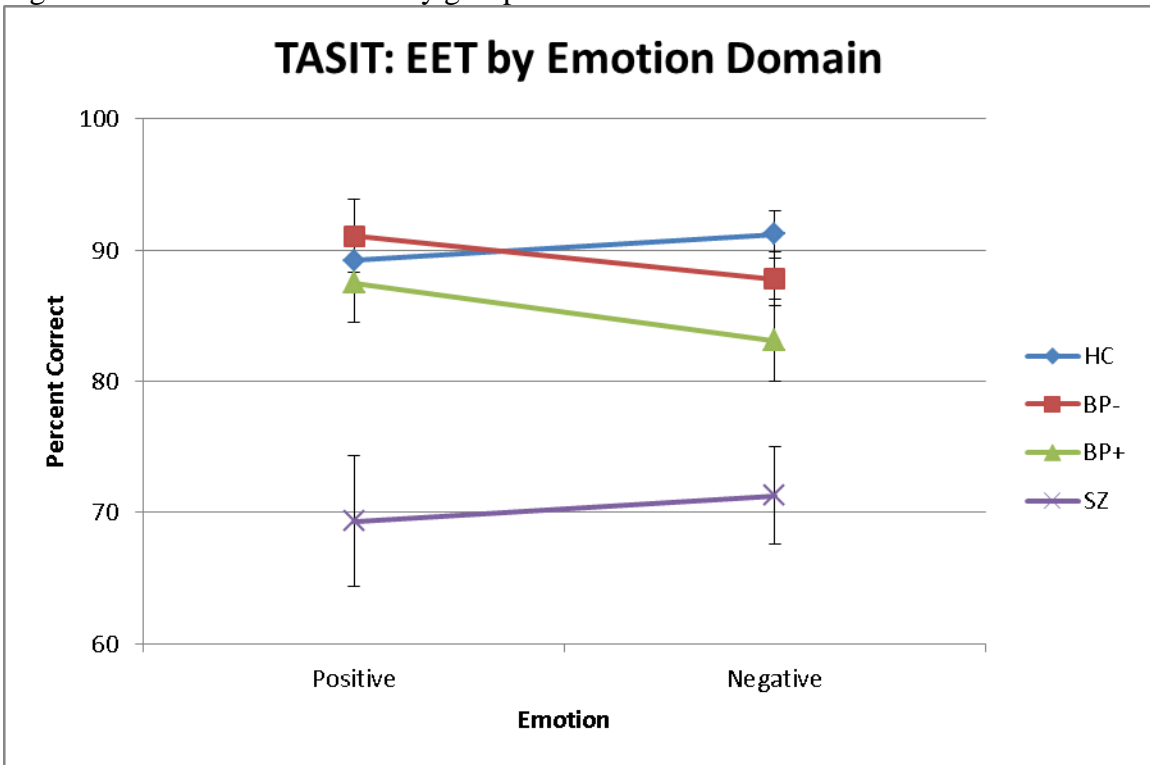
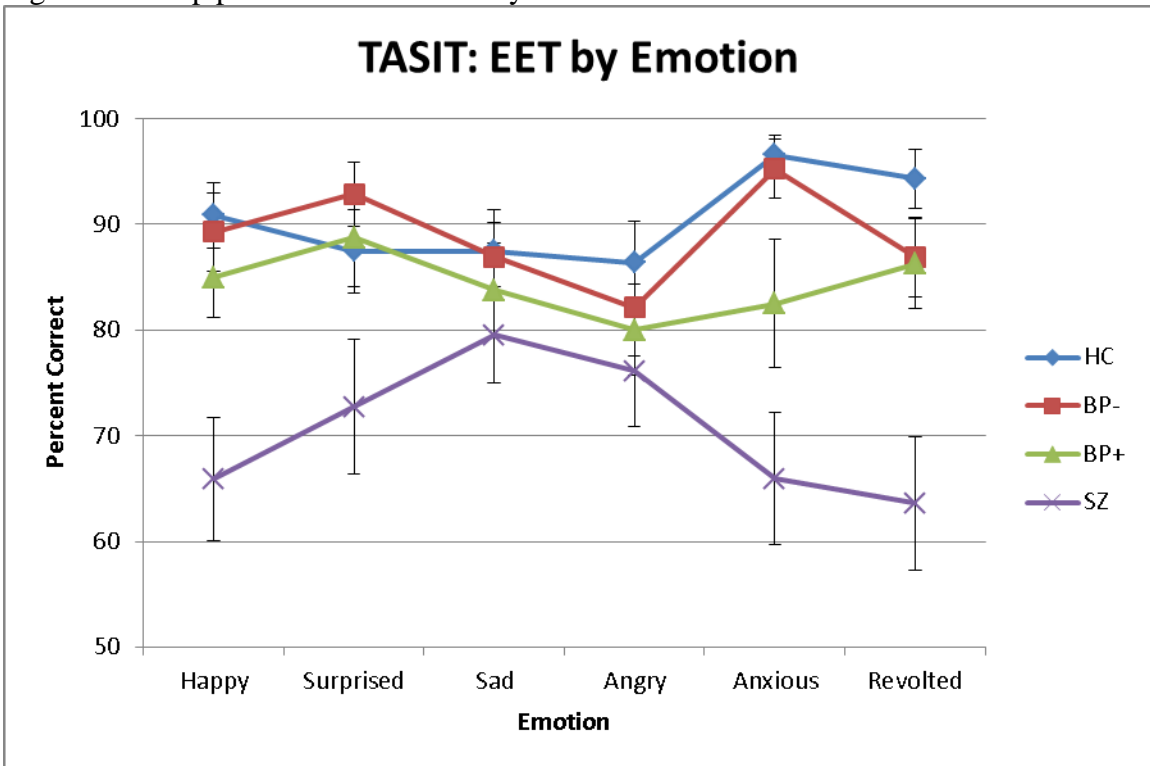


Figure 3. Group performance on EET by emotion



Impact of Estimated Current IQ on Emotion Identification

A repeated measures ANCOVA was conducted to ascertain the presence of group differences in emotion recognition after statistically controlling for the effects of estimated current IQ. In this case, positive and negative emotions served as the within-subjects variables, the between-subjects variable was participant groups, and the covariate was estimated current IQ. After adjusting for IQ, results indicated no significant EMOTION x GROUP interaction, Wilks' $\lambda = .95$, $F(3, 80) = 1.29$, $p = .28$, no significant EMOTION x IQ interaction, Wilks' $\lambda = .99$, $F(1, 80) = .10$, $p = .76$, and no significant effect for EMOTION, Wilks' $\lambda = .99$, $F(1, 80) = .05$, $p = .82$. There was a significant main effect for GROUP, $F(3, 80) = 3.21$, $p < .05$, multivariate partial $\eta^2 = .11$. Follow-up MANCOVA indicated a significant between-group difference in participants' ability to identify positive emotions $F(3,80) = 2.88$, $p < .05$, multivariate partial $\eta^2 = .10$, but not negative emotions, $F(3,80) = 2.53$, $p = .06$. Regarding group differences in correct recognition of positive emotions, K Matrix Contrast statistics indicated the SZ group performed significantly worse than both BP groups, but curiously not the HCs (Figure 4). When the emotions were considered independently (e.g., happy, surprised, sad, etc.), group effect remained insignificant $F(6,75) = 1.36$, $p = .16$; however, follow-up MANCOVAs indicated significant group differences in participants' ability to correctly identify negative emotions, such as anxiousness, $F(3,80) = 4.12$, $p < .01$, multivariate partial $\eta^2 = .13$ and revolted $F(3,80) = 2.90$, $p < .05$, multivariate partial $\eta^2 = .10$ emotions. K Matrix Contrast statistics indicated the SZ group performed significantly worse than the HC and BP- group in their ability to identify said negative emotions,

whereas the SZ group only performed significantly worse than the BP+ group in their ability to correctly identify emotional expression characterized by revolt (Figure 5).

Figure 4. EET performance by group with IQ as a covariate

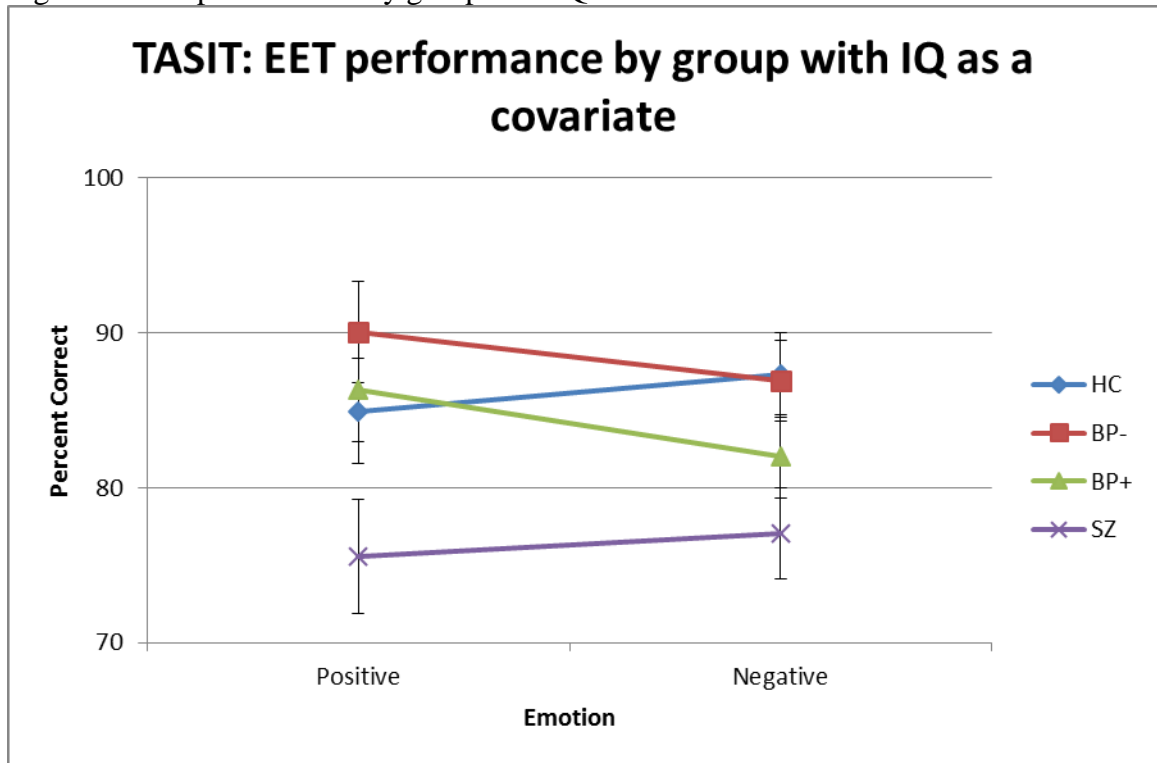
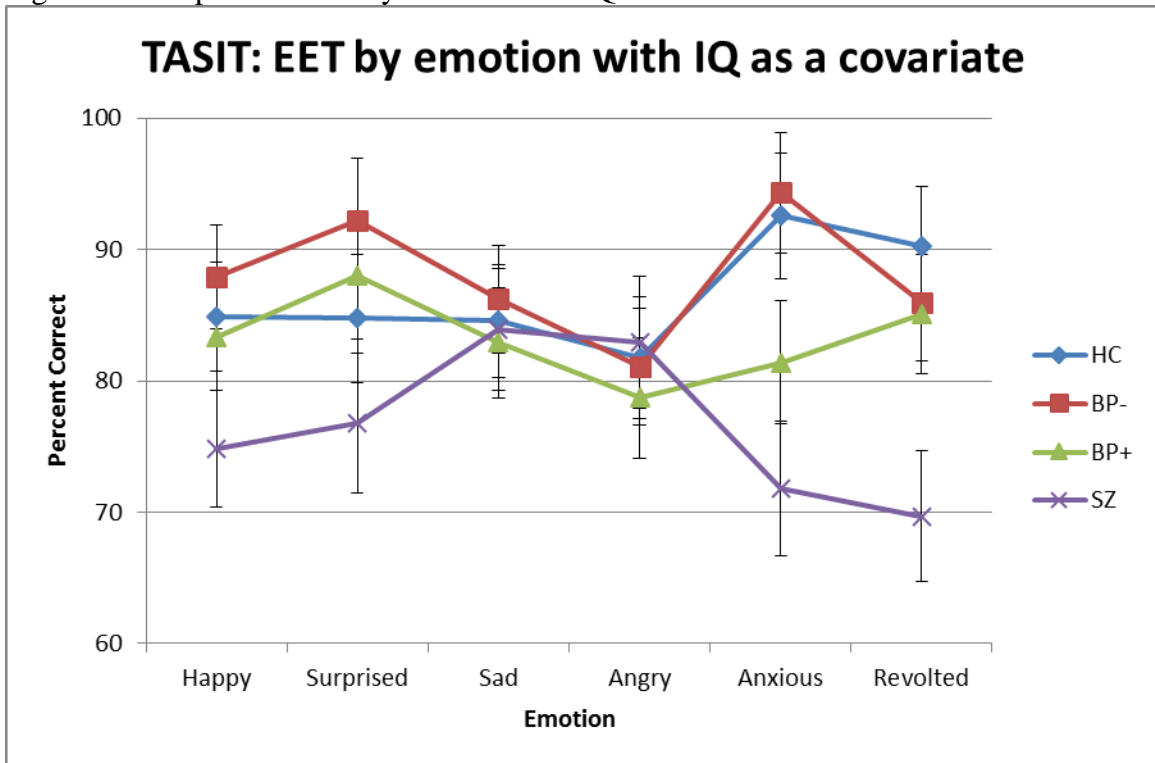


Figure 5. EET performance by emotion with IQ as a covariate



Identification of Naturalistic Social Exchanges without Contextual Cue

In the Social Inference – Minimal (SI-M) task of TASIT, sarcastic social exchanges were either convergent with the situation and topic, where the speaker openly communicated his or her intentions (Simple), or incongruent, where aspects of the speaker’s body language and prosody contradict the situation or topic (Paradoxical). A repeated measures ANOVA was used to evaluate participants’ ability to correctly identify TOM-related questions in the presence of naturalistic sincere and sarcastic social exchanges. The first within-subjects factor was titled EXCHANGE and consisted of three levels: Sincere, Simple Sarcasm, and Paradoxical Sarcasm. The second within-subjects factor was labeled TOM and consisted of four levels each representing and different type of TOM according to TASIT: Meaning, 1st Order TOM, 2nd Order TOM,

and Affective TOM. The between-subjects variable concerned the participant groups (SZ, BP+, BP-, and HC).

A simple main effects for EXCHANGE ($F_{2,80} = 3.61, p < .05$), TOM ($F_{3,79} = 11.91, p < .001$), and GROUP ($F_{3,81} = 17.84, p < .001$) were observed. Results also indicated a significant EXCHANGE x GROUP effect, Wilks' $\lambda = .70, F(6,160) = 3.77, p < .01$, multivariate partial $\eta^2 = .12$, with the SZ group performing significantly worse than all group and the BP+ group performing significantly worse than the BP- and HCs (Figure 6). There was no differences in performance between the BP- and HC groups. There was a significant EXCHANGE x TOM interaction, Wilks' $\lambda = .75, F(6,76) = 4.27, p < .01$, multivariate partial $\eta^2 = .25$ (Figure 7). The repeated measures ANOVA did not yield a significant GROUP x TOM interaction, Wilks' $\lambda = .85, F(9, 192) = .81, p = .16$. The EXCHANGE x TOM x GROUP interaction was not significant either, Wilks' $\lambda = .78, F(18, 215) = .78, p = .35$. Significant group differences were present when TOM variables were compared across groups (Table 11). Figures 8 - 11 provide graphical representations of performance differences across EXCHANGE and TOM types.

Table 11. SI-M performance by group

TASIT (Maximum raw score)	Groups								$F(3,81)$	p	η_p^2	Contrast
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)					
	M	SD	M	SD	M	SD	M	SD				
Part 2 Total: SI-M (60)	41.86	8.21	49.40	8.39	54.05	4.36	55.91	3.32	20.61	<.01	0.43	SZ,BP+<BP-,HC
<i>Sincere Total (20)</i>	16.59	3.78	17.75	3.18	17.62	2.06	18.00	2.45	0.92	0.43		No Differences
Meaning (4)	4.23	1.02	4.40	1.00	4.52	0.60	4.55	0.74	0.64	0.59		No Differences
1st Order TOM (4)	4.14	1.08	4.30	1.08	4.19	0.75	4.27	0.77	0.14	0.94		No Differences
2nd Order TOM (4)	4.27	0.83	4.60	0.82	4.57	0.51	4.64	0.66	1.19	0.32		No Differences
Affective TOM (4)	4.00	1.16	4.45	0.83	4.33	0.80	4.55	0.67	1.59	0.20		No Differences
<i>Simple Sarcasm Total (20)</i>	12.82	5.09	15.90	4.13	18.48	1.99	18.77	1.88	13.26	<.01	0.33	SZ<BP+,BP-,HC; SZ,BP+<BP-,HC
Meaning (4)	3.14	1.42	3.75	1.41	4.67	0.48	4.64	0.66	10.25	<.01	0.28	SZ,BP+<BP-; BP+<BP-,HC
1st Order TOM (4)	3.14	1.42	3.75	1.33	4.52	0.60	4.64	0.58	9.62	<.01	0.26	SZ,BP+<BP-; BP+<BP-,HC
2nd Order TOM (4)	3.18	1.40	4.10	1.12	4.52	0.81	4.77	0.43	10.56	<.01	0.28	SZ<BP+; BP+<HC; BP+,BP-; BP-,HC
Affective TOM (4)	3.36	1.18	4.30	0.87	4.76	0.44	4.73	0.55	14.02	<.01	0.34	SZ<BP+,BP-,HC
<i>Paradoxical Sarcasm Total (20)</i>	12.41	4.52	15.75	3.28	17.95	2.29	19.14	0.99	20.41	<.01	0.43	SZ<BP+,BP-,HC; BP+<BP-,HC
Meaning (4)	3.14	1.52	4.10	1.25	4.62	0.67	4.91	0.29	12.06	<.01	0.31	SZ<BP+; BP+<HC; BP-,HC
1st Order TOM (4)	2.86	1.49	3.65	1.09	4.19	0.98	4.59	0.50	10.56	<.01	0.28	SZ<BP+; BP+<HC; BP-,HC
2nd Order TOM (4)	2.68	1.25	3.90	1.07	4.29	0.78	4.82	0.40	20.90	<.01	0.44	SZ<BP+; BP+<HC; BP-,HC
Affective TOM (4)	3.73	1.16	4.10	0.91	4.86	0.36	4.82	0.40	10.77	<.01	0.29	SZ,BP+<BP-,HC; BP-,HC

Note: SI-M = Social Inference - Minimal.

Figure 6. Social exchange by group interaction on SI-M

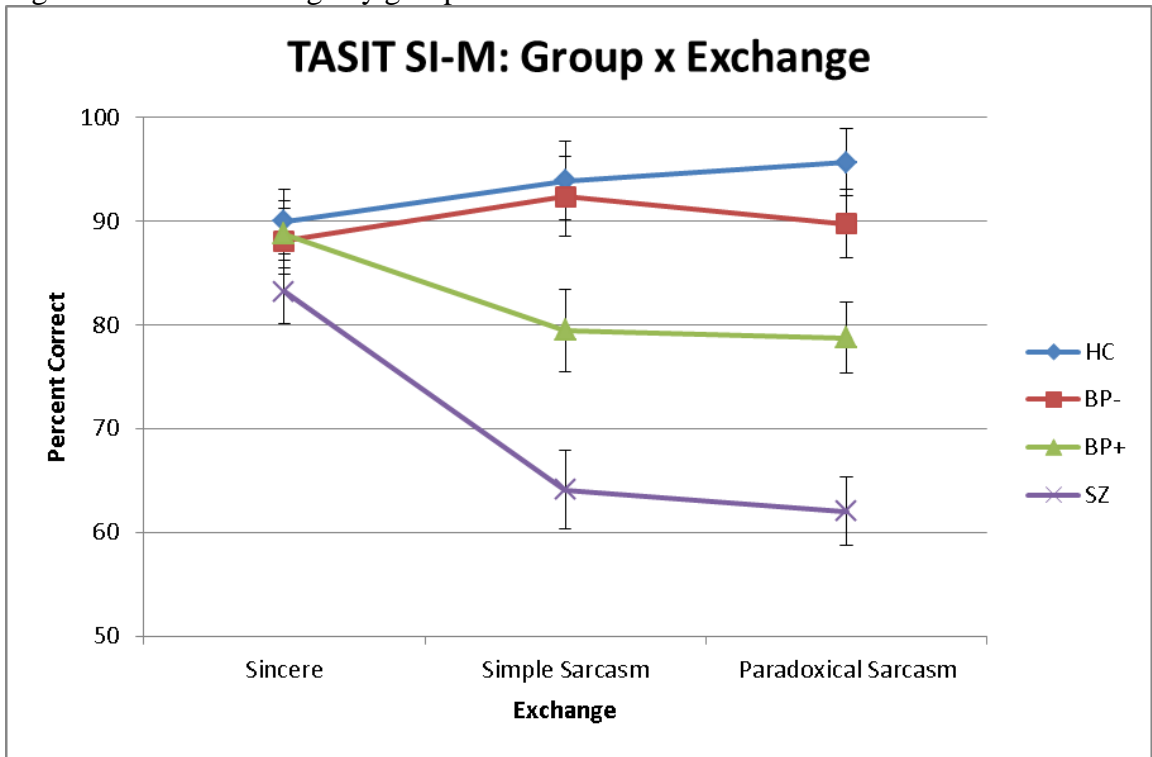


Figure 7. SI-M exchange by TOM interaction

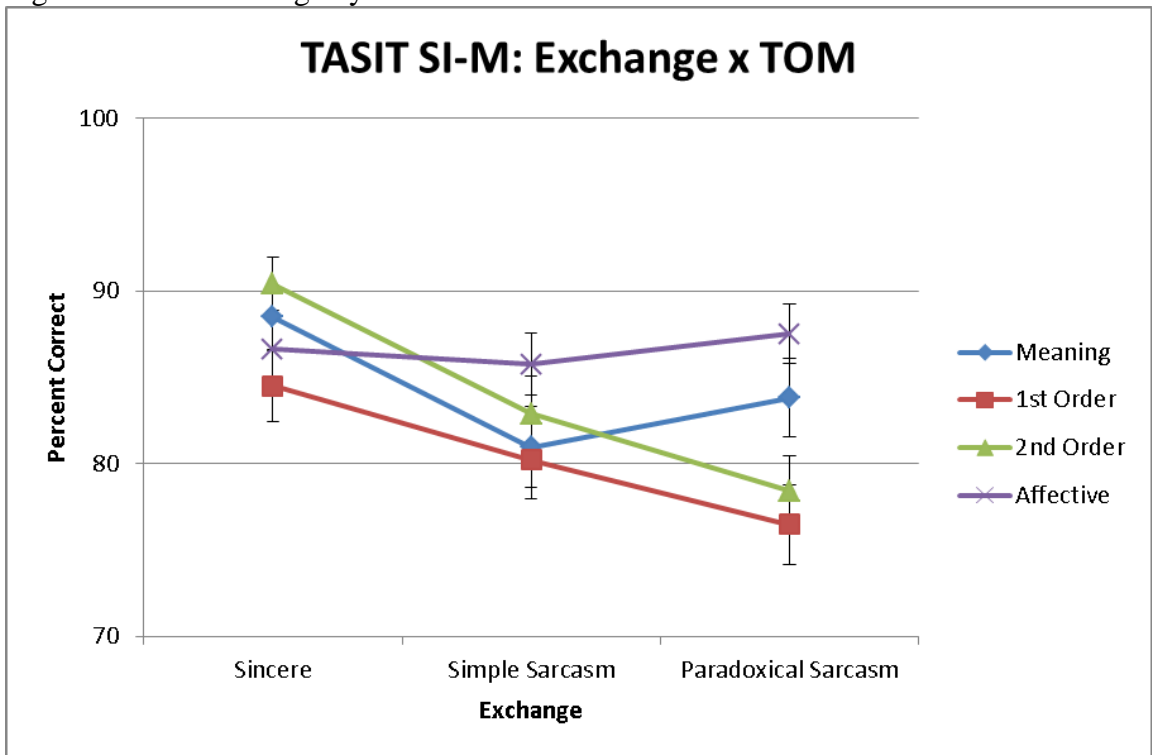


Figure 8. SI-M group performance by type of TOM: Meaning

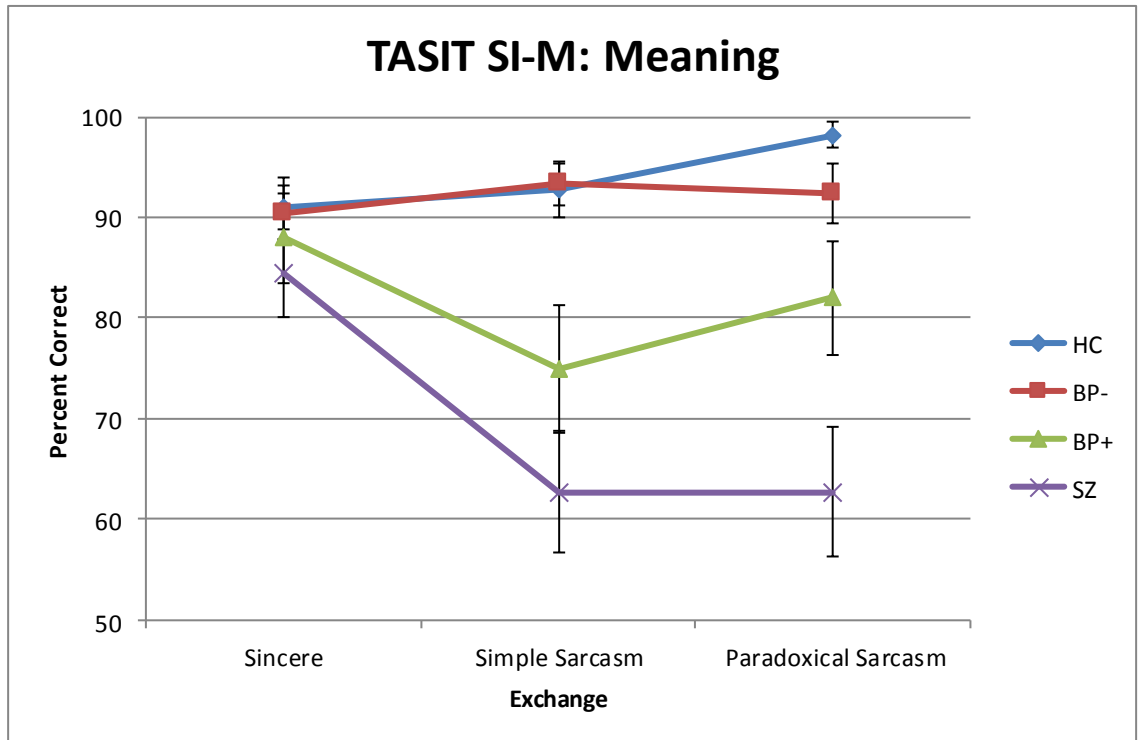


Figure 9. SI-M group performance by type of TOM: 1st Order TOM

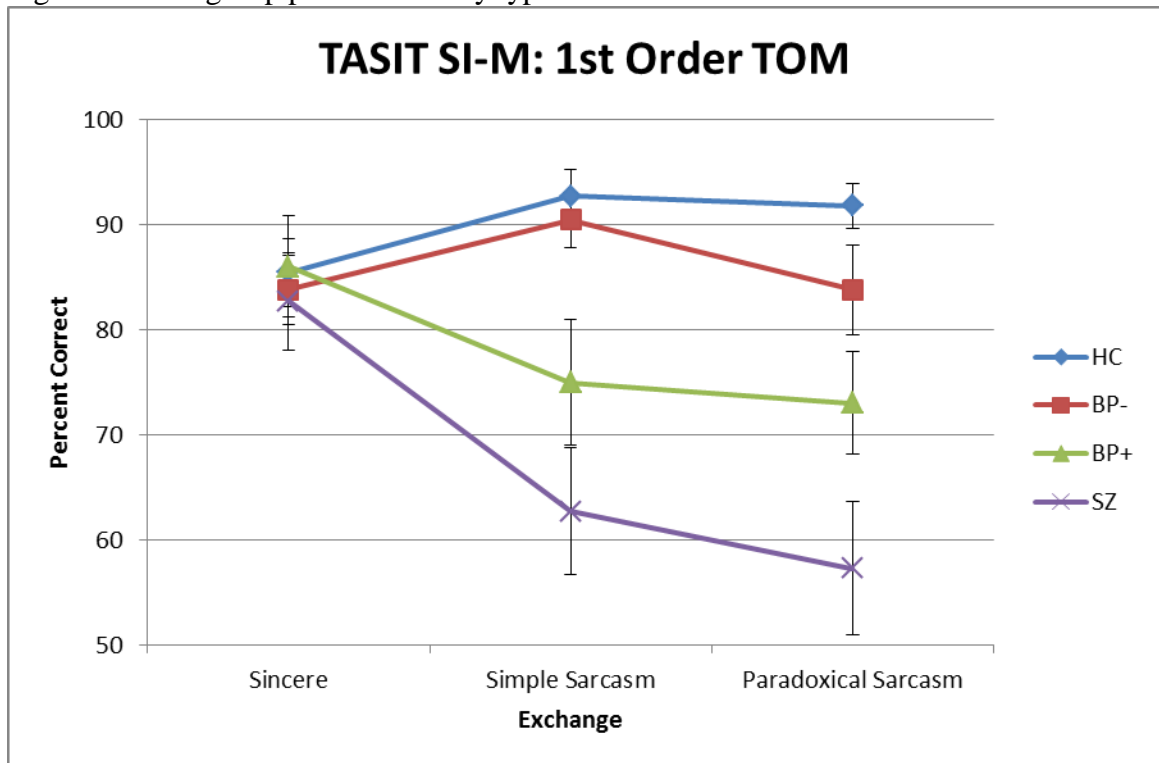


Figure 10. SI-M group performance by type of TOM: 2nd Order TOM

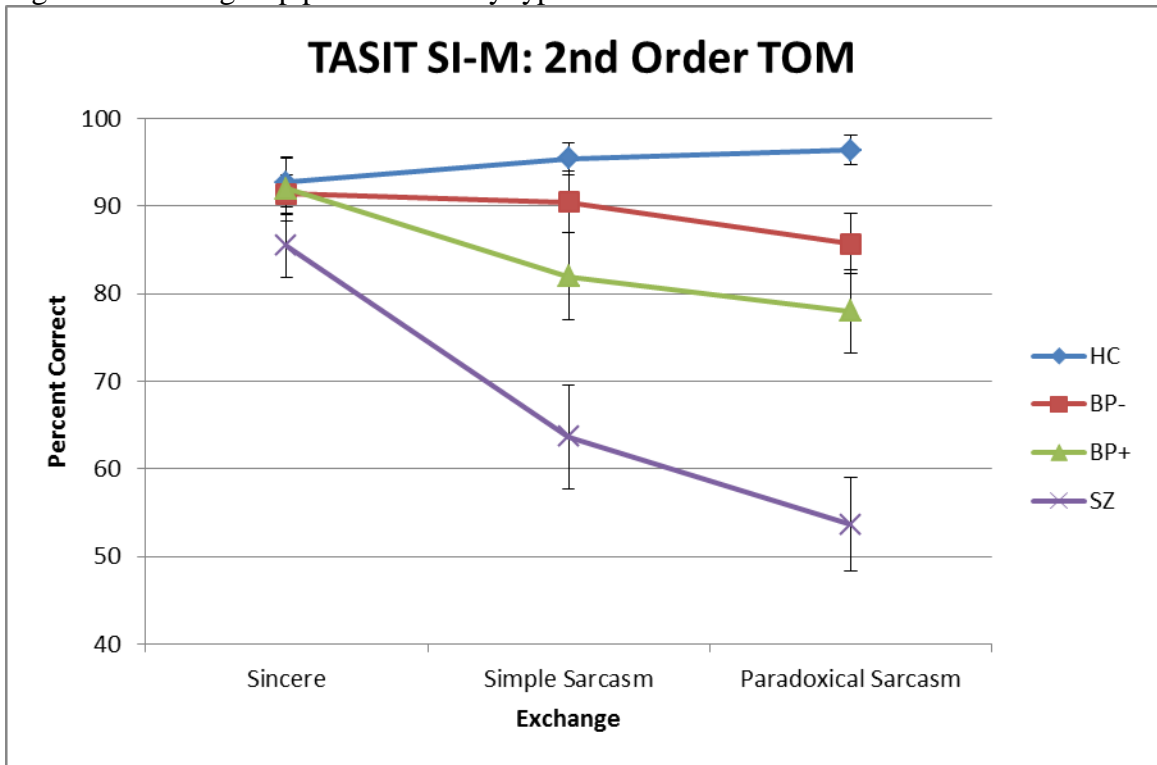
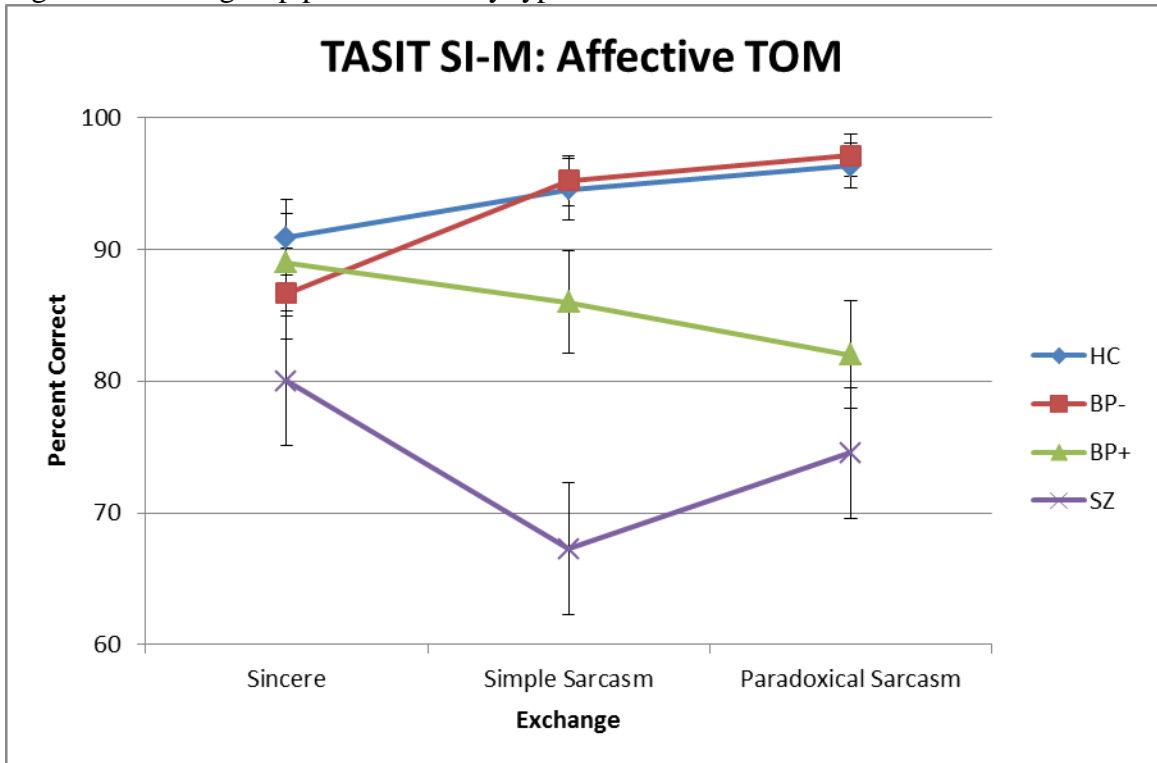


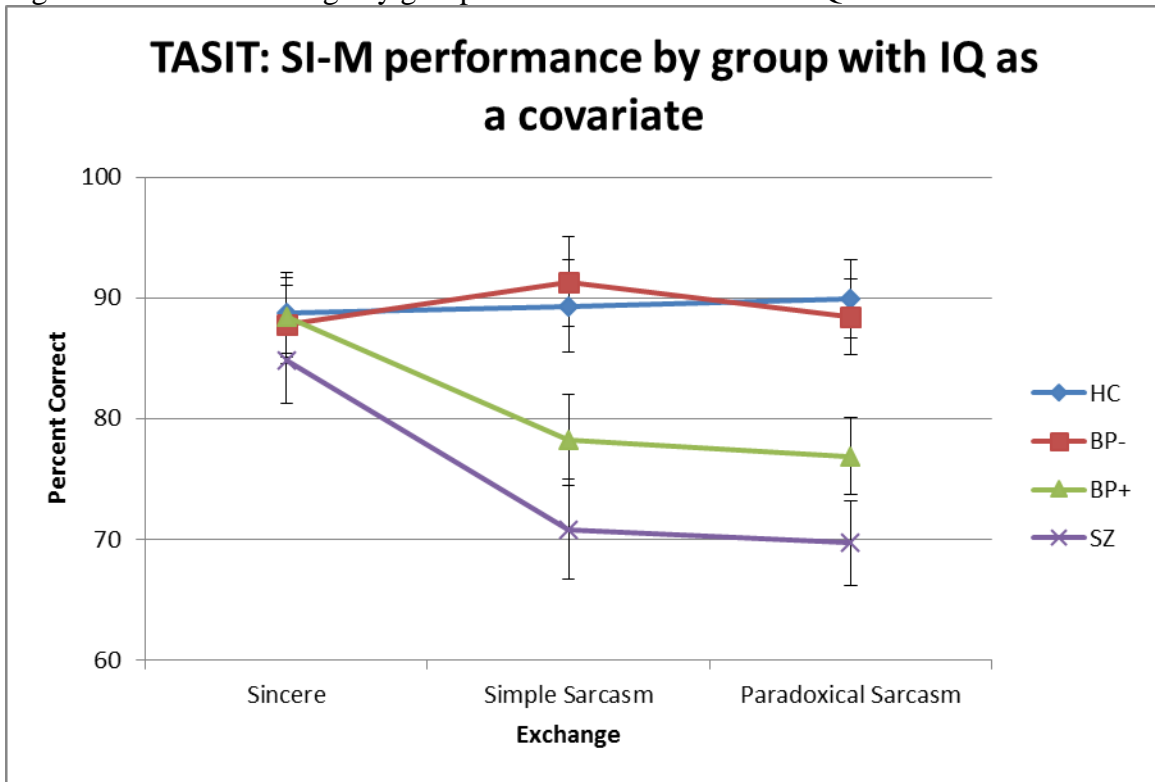
Figure 11. SI-M group performance by type of TOM: Affective TOM



Impact of Estimated Current IQ on Recognition and Identification of Sincere and Sarcastic Exchanges with Minimal Contextual Cues

A multivariate ANCOVA was used to evaluate participants' ability to correctly identify naturalistic social exchanges involving sincerity, simple sarcasm, and paradoxical sarcasm after controlling for the effects of IQ. For this analysis, the within-subjects factor consisted of three levels: sincere, simple sarcasm, and paradoxical sarcasm, the between-subjects variable concerned participant group, and the covariate was IQ. Results indicated a significant main effect for IQ, Wilks' $\lambda = .76$, $F(3,78) = 8.41$, $p < .001$, multivariate partial $\eta^2 = .24$. Between-subjects effects indicated the presence of group differences for performance on simple sarcasm items, $F(3,80) = 5.43$, $p < .005$, multivariate partial $\eta^2 = .17$ and paradoxical sarcasm items, $F(3,78) = 7.50$, $p < .001$, multivariate partial $\eta^2 = .22$, but not items involving sincere social exchanges, $F(3,78) = .21$, $p = .89$. K Matrix Contrast statistics indicated the SZ and BP+ groups performed significantly worse than the BP- and HC groups. The SZ and BP+ groups did not differ significantly from one another, nor did the BP- and HC groups. Adjusting for the effects of IQ significantly influenced performance by the SZ participants, such that scores more closely approximated the BP+ sample (Figure 12).

Figure 12. Social exchange by group interaction on SI-M with IQ as a covariate



Additional MANCOVAs were run to examine the effect of estimated current IQ on participants' recognition and interpretation of different types of TOM. Results indicated no significant group differences on the four types of TOM in the presence of sincere exchanges with the following significance values: Meaning ($p = .86$), 1st Order TOM ($p = .98$), 2nd Order TOM ($p = .91$), and Affective TOM $p = .77$. All types of TOM questions regarding simple sarcasm exchanges differed between groups: Meaning, $F(3,80) = 4.87, p < .005$, multivariate partial $\eta^2 = .15$, 1st Order TOM, $F(3,80) = 3.82, p < .05$, multivariate partial $\eta^2 = .13$, 2nd Order TOM, $F(3,80) = 3.64, p < .05$, multivariate partial $\eta^2 = .12$, and Affective TOM, $F(3,80) = 6.16, p = .001$, multivariate partial $\eta^2 = .19$. K Matrix Contrast statistics revealed no significant differences between the HC and BP- groups in their ability to correctly answer questions to the four types of TOM. The

BP+ group performed significantly worse than the BP- on Meaning and 1st Order TOM questions. The SZ group performed significantly worse than the HC and BP- groups on all types of TOM. The SZ group performed significantly worse than the BP+ group on SI-M items involving Affective TOM. The BP+ group did not performed significantly worse than the HC group on items involving 2nd Order TOM and Affective TOM. When Similarly, TOM questions related to paradoxical sarcasm exchanges differed significantly between groups: Meaning, $F(3,80) = 3.77, p < .05$, multivariate partial $\eta^2 = .12$, 1st Order TOM, $F(3,80) = 3.63, p < .05$, multivariate partial $\eta^2 = .12$, 2nd Order TOM, $F(3,80) = 6.59, p < .001$, multivariate partial $\eta^2 = .20$, and Affective TOM, $F(3,80) = 5.64, p = .001$, multivariate partial $\eta^2 = .17$. K Matrix Contrast statistics indicated that the SZ group performed significantly worse than the HC and BP- groups on all types of TOM. The SZ group performed significantly worse than the BP+ group on SI-M items involving 2nd Order TOM. Results also indicated that the BP+ group performed significantly worse than HCs in their ability to correctly recognize and interpret 1st Order, 2nd Order, and Affective TOM items. Moreover, the BP+ group performed significantly worse than the BP- group on Affective TOM questions. There were no significant differences between the HC and BP- groups in their ability to correctly answer questions to the four types of TOM (Figures 13-16).

Figure 13. SI-M group performance by type of TOM with IQ as a covariate: Meaning

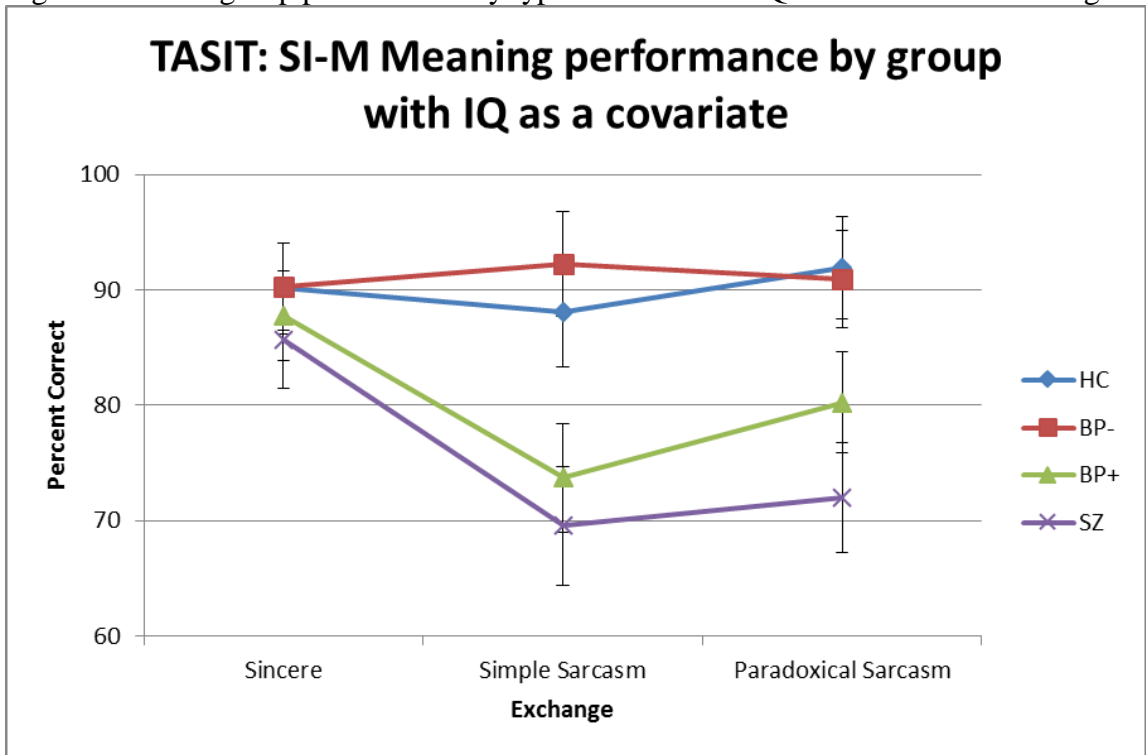


Figure 14. SI-M group performance by type of TOM with IQ as a covariate: 1st Order TOM

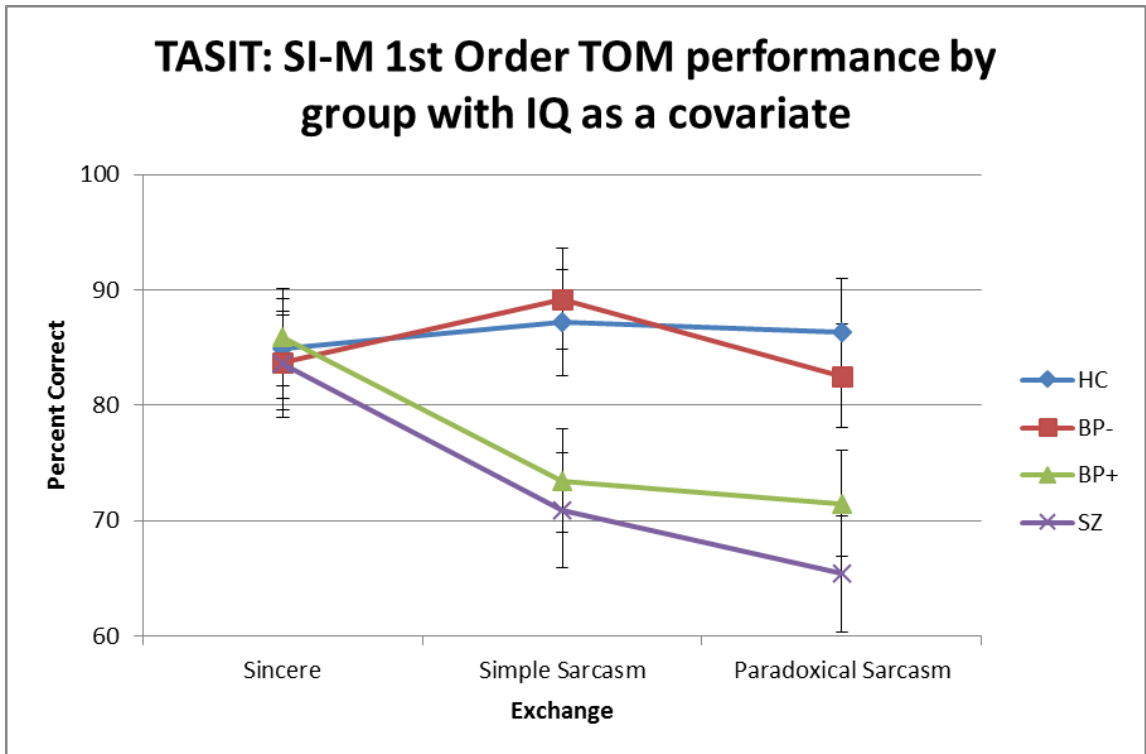


Figure 15. SI-M group performance by type of TOM with IQ as a covariate: 2nd Order TOM

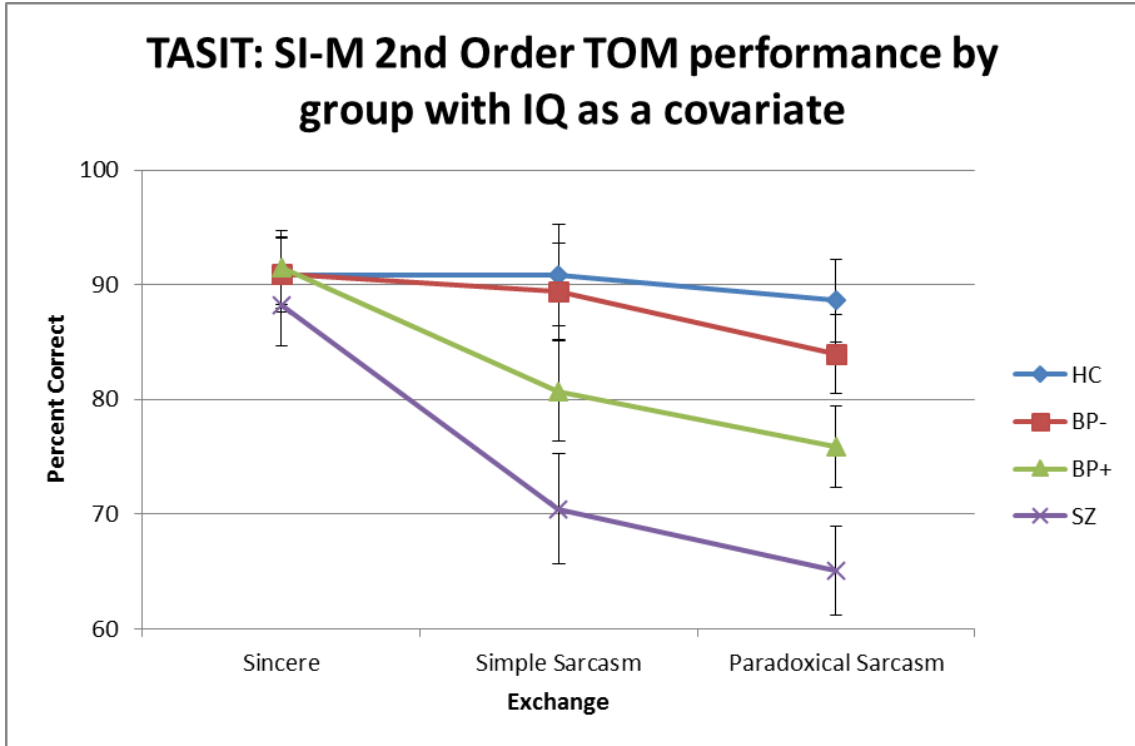
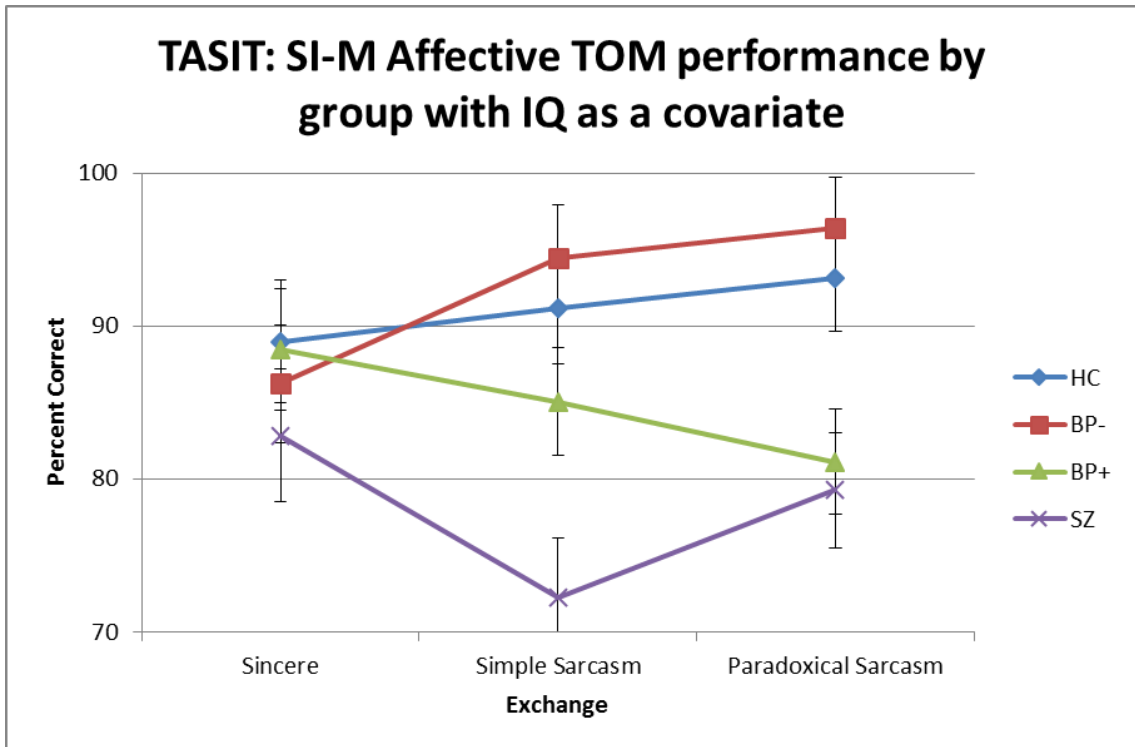


Figure 16. SI-M group performance by type of TOM with IQ as a covariate: Affective TOM



Identification of Naturalistic Social Exchanges with Contextual Cue

A repeated measures ANOVA was used to evaluate participants' ability to interpret TOM-related questions in the presence of lying and sarcastic social exchanges. A 2 x 4 factorial model was used to evaluate differences among groups. The first within-subjects factor was titled EXCHANGE and this factor consisted of two levels: Lie and Sarcasm. The second within-subjects factor was labeled TOM and consisted of four levels, each which represented a different type of TOM according to TASIT: Meaning, 1st Order TOM and 2nd Order TOM (Cognitive TOM), and Affective TOM. The between-subjects variable concerned participant groups (SZ, BP+, BP-, and HC).

Results indicated several notable group differences were present when TOM variables were compared across groups (Table 12 and Figure 17). Results also indicated a significant EXCHANGE x TOM interaction, Wilks' $\lambda = .46$, $F(3,79) = 31.57$, $p < .01$, multivariate partial $\eta^2 = .55$ (Figure 18). Two way interactions between TOM x GROUP and EXCHANGE x GROUP were not significant. Consistent with our hypothesis, there was a significant EXCHANGE x TOM x GROUP interaction, Wilks' $\lambda = .80$, $F(9, 192) = 2.09$, $p < .05$, multivariate partial $\eta^2 = .07$. Figures 19-22 provide graphical representations of performance differences across EXCHANGE and TOM types.

Table 12. SI-E performance by group

	Groups								F(3,81)	p	η_p^2	Contrast
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)					
TASIT (Maximum raw score)	M	SD	M	SD	M	SD	M	SD				
Part 3 Total: SI-E (64)	43.32	8.00	50.10	6.44	52.48	6.15	55.27	4.05	14.34	<.01	0.35	SZ<BP+,BP-,HC; BP+<HC; BP+,BP-
<i>Lie Total (32)</i>	22.64	4.33	26.50	3.44	26.33	3.92	27.36	3.54	6.56	<.01	0.20	SZ<BP-,BP+,HC
Meaning	5.00	1.69	6.60	1.10	6.48	1.40	6.59	1.62	6.04	<.01	0.18	SZ<HC,BP-,BP+
1st Order TOM	5.73	1.12	6.45	1.05	6.57	1.03	6.95	0.72	5.90	<.01	0.18	SZ<BP+,BP-,HC
2nd Order TOM	6.14	1.39	7.05	0.89	7.19	0.81	7.27	0.77	6.02	<.01	0.18	SZ<BP+,BP-,HC
Affective TOM	5.77	1.74	6.40	1.54	6.10	1.61	6.55	1.63	0.96	0.42		No Differences
<i>Sarcasm Total (32)</i>	20.68	5.19	23.60	4.73	26.14	3.38	27.91	2.47	13.01	<.01	0.33	SZ<BP+; BP+<BP-,HC
Meaning	5.32	1.52	5.60	1.57	6.43	1.43	7.14	1.25	7.06	<.01	0.21	SZ,BP+<BP-,HC; BP+,BP-; BP-,HC
1st Order TOM	5.95	1.56	6.80	1.15	7.33	0.73	7.18	0.73	6.85	<.01	0.20	SZ<BP+,HC,BP-
2nd Order TOM	4.41	1.71	5.45	1.88	5.86	1.49	6.82	1.05	9.03	<.01	0.25	SZ<BP+,BP-<HC
Affective TOM	5.00	1.54	5.75	1.33	6.52	0.93	6.77	0.75	10.08	<.01	0.27	SZ<BP+; BP+<BP-,HC

Note: SI-E = Social Inference - Enhanced.

Figure 17. SI-E performance by group

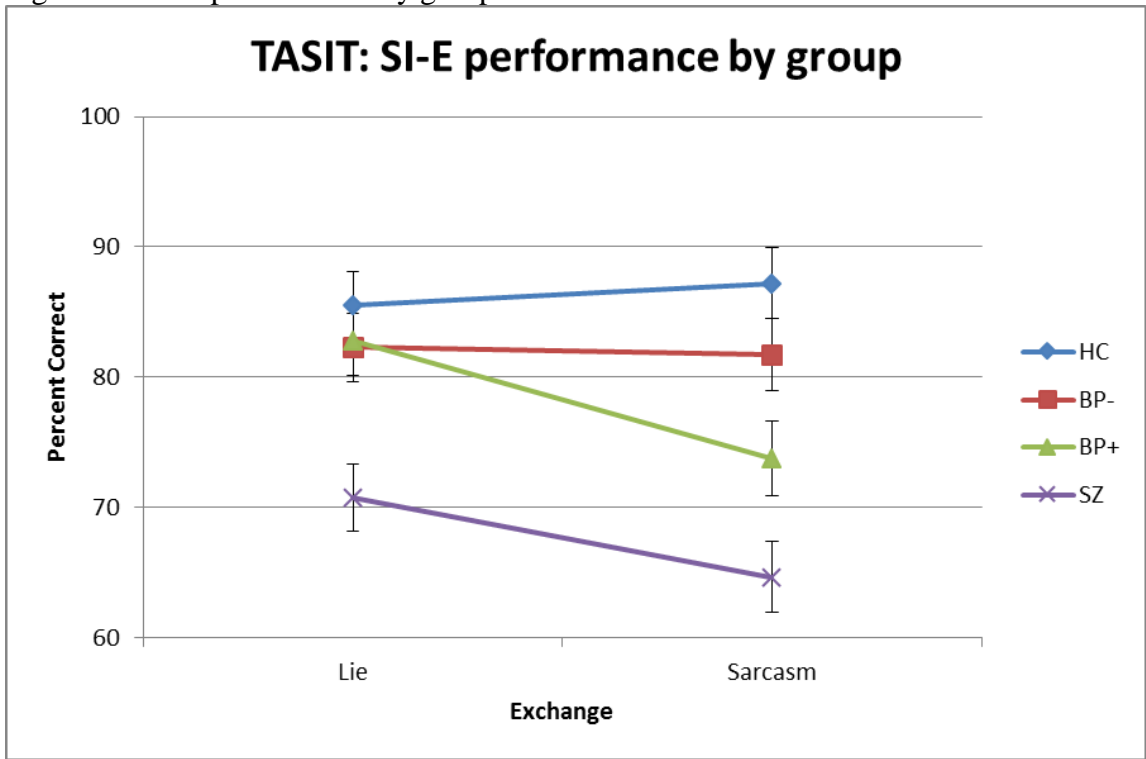


Figure 18. SI-E performance: Exchange by TOM interaction

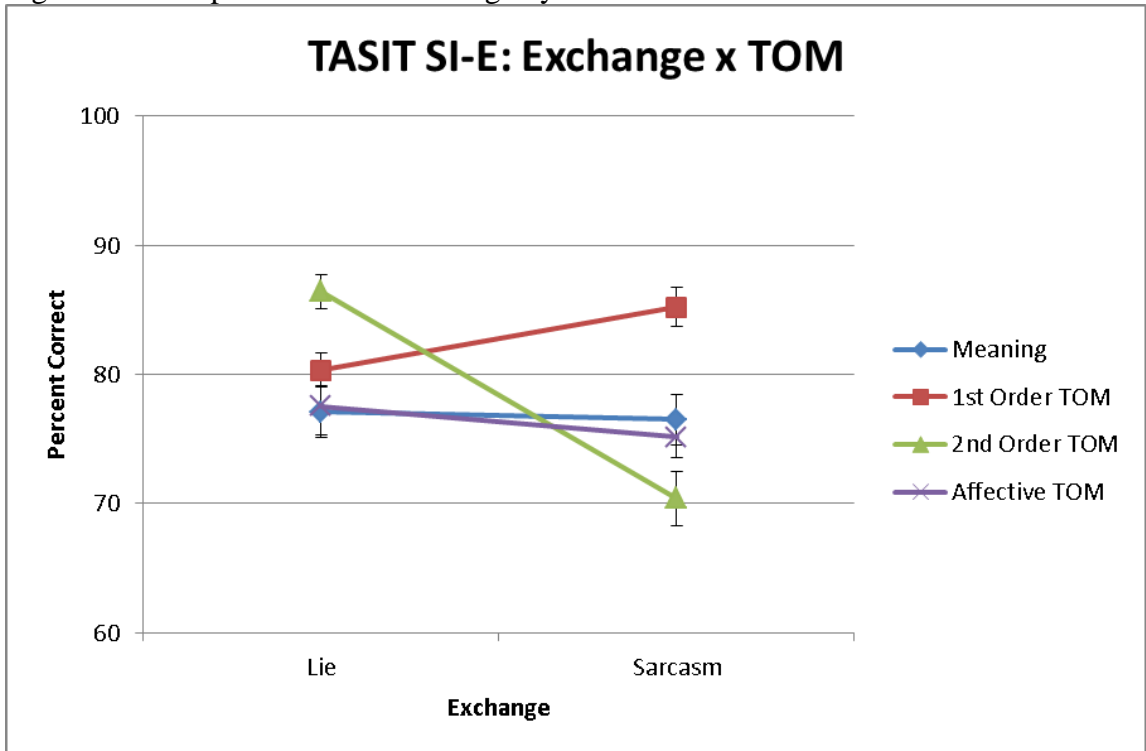


Figure 19. SI-E group performance by type of TOM: Meaning

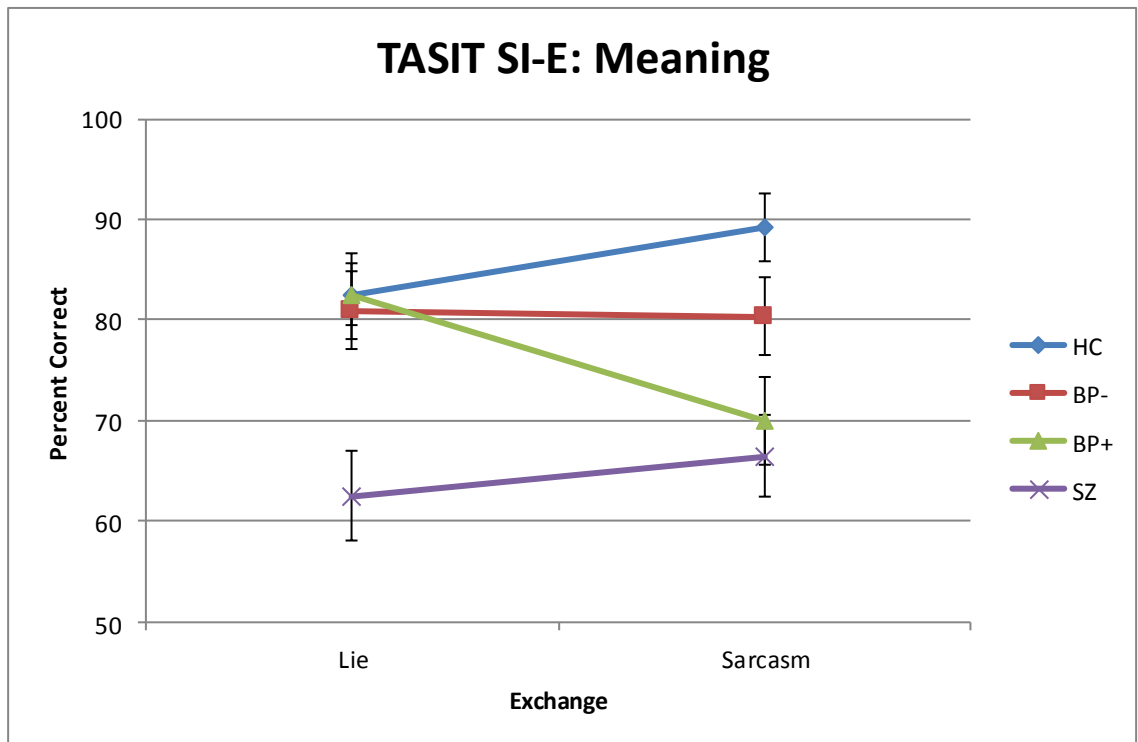


Figure 20. SI-E group performance by type of TOM: 1st Order TOM

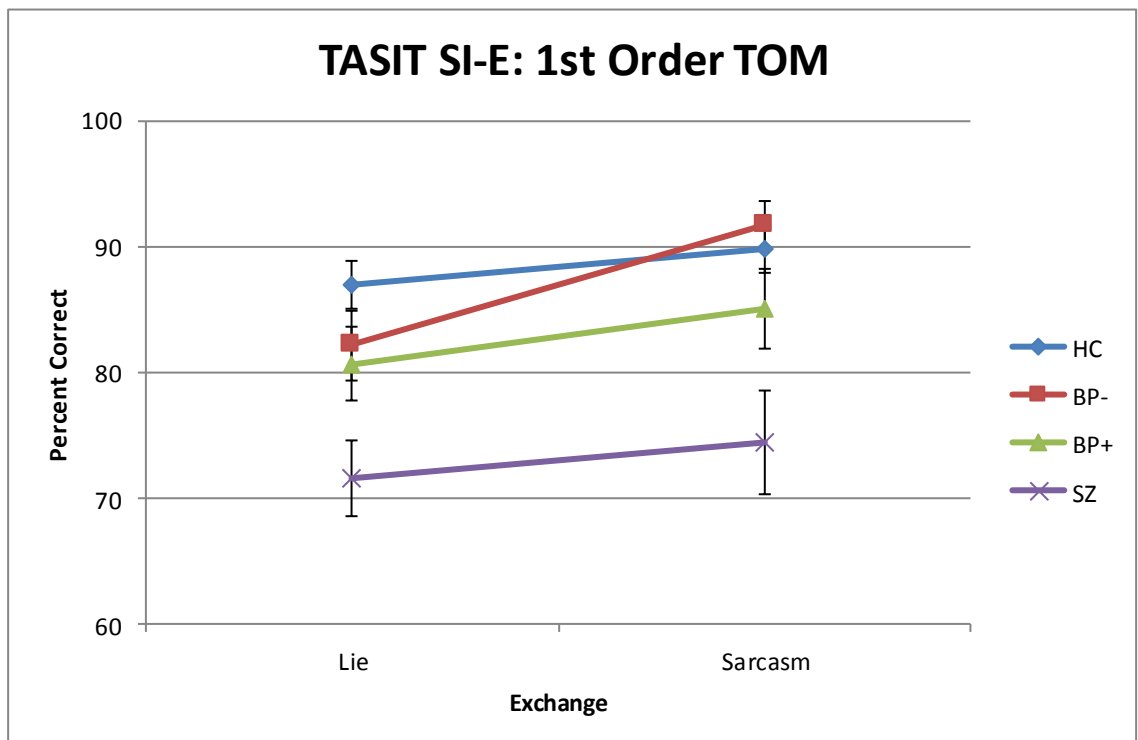


Figure 21. SI-E group performance by type of TOM: 2nd Order TOM

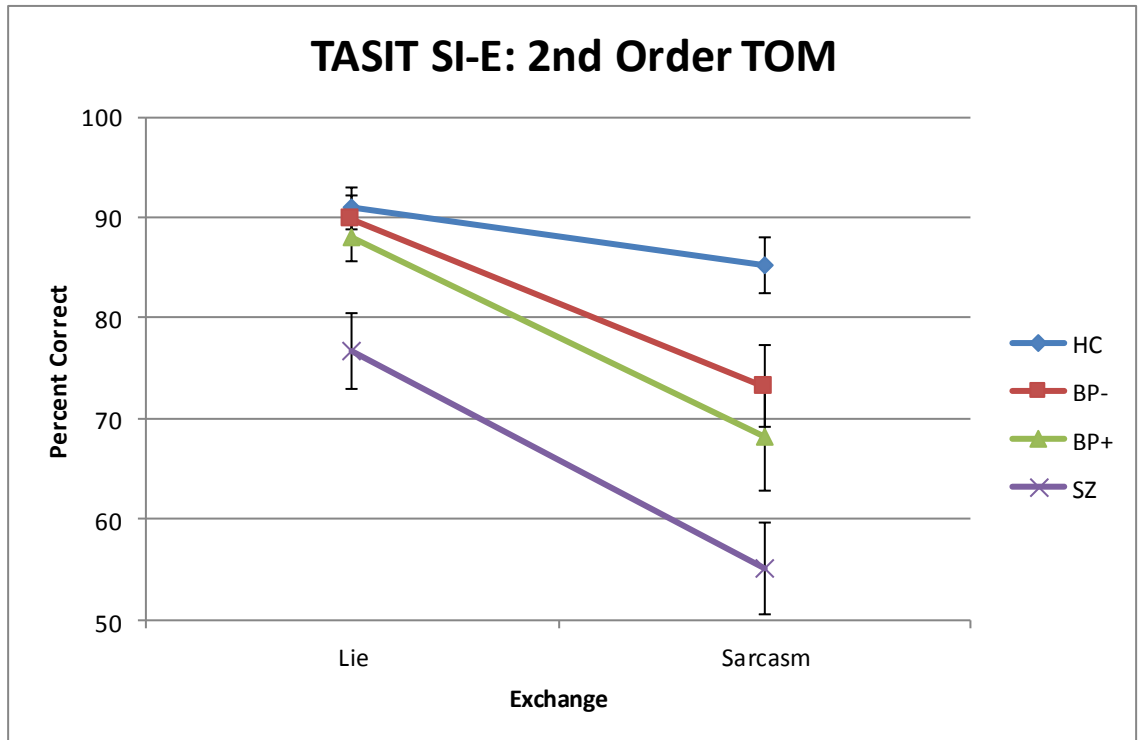
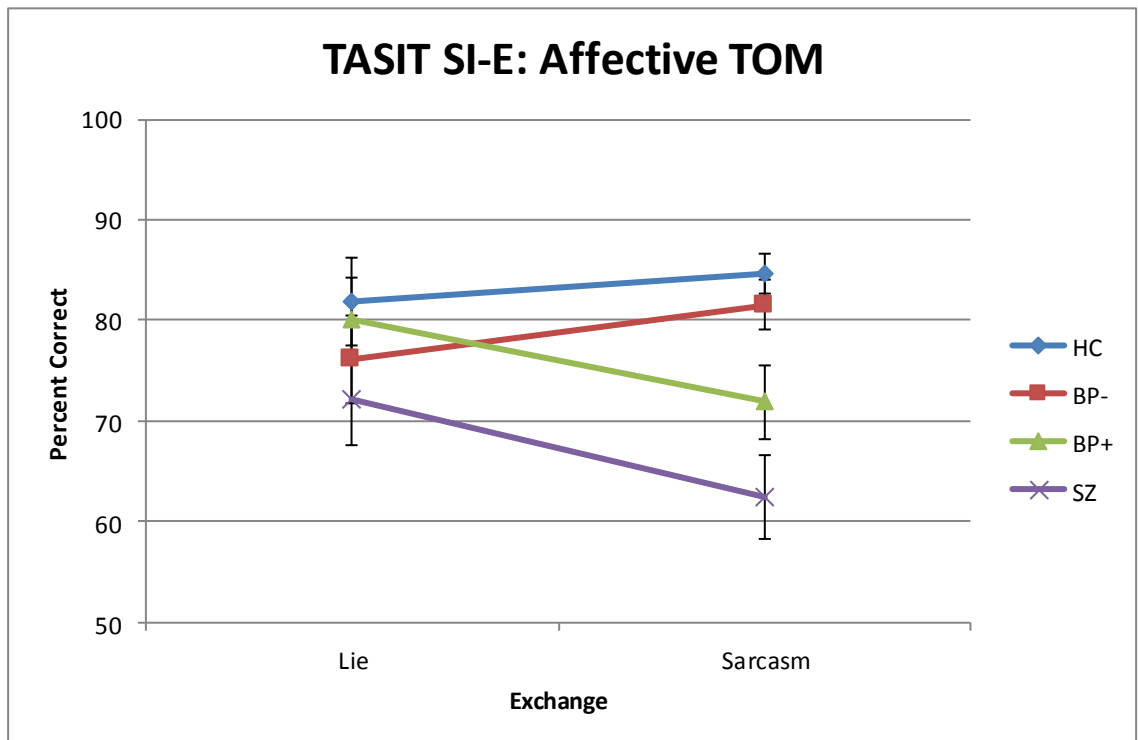


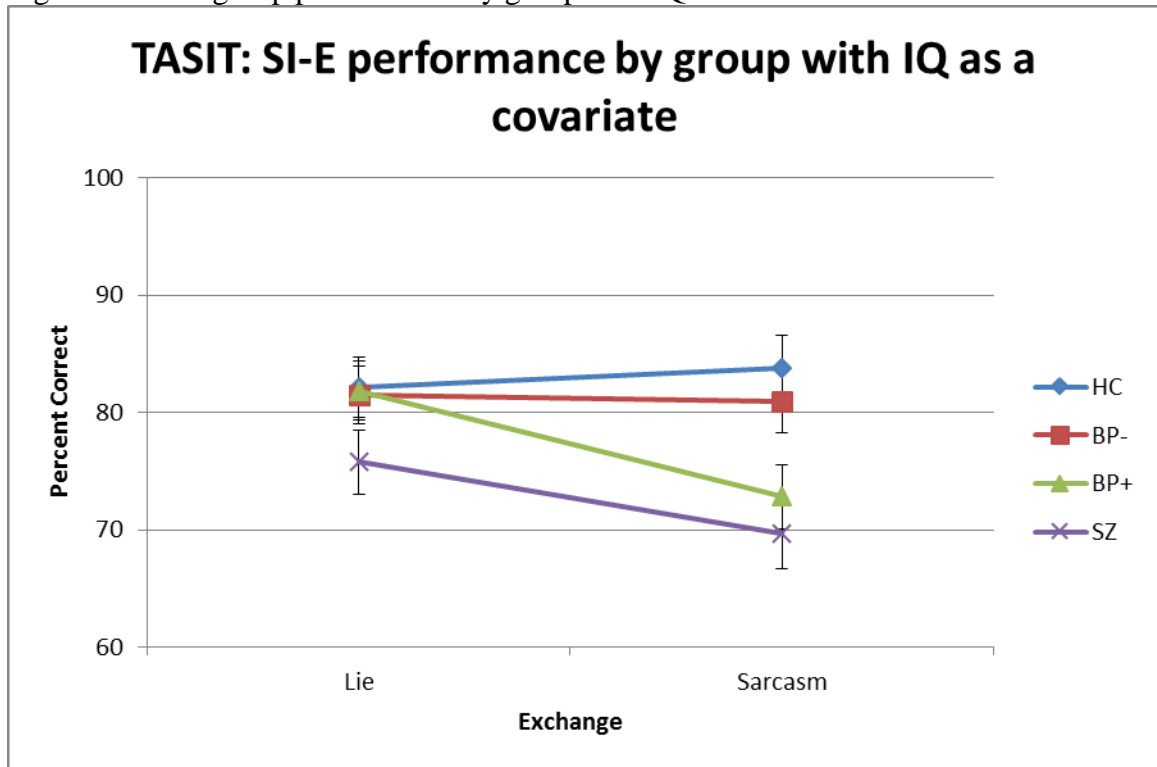
Figure 22. SI-E group performance by type of TOM: Affective TOM



Impact of Estimated Current IQ on Recognition and Identification of Sincere and Sarcastic Exchanges with Enhanced Contextual Cues

A multivariate ANCOVA was used to evaluate participants' ability to correctly identify deceitful and sarcastic social exchanges after controlling the effects of estimated current IQ. For this analysis, the within-subjects factor consisted of two levels: lie and sarcasm, the between-subjects variable concerned participant group, and the covariate was IQ. Results indicated a significant main effect for IQ, Wilks' $\lambda = .82$, $F(2,79) = 2.79$, $p < .05$, multivariate partial $\eta^2 = .10$. There was a significant between-subjects effect for sarcasm, $F(3,80) = 5.06$, $p < .005$, multivariate partial $\eta^2 = .16$, but not for items involving deceitful exchanges, $F(3,80) = 1.10$, $p = .35$. Regarding the sarcastic exchanges, K Matrix Contrast statistics indicated significantly worse performance by the SZ and BP+ groups compared to the BP- and HC groups, who did not differ significantly. The SZ and BP+ groups did not differ significantly from one another, nor did the BP- and HC groups (Figure 23).

Figure 23. SI-E group performance by group with IQ as a covariate



Next, a MANCOVA was used to examine the effect of estimated current IQ on participants' recognition and interpretation of different types of TOM in the presence of deceitful and sarcastic responses. There was a significant group effect, $F(8,73) = 1.58, p < .05$, multivariate partial $\eta^2 = .15$. However, the results indicated no significant group differences on the four types of TOM in the presence of lie exchanges with the following significance values: Meaning ($p = .12$), 1st Order TOM ($p = .14$), 2nd Order TOM ($p = .15$), and Affective TOM ($p = .82$). Although there was not a significant group effect for Lie items, the SZ group performed significantly worse than the BP participants, but not HCs, in their ability to correctly recognize and interpret Meaning items. Only two types of TOM involving sarcastic exchanges differed between groups, Meaning, $F(3,80) = 3.27, p < .05$, multivariate partial $\eta^2 = .11$ and Affective TOM, $F(3,80) = 7.63, p < .001$, multivariate partial $\eta^2 = .22$, whereas the other two types of TOM did not differ

significantly: 1st Order TOM $p = .08$ and 2nd Order TOM $p = .09$. Regarding the sarcasm items, K Matrix Contrast statistics indicated significantly worse performance by the BP+ group relative to the BP- and HC groups who did not differ. The SZ and BP+ groups differed significantly from HCs on items involving Meaning, 2nd Order TOM, and Affective TOM, but not 1st Order TOM. Performance by the SZ and BP+ groups did not differ significantly (Figures 24-27).

Figure 24. SI-E group performance by type of TOM with IQ as a covariate: Meaning

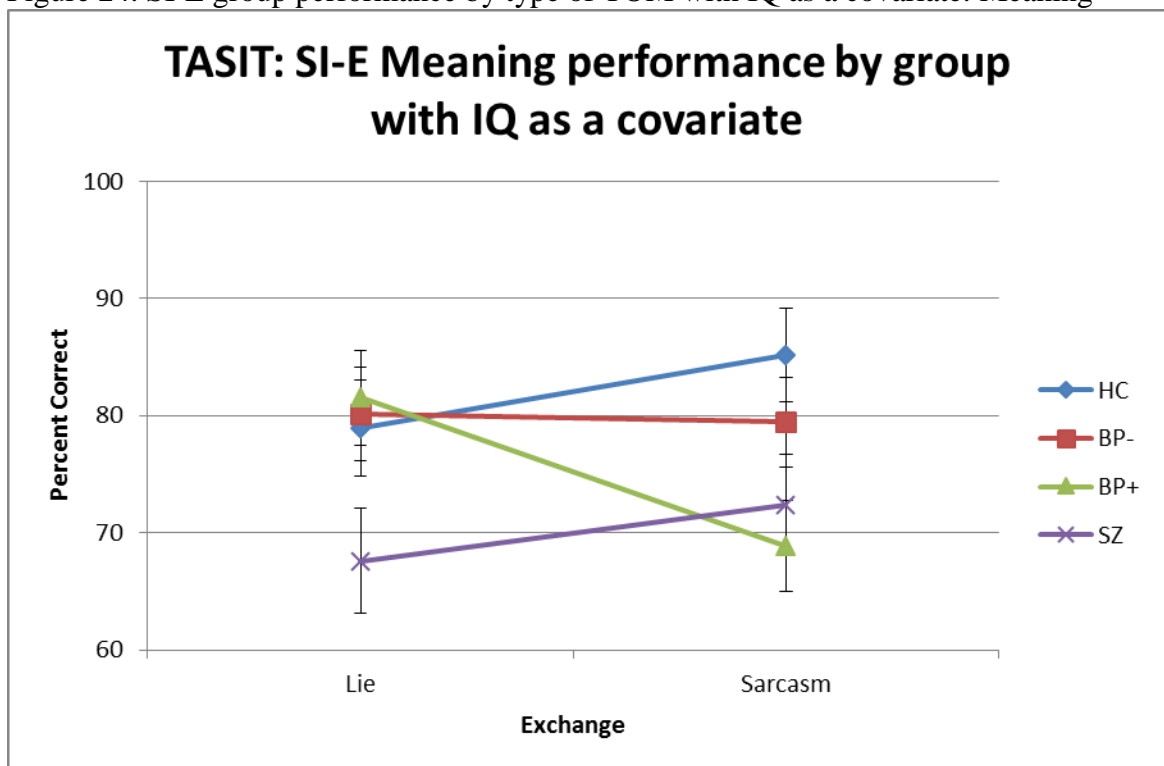


Figure 25. SI-E group performance by type of TOM with IQ as a covariate: 1st Order TOM

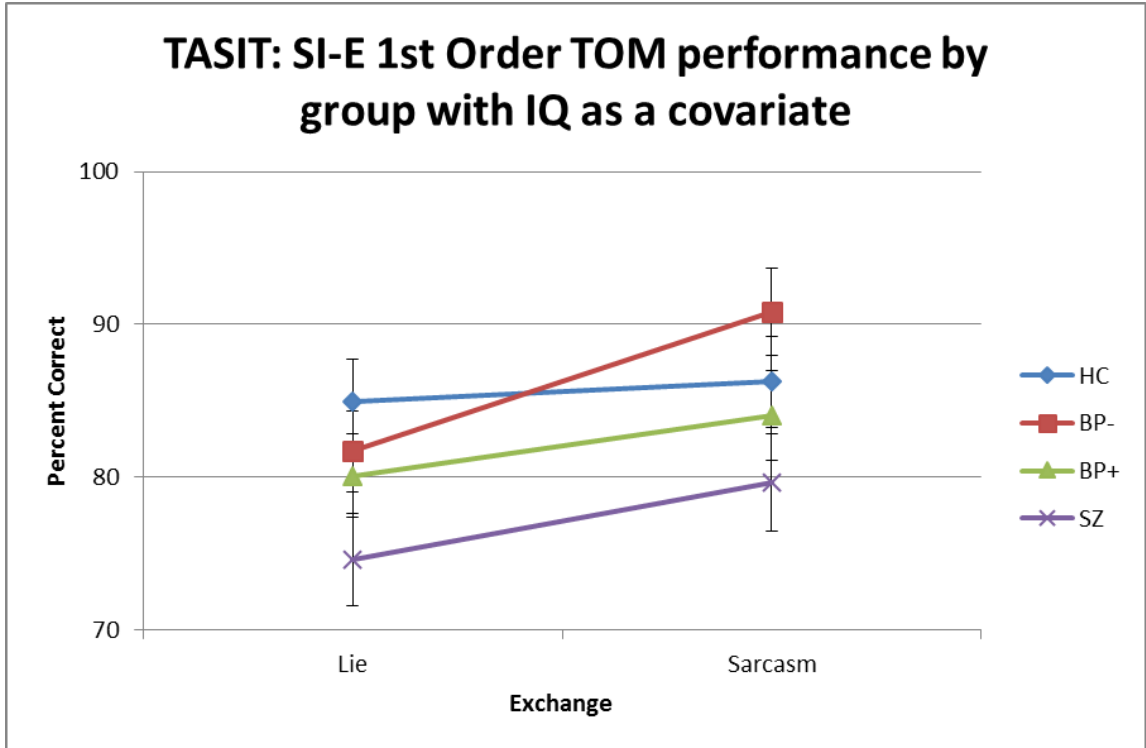


Figure 26. SI-E group performance by type of TOM with IQ as a covariate: 2nd Order TOM

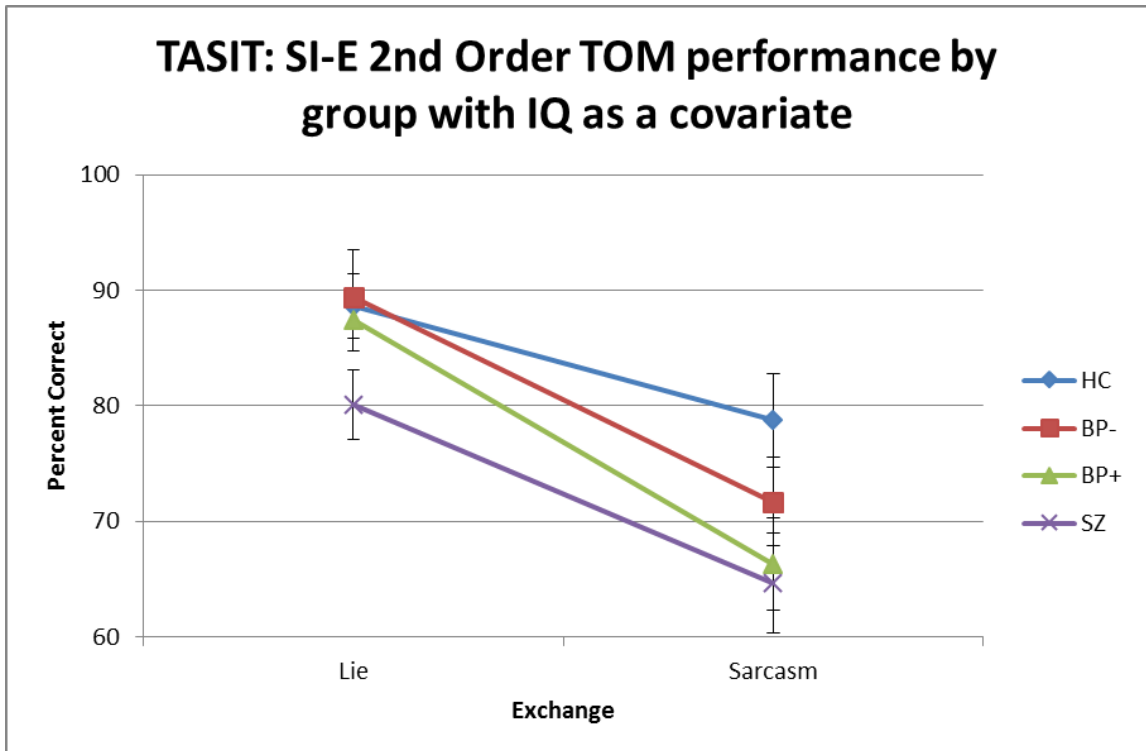
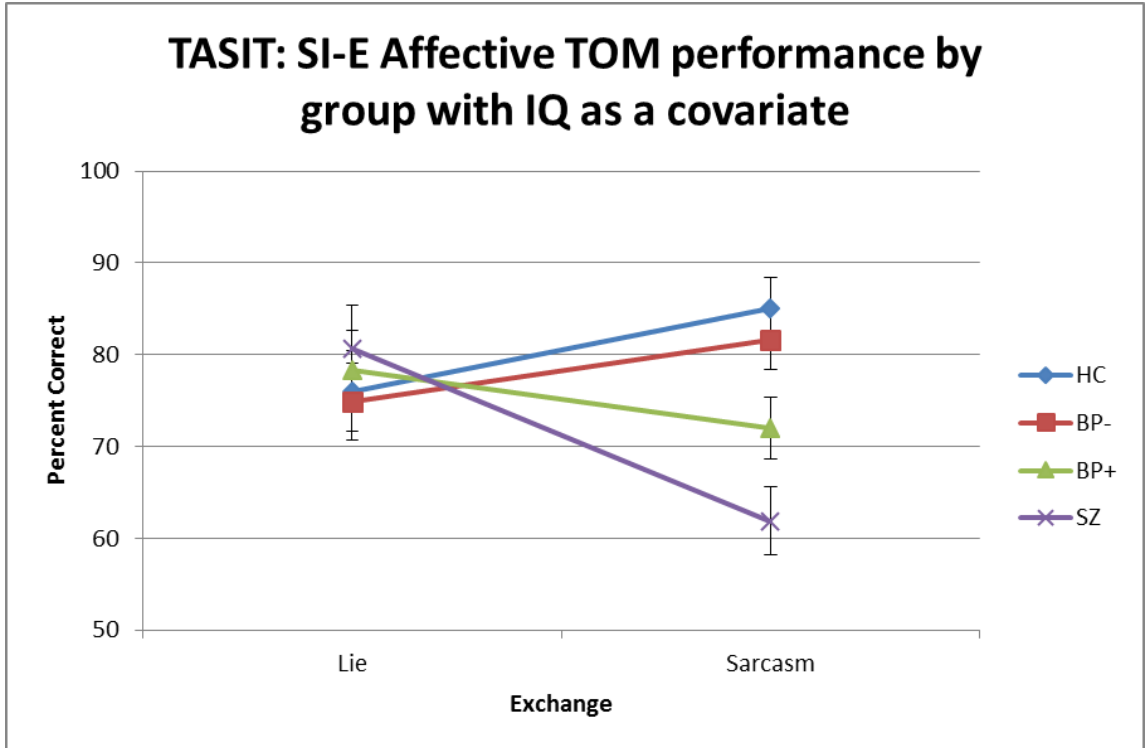


Figure 27. SI-E group performance by type of TOM with IQ as a covariate: Affective TOM



Evaluating the Impact of Context on Identification of Lie and Sarcastic Exchanges

Another repeated measures ANOVA was used to evaluate participants' ability to interpret lying and sarcastic social exchanges that were differentially enhanced by visual and text contextual cues. A 2 x 2 design was used to evaluate if the contextual cues influenced interpretation of lie and sarcastic social exchange among groups. The first within-subjects factor was titled EXCHANGE and consisted of two levels, Lie and Sarcasm. The second within-subjects factor was labeled CONTEXT and consisted of two levels each which represented different type of contextual cue according to TASIT. The between-subjects variable concerned the participant groups (SZ, BP+, BP-, and HC).

Results shown in Table 13 and indicated a significant EXCHANGE x CONTEXT interaction, Wilks' $\lambda = .68$, $F(1,81) = 37.58$, $p < .001$, multivariate partial $\eta^2 = .32$, with visual-loaded sarcastic exchanges being significantly more difficult to correctly interpret than sarcastic text-loaded exchanged. Differences in context did not appear to influence participants' ability to interpret naturalistic social exchanges involving lies (Table 14).

Table 13. SI-E performance separated with contextual cues by group

TASIT (Maximum raw score)	Groups								F	p	η_p^2	Contrast
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)					
	M	SD	M	SD	M	SD	M	SD				
Part 3: SI-E (64)	43.32	8.00	50.10	6.44	52.48	6.15	55.27	4.05	14.34	<.01	0.35	SZ<BP+,BP-,HC; BP+<HC; BP+,BP-
<i>Lie (32)</i>	22.64	4.33	26.50	3.44	26.33	3.92	27.36	3.54	6.56	<.01	0.20	SZ<BP-,BP+,HC
Visual Load	11.82	2.52	12.85	2.43	13.14	2.35	14.09	1.72	3.73	<.05	0.12	SZ<BP+,BP-,HC
Text Load	10.82	2.72	13.65	1.76	13.19	2.06	13.27	2.16	7.35	<.01	0.21	SZ<HC,BP-,BP+
<i>Sarcasm (32)</i>	20.68	5.19	23.60	4.73	26.14	3.38	27.91	2.47	13.01	<.01	0.33	SZ<BP+; BP+<BP-,HC
Visual Load	8.77	3.07	10.90	2.86	11.87	2.69	13.14	2.05	10.25	<.01	0.28	SZ<BP+; BP+<BP-,HC; BP+,BP-
Text Load	11.91	3.19	12.70	2.85	14.29	1.65	14.77	1.45	6.75	<.01	0.20	SZ,BP+<BP-; BP+<BP-,HC

Note: SI-E = Social Inference - Enhanced.

Finally, a series five one-way repeated measures ANOVA were conducted to evaluate ascertain whether visual or text loaded cues influenced recognition and interpretation of sarcastic exchanges. The first one-way repeated measures ANOVA was run to assess group difference between sarcasm scores on TASIT Part II and Part III. In this analysis, the between-subjects variable was participant groups (SZ, BP+, BP-, and HC) and the within-subjects factor, titled PART, consisted of two levels: 1) Correct responses for all sarcasm items in Part II of TASIT and 2) Correct responses for all sarcasm items in Part III of TASIT. Results indicated a significant PART x GROUP effect, Wilks' $\lambda = .90$, $F(3, 81) = 3.09$, $p < .05$, multivariate partial $\eta^2 = .10$ suggesting the presence of significant changes between TASIT parts by group. K Matrix Contrast statistics indicated that the SZ group performed significantly worse than the BP+ group who in-turn struggled significantly more than the BP- and HCs who did not differ significantly. Given that this analysis produced significant results, the series of ANOVAs

was initiated. There was a significant PART x GROUP effect when TASIT Part II Simple Sarcasm scores were compared with the Text augmented TASIT Part III items Wilks' $\lambda = .89$, $F(3, 81) = 3.43$, $p < .05$, multivariate partial $\eta^2 = .11$. K Matrix Contrast statistics indicated that performance by the SZ and BP+ groups did not differ significantly and was significantly worse than the BP- and HCs who, similarly, did not perform significantly different from one another. Similar findings were present when TASIT Part II Paradoxical Sarcasm scores were compared with scores from Text augmented TASIT Part III Wilks' $\lambda = .85$, $F(3, 81) = 4.62$, $p < .01$, multivariate partial $\eta^2 = .15$. As reported above, K Matrix Contrast statistics indicated the worst performance by the SZ group who performed significantly worse than the BP+, who then performed significantly worse than the BP- and HC groups who did not differ significantly. There were no significant results when Simple and Paradoxical sarcasm items from Part II of TASIT were evaluated against TASIT Part III visually augmented social exchanges; insofar as visual cues did not appear to significantly improve performance. Recognize still that different levels of performance were present. Results suggested that the SZ and BP+ groups consistently performed significantly worse than the BP- and HCs groups who did not differ significantly. When considered individually, paired-samples t-test was conducted to evaluate the impact context has on correct recognition and interpretation of sarcastic social exchanges in the SZ group. There was a statistically significant improvement in performance from correct recognition and interpretation of simple sarcasm items on TASIT Part II ($M = 64.10$, $SD = 25.43$) to sarcasm items on Part III ($M = 74.43$, $SD = 19.94$), $t(21) = 2.38$, $p < .05$ (two-tailed). The mean increase in performance was 20.36 with a 95% confidence interval ranging from 1.31 to 19.37. The

eta squared statistic (.21) indicated a small-to-medium effect size. Additionally, there was a statistically significant improvement in performance from correct recognition and interpretation of paradoxical sarcasm items on TASIT Part II ($M = 61.14$, $SD = 24.25$) to sarcasm items on Part III ($M = 74.43$, $SD = 19.94$), $t(21) = 2.88$, $p < .01$ (two-tailed). The mean increase in performance was 21.66 with a 95% confidence interval ranging from 3.69 to 22.90. The eta squared statistic (.28) indicated a medium effect size. Also, individuals with SZ were the only group to improve significantly with the use Text loaded social exchanges. Contrary to our hypothesis, overall sarcasm performance from TASIT Part II ($M = 91.07$, $SD = 9.03$) to Part III decreased in the BP- group ($M = 81.70$, $SD = 10.56$), $t(20) = 4.30$, $p < .01$ (two-tailed). The mean decrease in performance was 9.37 with a 95% confidence interval ranging from 4.83 to 13.91. The eta squared statistic (.48) indicated a medium-to-large effect size. A similar pattern was found in the HC group, such that overall sarcasm performance from TASIT Part II ($M = 94.77$, $SD = 5.56$) to Part III decreased significantly ($M = 87.22$, $SD = 7.71$), $t(21) = 3.32$, $p < .01$ (two-tailed). The mean decrease in performance was 7.55 with a 95% confidence interval ranging from 2.81 to 12.29. The eta squared statistic (.34) indicated a medium effect size (Figures 28-30).

Table 14. TASIT sarcasm performance with contextual cue by group

Percent Correct	Groups								<i>F</i> (3,81)	<i>p</i>	<i>Contrast</i>
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)				
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
TASIT Part II Sarcasm Total	62.61	21.54	79.00	17.37	91.07	9.03	94.77	5.56			
TASIT Part III Sarcasm Total	64.63	16.21	73.75	14.78	81.70	10.56	87.22	7.71	3.09	<.05	SZ<BP+<BP-,HC
TASIT Part II Simple Sarcasm	64.09	25.43	79.50	20.64	92.38	9.95	93.86	9.38			
Part III Visual Sarcasm	54.83	19.18	68.13	17.90	74.11	16.80	82.10	12.84	0.73	>.05	No Difference
Part III Text Sarcasm	74.43	19.94	79.38	17.81	89.29	10.30	92.33	9.03	3.43	<.05	SZ,BP+<BP-,HC
TASIT Part II Paradoxical	61.14	24.25	78.50	16.39	89.76	11.45	95.68	4.95			
Part III Visual Sarcasm	54.83	19.18	68.13	17.90	74.11	16.80	82.10	12.84	0.88	>.05	No Difference
Part III Text Sarcasm	74.43	19.94	79.38	17.81	89.29	10.30	92.33	9.03	4.62	<.01	SZ<BP+<BP-,HC

Figure 28. TASIT total sarcasm performance on Part II and III by group

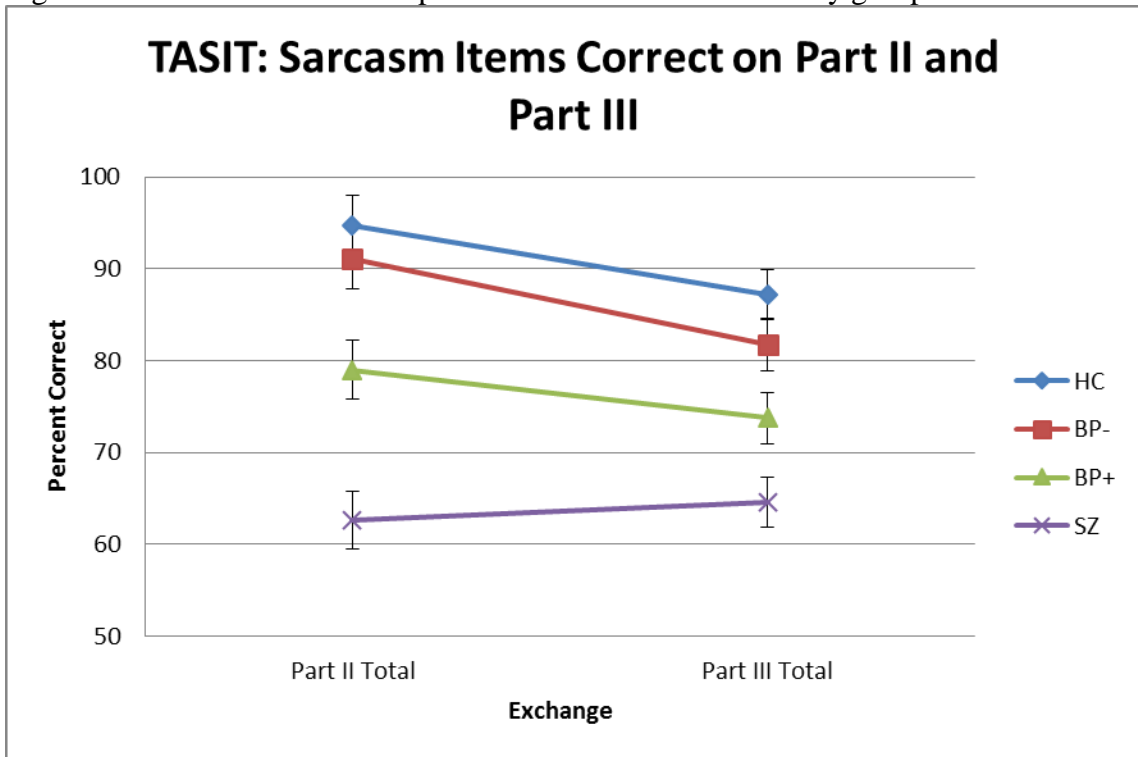


Figure 29. TASIT Part II simple sarcasm and Part III sarcasm text by group

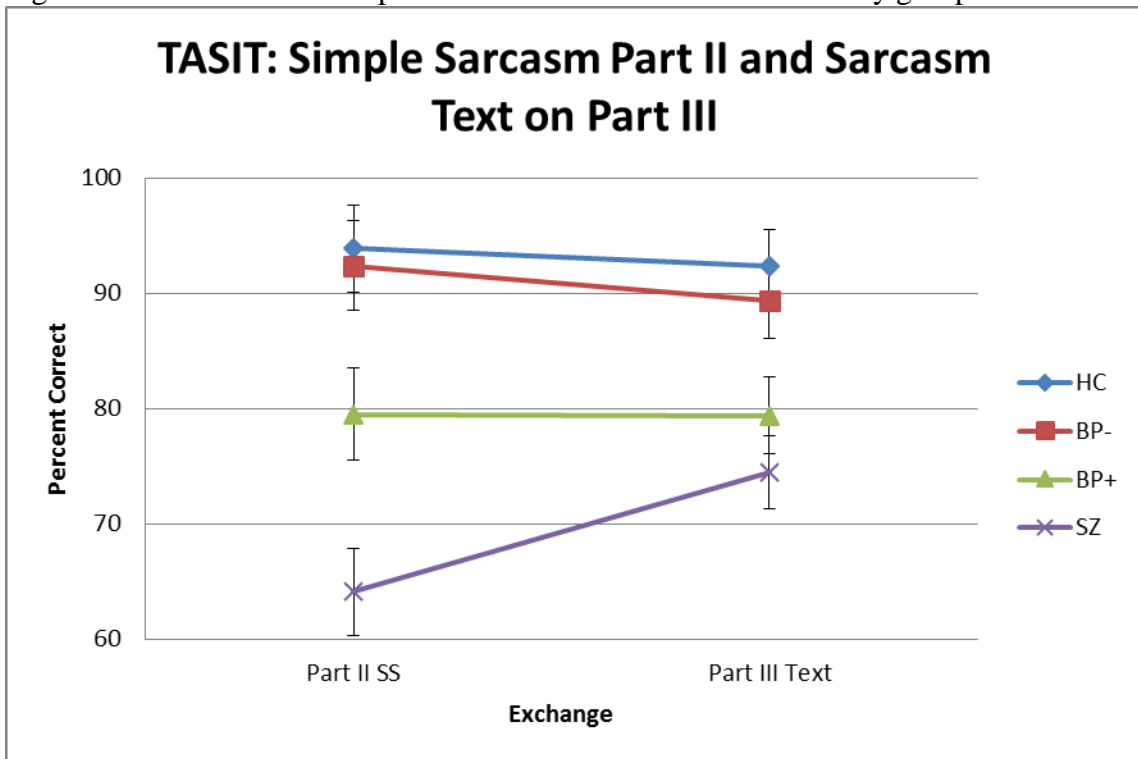
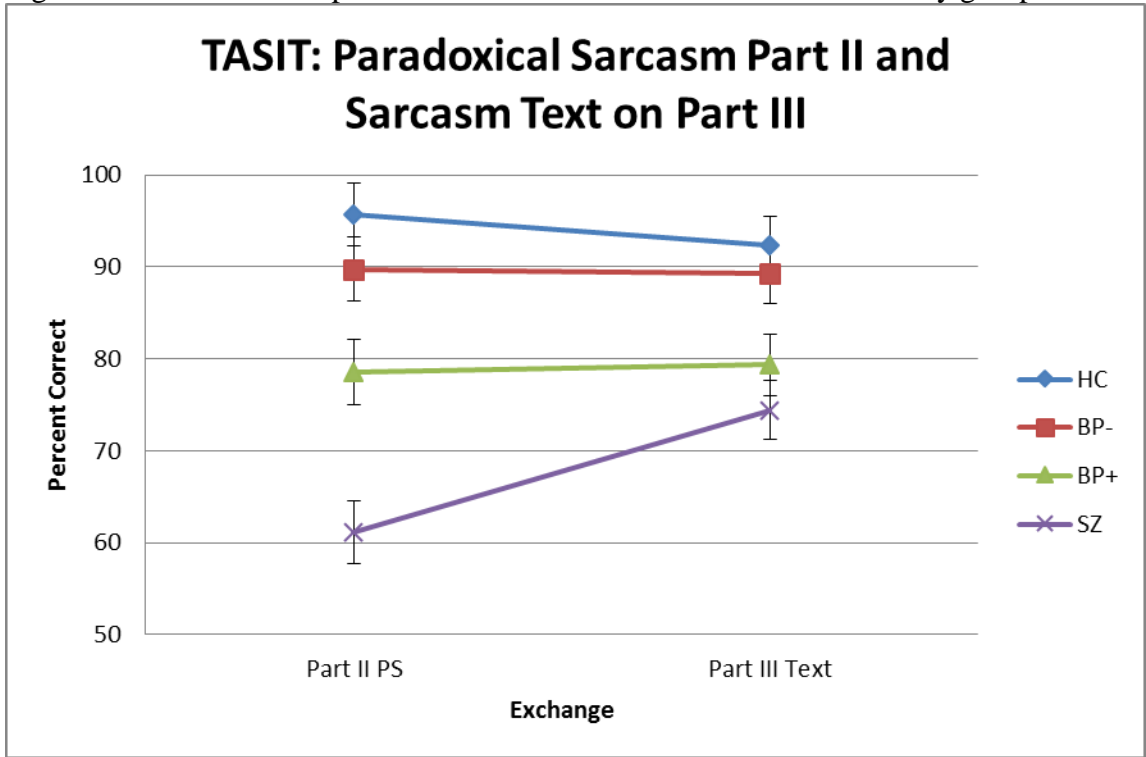


Figure 30. TASIT Part II paradoxical sarcasm and Part III sarcasm text by group



To evaluate the effects of emotion identification on correct recognition and interpretation of sarcastic exchanges with and without context cues multivariate analysis of covariance (MANCOVA) was employed. Results indicated that group differences in correct recognition and identification of sarcasm persisted even after controlling for total performance on Part I of TASIT. Wilks' $\lambda = .63$, $F(12, 204) = 3.29$, $p < .001$, multivariate partial $\eta^2 = .15$. K Matrix Contrast statistics indicated that the SZ performed worse than the BP- and HC groups in their ability to correctly recognize and interpret test items involving sarcasm on Part II and Part III of TASIT. Performance did not differ significantly among groups on context specific items, meaning there were not group differences when social exchanges were enhanced by Text. After controlling for EET performance by the SZ and BP+ groups differed only on total sarcasm correct on Part II and paradoxical sarcasm items correct in Part II. Performance by the BP+ group differed

from HCs on all variables and differed from the BP- group on overall sarcasm performance for Part II, as well as simple and paradoxical sarcasm performance from Part II. Using emotion evaluation as a covariate positively impacted the SZ group, but minimally impacted all other groups (Table 15).

Table 15. Estimate marginal mean on TASIT sarcasm performance

Percent Correct	Groups								<i>F</i> (12,204)	<i>p</i>	partial η^2	Contrast
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)					
	M	SEM	M	SEM	M	SEM	M	SEM				
TASIT Part II Sarcasm Total	68.49	3.23	78.54	3.03	88.99	3.00	91.30	3.01	9.82	<.001	0.27	SZ<BP+<BP-,HC
TASIT Part II Simple	69.36	4.04	79.09	3.80	90.52	3.76	90.75	3.77	6.03	<.001	0.18	SZ,BP+<BP-,HC
TASIT Part II Paradoxical	67.62	3.46	77.99	3.25	87.47	3.21	91.85	3.23	9.02	<.001	0.25	SZ<BP+<BP-,HC
TASIT Part III Sarcasm Total	69.72	2.77	73.35	2.60	79.90	2.58	84.21	2.59	5.29	<.01	0.17	SZ,BP+;SZ<BP-,HC; BP+,BP-
Part III Text Sarcasm	81.81	3.08	78.80	2.89	86.68	2.86	87.97	2.87	2.08	>.05	0.07	No Difference

Note. SEM= Standard Error of Measurement.

TASIT Performance Predicts Functional Outcome

Part I: Predicting Functional Capacity. A repeated measures ANOVA was used to evaluate group differences on UPSA performance. The within-subjects factor was titled UPSA and consisted of six levels, included the summary scores of all UPSA domains: Planning, Finance, Communication, Transportation, Household skills, and UPSA Total score. The between-subjects variable was participant group (SZ, BP+, BP-, and HC). Results indicated a significant UPSA x GROUP effect, Wilks' $\lambda = .62$, $F(15,212) = 2.67$, $p < .001$, multivariate partial $\eta^2 = .15$, with K Contrast statistics suggesting performance by the SZ group was significantly worse than all groups. Follow up ANOVAs were conducted to ascertain group differences among subtests (Table 16).

Table 16. UPSA performance by group

	Groups								<i>F</i> (3,81)	<i>p</i>	η_p^2	Contrast	Tukey's B
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)						
	M	SD	M	SD	M	SD	M	SD					
UPSA (Summary Scores)									2.67	<.01	0.15	SZ<BP+,BP-,HC	
Planning	16.03	2.14	18.59	1.54	18.03	2.03	18.45	1.50	9.17	<.001		SZ<BP-,HC,BP+	
Finance	14.05	3.77	17.36	2.47	17.23	2.73	17.77	2.57	7.42	<.001		SZ<BP-,BP+,HC	
Communication	13.84	4.28	15.67	2.93	16.62	2.59	16.06	2.65	3.07	<.05		SZ<BP-;SZ,BP+,HC;BP+,HC,BP-	
Transportation	15.61	3.62	16.83	3.50	16.99	3.48	17.58	2.34	1.41	>.05		No Difference	
Household skills	15.45	3.75	17.50	3.44	18.10	2.49	18.18	2.91	3.49	<.05		SZ,BP+;SZ<BP+,BP-,HC	
UPSA Total Score	74.97	13.34	85.96	5.93	86.95	6.93	88.04	6.66	12.52	<.001		SZ<BP+,BP-,HC	

Note. UPSA = UCSD Performance-based Assessment.

Standard multiple regression analyses were utilized to ascertain whether TASIT subtests (EET, SI-M, and SI-E) predict functional capacity, as measured by the UPSA. Preliminary analyses were conducted to evaluate the multiple regression assumptions of normality, linearity, multicollinearity and homoscedasticity. To improve normality of TASIT scores, the HC group was not considered in this analysis and the three clinical groups (SZ, BP+, and BP-) were combine to yield a serious mental illness group (SMI; n = 63). Pearson’s correlation coefficients among TASIT scores can be found in Table 17.

Table 17. Pearson’s correlations among TASIT subtest with SMI group

Total	Total		
	EET	SI-M	SI-E
EET	1		
SI-M	.68**	1	
SI-E	.62**	.75**	1

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

Correlations among predictor variables suggested robust relationships among TASIT subscales, particularly between SI-M and SI-E. Pearson’s correlation coefficients among TASIT subscales and functional outcome measures are present in Table 18. These data suggested that, in general, relationships among predictor variables and criterion variables were sufficient for multiple regression analyses.

Table 18. Association between TASIT subtests and UPSA with SMI group

	TASIT		
	EET	SI-M	SI-E
UCSD Performance-based Assessment (UPSA)			
Planning	.37**	.49**	.49**
Finance	.41**	.50**	.50**
Communication	.41**	.54**	.41**
Transportation	0.24	.27*	.29*
Household skills	.26*	.29*	.47**
UPSA Total Score	.49**	.61**	.63**

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

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

In a series of standard multiple regression analyses, raw scores from the three TASIT subtests (EET, SI-M, and SI-E) were simultaneously entered as predictors of the UPSA subscales and total score. TASIT subtests predicted Planning, Finance, Communication, and House domains. TASIT predictors explained 41.9% of the UPSA Summary Score variance ($R^2 = .447$, Adjusted $R^2 = .419$, $F(3, 56) = 15.89$, $p < .001$). Results indicated that TASIT SI-E (Part III) made the strongest unique contribution to explaining the UPSA Summary Score after controlling for the variance of the other two predictor variables in the model (Standardized beta = .38, $p < .05$). Other TASIT variables did not contribute uniquely to predicting the UPSA Summary Score. Despite relatively strong bivariate correlations among TASIT subtests, collinearity diagnostics embedded within the multiple regression procedure indicated there were no problems with multicollinearity in the correlation matrix (Tolerance = .41; VIF = 2.44). A second standard multiple regression was conducted to ascertain which variables of TASIT SI-E, lie or sarcasm, offered the strongest predictor of the UPSA summary score. Pearson's correlation coefficients among TASIT SI-E scores are provided in Table 19. There was a moderately strong bivariate correlation between Lie and Sarcasm scores. Pearson's

correlation coefficients among TASIT SI-E and the UPSA are present in Table 20. These data suggested that, in general, relationships among predictor variables and criterion variables were sufficient for multiple regression analyses.

Table 19. Pearson’s correlations among TASIT SI-E with SMI group

	TASIT: SI-E	
	Lie	Sarcasm
Lie	1	
Sarcasm	.452**	1

Table 20. Pearson’s correlation among UPSA performance and TASIT Part III with SMI group

	TASIT: SI-E	
	Lie	Sarcasm
UCSD Performance-based Assessment (UPSA)		
Planning	.37**	.46**
Finance	.37**	.47**
Communication	0.24	.45**
Transportation	.30*	0.20
Household skills	.42**	.39**
UPSA Summary Score	.50**	.57**

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

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

Lie and Sarcasm raw scores from SI-E were used as predictor variables of the criterion variable, UPSA Summary Score. These TASIT predictors explained 38.4% of the UPSA summary score variance ($R^2 = .404$, Adjusted $R^2 = .384$, $F(2, 58) = 20.29$, $p < .001$). Both SI-E predictor variables contributed significantly to the model of predicting the UPSA Summary Score, with the Sarcasm score representing the strongest unique contribution to the model (Standardized beta = .437, $p < .001$), followed by the Lie score (Standardized beta = .317, $p < .01$). Given that the effects of estimated current IQ were found to have a significant effect on TASIT performance, IQ and TASIT Part III total

score were used as predictor variables of UPSA Summary Score in a final standard multiple regression analysis. Results indicated that IQ did not contribute significantly to the regression model ($p = .14$).

Part II: Predicting Social Adjustment. A repeated measures ANOVA was used to evaluate group differences on UPSA performance. The within-subjects factor was titled UPSA and consisted of eight levels, included the total raw scores of all SFS domains: Social Engagement, Interpersonal Communication, Independence Performance, Independence Competence, Recreation, Prosocial, Employment, and SFS Total score. The between-subjects variable was participant group (SZ, BP+, BP-, and HC). Results indicated a significant SFS x GROUP effect, Wilks' $\lambda = .51$, $F(21,215) = 2.68$, $p < .001$, multivariate partial $\eta^2 = .20$, with the K Contrast statistic revealing that the SZ group performed significantly worse than all group and the BP+ and BP- performed similarly and significantly worse than HCs. These findings were followed by a series of one-way ANOVAs to ascertain differences in group performance among the SFS subtests (Table 21).

Table 21. SFS performance by group

	Groups								$F(3,81)$	p	η^2	Contrast	Tukey's B
	SZ (n = 22)		BP+ (n = 20)		BP- (n = 21)		HC (n = 22)						
	M	SD	M	SD	M	SD	M	SD					
SFS (Total Scores)										<.001	0.2	SZ<BP+,BP-<HC	
Social Engagement	10.73	2.35	10.20	2.24	10.19	2.27	12.05	1.91	3.39	<.05		BP-,BP+,SZ;SZ,HC;BP-<HC	
Interpersonal Communication	6.91	1.72	7.35	1.63	7.00	2.03	8.14	1.39	2.35	>.05		No Difference	
Independence Performance	26.59	5.56	29.50	5.13	31.05	5.30	34.50	3.22	10.01	<.001		SZ,BP+<BP+,BP-<BP-,HC	
Independence Competence	32.45	5.19	34.60	4.35	35.43	2.93	36.77	3.27	4.42	<.005		SZ<HC;SZ,BP+,BP-,BP+,BP-HC	
Recreation	15.82	6.64	21.20	8.81	22.52	9.36	26.73	6.91	6.99	<.001		SZ,BP+;SZ<BP+,BP-,HC	
Prosocial	13.36	6.93	22.40	13.71	20.29	12.47	24.95	12.42	4.01	<.01		SZ,BP+;SZ<BP+,BP-,HC	
Employment	3.95	3.39	5.85	3.25	5.05	3.47	8.32	2.08	7.91	<.001		SZ,BP-,BP+<HC	
SFS Total Score	109.82	20.04	131.10	31.23	131.52	29.42	151.45	22.64	9.36	<.001		SZ<BP+,BP-<HC	

Note . SFS = Birchwood Social Functioning Scale.

Similar to Part I, standard multiple regression analyses were used to evaluate whether TASIT subtests (EET, SI-M, and SI-E) predict social functioning, as measured

by the SFS. Preliminary analyses were conducted to evaluate the multiple regression assumptions of normality, linearity, multicollinearity and homoscedasticity. The HC group was not considered in this analysis; the three clinical groups were combined to yield a SMI group. Pearson’s correlation coefficients among TASIT subtests and social functioning domains of the SFS are present in Table 22. These data suggested that the relationships among predictor variables and criterion variables were sufficient for multiple regression analyses.

Table 22. Association between TASIT subtests and SFS with SMI group

	TASIT		
	EET	SI-M	SI-E
Birchwood Social Functioning Scale (SFS)			
Social Engagement	0.07	-0.03	0.03
Interpersonal Communication	0.12	0.06	0.23
Independence Performance	.53**	.49**	.44**
Independence Competence	.51**	.44**	.47**
Recreation	.31*	.44**	.40**
Prosocial	.34**	.35**	.40**
Employment	0.22	0.12	.25*
SFS Total Score	.46**	.46**	.49**

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

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

In a series of standard multiple regression analyses, raw scores from the three TASIT subtests were simultaneously entered as predictors of the SFS subscales and total score. In addition to TASIT predicting the SFS total score, the variables predicted scores on Independent Performance, Independent Competence, Recreation, and Prosocial domains. TASIT EET (Part I) made the strongest unique contribution to explaining total scores of Independent Performance domain ($R^2 = .315$, Adjusted $R^2 = .28$, $F(3, 56) = 9.04$, $p < .001$) after controlling the variance of the other two predictor variables in the model

(Standardized beta .33, $p < .05$). A second standard multiple regression was conducted to ascertain which variables of TASIT EET, positive or negative, offered the strongest predictor of the SFS Independent Performance score. Pearson's correlation coefficients among TASIT EET scores are provided in Table 23.

Table 23. Pearson's correlations among TASIT EET with SMI group

	TASIT: EET	
	Positive	Negative
Positive	1	
Negative	.68**	1

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

Pearson's correlation were also conduct to evaluate the relationship among TASIT EET and the SFS (see Table 24). In contrast to predictors of UPSA performance, social functioning was not predicted by TOM abilities, as measured by TASIT. These data suggest that, relationships among predictor variables and criterion variables were sufficient for multiple regression analyses.

Table 24. Pearson's correlation among SFS performance and TASIT Part I with SMI group

	TASIT: EET	
	Positive	Negative
Birchwood Social Functioning Scale (SFS)		
Social Engagement	0.07	0.06
Interpersonal Communication	0.16	0.08
Independence Performance	.53**	.46**
Independence Competence	.57**	.40**
Recreation	.36**	0.24
Prosocial	.39**	.26*
Employment	0.25	0.17
SFS Total Score	.51**	.36**

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

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

Raw scores of the positive and negative emotion domain from EET were used to predict the Independent Performance score from the SFS. These TASIT predictors explained 27.1% of the SFS Independent Performance domain variance ($R^2 = .294$, Adjusted $R^2 = .271$, $F(2, 58) = 12.52$, $p < .001$). Correct identification of positive emotions (happy and surprised) contributed significantly to the model of predicting the raw score on SFS Independent Performance domain (Standardized beta = .403, $p < .005$). Correct identification of negative emotions did not contribute significantly to the model. As before, IQ and TASIT Part I, total positive emotions correct were used as predictor variables of SFS Independent Performance in a final standard multiple regression analysis. Results indicated that IQ did not contribute significantly to the regression model ($p = .11$).

CHAPTER 5

DISCUSSION AND IMPLICATIONS

This study evaluated TOM abilities in individuals with BP and SZ compared to HCs. Evaluating participants' ability to recognize and interpret naturalistic social exchanges involving sincere, deceitful, and sarcastic remarks was the primary objective of this study. The current study also evaluated participants' abilities to interpret emotional expressions and sought to ascertain whether TOM or emotion identification ability predict functional outcome in persons with serious mental illness. Unique to the extant literature in this area, this study dichotomized a euthymic BP cohort by individuals who experience psychotic symptoms during affective episodes (BP+) from those with no history of psychotic symptoms during affective episodes (BP-), in order to determine whether the presence of psychotic symptoms in BP was associated with diminished TOM abilities. This study employed a valid and reliable criterion referenced task, The Assessment of Social Inference Test (TASIT; McDonald et al., 2003; McDonald, 2012) to evaluate TOM and emotion identification abilities. While several researchers have employed TASIT to evaluate TOM and emotion identification abilities, few have incorporated BP samples (e.g., Baez et al., 2013; Lee et al., 2013; Rowland et al., 2013) and to our knowledge, no research groups have dichotomized BP participants on the basis of presence or absence of psychotic symptoms during affective episodes, even though it is apparent that the presence of psychotic symptoms are associated with a number of negative features, including increased symptom severity, poorer outcomes and diminished neurocognitive abilities.

Study hypotheses predicted patterns of relationships among social cognitive abilities in BP participants with and without a history of psychosis and were based on findings from other TOM research examining schizophrenia and bipolar disorders, as well as studies that employed TASIT with similar samples (Baez et al., 2013; Chang et al., 2011; Horan et al., 2011; Kern et al., 2009; Kosmidis et al., 2008; Lee et al., 2013; Leitman et al., 2006; Mancuso et al., 2011; Rowland et al., 2013; Sparks et al., 2010). Participants' ability to identify emotions was incorporated into this investigation as emotion identification is a basic component of TOM and also found to be disrupted in clinical populations (Green & Horan, 2010; Mancuso et al., 2011), and so its impact on higher TOM abilities was important to examine. Of particular interest was the expression of sarcasm, given that sarcasm generally involves more fluctuations in tone than sincere exchanges (Anolli et al., 2000), and requires appraisal of mismatched semantic information and emotional expression (Beaucousin et al., 2007; Belin et al., 2000; Shamay-Tsoory, Tomer, & Aharon-Peretz, 2005; Wildgruber et al., 2006). We were also interested in understanding whether both emotion identification and TOM abilities would be differentially impaired between BP+ and BP, as well as whether putative impairments in individuals' ability to recognize and interpret conversational exchanges involving sarcasm, with and without contextual cues, would be better accounted for by emotional processing abilities. Findings from this study advance the literature regarding differential performance between BP samples who were similar in age, sex, education, and ethnicity, but differed on the basis of their history of exhibiting or not exhibiting psychotic symptoms during mood episodes. Findings relevant to each hypothesis are discussed in the following sections.

Considering the existing literature using TASIT, we first hypothesized that the SZ and BP+ groups would exhibit greater difficulty than the BP- and HC groups in their ability to correctly interpret emotional expressions. It was also hypothesized that the SZ and BP+ groups would exhibit impaired performance compared to the BP- and HCs in their ability to recognize and interpret naturalistic social exchanges involving sarcasm, but not sincere exchanges. We predicted that the clinical groups would perform worse in their ability to correctly recognize and interpret inconsistent “paradoxical” usage of sarcasm compared to consistent “simple” sarcasm. TOM abilities were also evaluated with contextually loaded (i.e., visual or verbal) social exchanges and in this regard, we hypothesized that all clinical groups would exhibit impaired performance in their ability to recognize and interpret naturalistic social exchanges portraying sarcasm even with contextual cues. In other words, visually and verbally augmented social exchanges were not anticipated to influence recognition and interpretation abilities of sarcastic utterances across clinical groups. We anticipated both BP groups would be unimpaired in their ability to recognize and interpret deceitful remarks and that the SZ group would perform no better in their ability to recognize and interpret remarks deceitful exchanges than those involving sarcasm. Despite the presence of an emotional component to correct recognition and interpretation of sarcasm, we did not expect emotion identification abilities would better account for TOM impairments. Finally, performance on emotion evaluation and TOM abilities were used to predict functional capacity and social adjustment when the three clinical groups were combined, and it was predicted the recognition and interpretation of sarcastic exchanges would predict both functional capacity and social adjustment, as measured by the UPSA and SFS. Estimated current IQ

was utilized as a covariate in the primary analyses, but was not included in the hypotheses.

Addressing the Hypotheses

Across this study, performance by the SZ group was anticipated to be worse than both BP groups and the HCs. The BP+ group was expected to more closely approximate that of the SZ group than the BP- or HC groups. Numerous studies have used TASIT to evaluate emotions and TOM abilities in SZ (Chung et al., 2011; Horan et al., 2011; Kern et al., 2009; Kosmidis et al., 2008; Leitman et al., 2006; Mancuso et al., 2011; Sparks et al., 2010), but few have applied TASIT in a BP cohort (Lee et al., 2013; Rowland et al., 2013). Sparks and colleagues (2010) considered age and years of education as covariates and Rowland et al. (2013) used age as a covariate in primary analyses. Findings from this study are consistent with previous investigations using TASIT as a measure of social cognition and demonstrate that correct recognition and interpretation of emotional expression and TOM abilities are impaired in SZ.

The first hypothesis was partially confirmed, such that individuals with SZ performed significantly worse than all other groups in their ability to correctly identify positive and negative emotions. Impaired performance was present in the BP+ group, but did not share the level of severity or pattern of impairment exhibited by the SZ group. The BP+ group displayed more impairment than the BP- and HC groups in their ability to correctly identify positive and negative emotions, but often the difference in performance did not reach significance. Individuals with BP+ performed significantly worse than the HC group in their ability to correctly identifying negative emotions as a broad domain; differences were most pronounced in identifying emotional expressions involving

anxiousness and disgust. Controlling for the effects of estimated current IQ indicated significantly worse performance by the SZ group in their ability to correctly identify positive and negative emotions. The SZ group performed significantly worse than both BP groups. Correct identification of anxiety as an emotion expressed by a single individual differentiated the SZ and BP+ groups from the BP- and HC groups. Our finding from hypothesis one parallel those of Sparks and colleagues (2010) who found their SZ group to perform significantly worse than HCs in correctly recognizing negative emotional expression after controlling for the effects of age and education. Results from our study are consistent with existing literature describing impaired emotion perception in SZ (Donohoe et al., 2012; Kohler & Brennan, 2004; Kohler et al., 2010) and BP when identify negative emotions compared to controls, particularly disgust (Baez et al., 2013; Lembke & Ketter, 2002; Lennox et al., 2004; Rocca et al., 2009; Thaler et al., 2013b). Results from the present study add anxiety to the list of negative emotion identification deficits in BP+. Our findings support findings by Thaler and colleagues (2013b) and advance the literature by providing evidence for greater emotion processing impairment in euthymic BP+ participants compared to controls BP- in a valid and reliable measure of emotion expression never before employed with a sample of BP participants differentiated on the basis of a history of psychosis. Although there are conflicting reports in the literature regarding whether emotion recognition impairments exist in BP (Harmer, Grayson, Goodwin, 2002), or whether impairments are state- or trait-dependent (Rocca et al., 2009), our findings support the presence of emotion recognition deficits in euthymic BP (Bozikas et al., 2007; Kohler et al., 2011; Mercer & Baccerra, 2013; Samamé et al., 2012). It could be that emotion recognition, which has been attributed to the dorsal

and ventral systems (Phillips, Drevets, Rauch, and Lane, 2003) involving abnormal fronto-limbic activity (Lembke & Ketter, 2002) and left superior temporal gyrus (Mitchell et al., 2004), are particularly sensitive to the effects of psychosis, although the neural circuitry underlying the deficits identified here warrants further investigation.

Hypothesis two was also partially confirmed, such that all groups evaluated displayed better performance in their ability to correctly recognize and interpret sincere social exchanges compared to sarcastic exchanges. Similar findings involving SZ and healthy controls have been reported in the literature (Kosmidis et al., 2008; Sparks et al., 2010). Compared to the clinical sample in Sparks et al. (2010) study, performance by our SZ group was nearly identical on TASIT Part II Sincere items, but slightly worse on sarcastic items. Findings from this study revealed a clear pattern of poor exchange recognition (e.g., sincere, simple sarcasm, and paradoxical sarcasm) by the SZ group relative to all other groups. After controlling for the effects of IQ, individuals with SZ continued to struggle with correctly recognizing and interpreting sarcastic social exchanges. Although the effects of IQ significantly impacted TASIT performance, controlling for said variable was reflected by similar performance by the SZ and BP+ group. Controlling for the effects of IQ minimally impacted performance by the BP participants and HCs. Impaired recognition and interpretation of sincere social exchanges by the SZ group is not a wholly unique finding in the literature (Rowland et al., 2013). Given that group differences in sincere recognition have been sparsely reported in the literature may provide evidence toward global TOM impairment, rather than specific TOM impairment, and underscores the severity of cognitive impairment in our SZ sample (Kosmidis et al., 2008; Sparks et al., 2010); evidence of global impairment

and possible non-social cognitive involvement in SZ participants' social cognitive function appears to be supported by the extent of change in performance after controlling for the effects of IQ. When considering the types of TOM (e.g., Meaning, 1st Order Cognitive, 2nd Order Cognitive, and Affective), the SZ and BP+ group performed significantly worse than BP- and HC participants in their ability to correctly answer Meaning and both Cognitive TOM questions which involved simple sarcasm. Similar levels and patterns of group performance were noted for paradoxical sarcasm; paradoxical sarcasm is more cognitively complex than simple sarcasm, which might account for the observed group differences in Affective TOM questions. When the effects of IQ were considered, the SZ and BP+ groups performed substantially worse than the BP- and HCs in correctly answering simple sarcasm Meaning and 1st Order TOM items. Similar group differences were present across all four exchanges in the context of paradoxical sarcasm exchanges. This appears to be the first study evaluating TOM to report differential performance between cognitive and affective TOM abilities between BP+ and BP-. If the cognitive and affective TOM abilities are functionally independent with different, yet overlapping neural networks (Abu-Akel & Shamay-Tsoory, 2011; Kalbe et al., 2010; Sebastian et al., 2012) then our findings extend the existing literature and implicate added cognitive load on questions involving higher-order cognitive and affective TOM even after the effects of IQ are considered. Biological mechanisms associated with psychotic symptoms may negatively impact neural networks involved in cognitive and affective TOM processing, and the current findings provide a foundation for hypothesis generation to evaluate these relationships.

Hypothesis three was generally confirmed and indicated significantly worse performance by the SZ group from all other groups and impaired performance by the BP+ group relative to HCs, but not BP-. Similar findings involving SZ and controls have been reported in the literature (Chung et al., 2011; Kern et al., 2009; Kosmidis et al., 2008; Lee et al., 2013; Mancuso et al., 2011; Rowland et al., 2013; Sparks et al., 2010). Additionally, the BP+ group performed significantly worse than the HCs in their ability to correctly recognize and interpret naturalistic social exchanges involving sarcasm. Controlling for the effects of IQ revealed similarly impaired performance by the SZ and BP+ group compared to HCs. Both SZ and BP+ participant groups struggled significantly more than the other two groups in their ability to correctly interpret sarcastic items directed at the Meaning of a social exchange, as well as answer questions related to 2nd Order Cognitive TOM and Affective TOM. These findings are consistent with ours from TASIT Part II and support existing speculations the additional cognitive load related to worse performance on questions involving higher-order Cognitive TOM and Affective TOM (McKinnon et al., 2010). When the effects of IQ were controlled, poor Meaning TOM, 2nd Order Cognitive, and Affective TOM performance on sarcastic exchanges were evident in the SZ and BP+ compared to HCs. Regarding the existing literature, the SZ group assessed by Sparks and colleagues (2010) performed worse than HCs in recognizing deceitful and sarcastic exchanges. Our BP+ group also performed similarly on TASIT Part III compared to the SZ participant's in Sparks et al. (2010). Previous studies have reported impaired sarcasm perception, but not lie perception compared to controls (Kern et al., 2009; Leitman et al., 2006), which, again, underscores the impairment severity of our SZ sample. The SZ group in Mancuso and colleagues (2011)

study, performed similarly to our SZ group in their ability to correctly recognize and interpret deceitful and sarcastic exchanges in TASIT Part III. In a recent study involving both SZ and BP participants, Lee and colleagues reported similar performance on Part III of TASIT compared to our clinical groups. Lee and colleagues (2013) conducted a post hoc analysis of Part III after splitting the BP group in BP+ and BP-. Their findings indicated worse, albeit not significantly, performance by the BP+ group relative to the BP- group in their ability to recognize sarcastic exchanges. Recognition and interpretation of sarcasm by the BP+ group was worse than controls, but failed to reach the level of impairment exhibited by the SZ group. Finally, Rowland and colleagues (2013) found that a sample of individuals with SZ and BP performed significantly worse than HCs on Part III of TASIT. Performance by our clinical groups were slightly worse than those reported by Rowland et al. (2013). These findings add to existing literature by demonstrating differential TOM performance of BP+ and BP- in the recognition and interpretation of naturalistic social exchanges even after controlling for the effects of estimated current IQ. Moreover, findings underscore that individuals with BP+ and BP- benefit no more from added contextual cues in their ability to understand social exchanges than HCs. Our study also adds to the literature by suggesting that specific impairments in TOM are not better accounted for by more basic deficits in emotion perception abilities. Impaired TOM abilities, specifically correct recognition and interpretation of sarcastic exchanges have been associated with reduced gray matter in the right superior temporal gyrus (Pride et al., 2013) as well as abnormal activity in the cingulate cortex, orbitofrontal cortex, and ventromedial prefrontal cortex (Carrington & Bailey, 2009). These brain regions have been associated with TOM networks (Abu-Akel

& Shamay-Tsoory, 2011) and impaired activity in these regions may be associated with a history of psychosis, which is consistent with our findings. When comparing performance on sarcasm exchanges in Part II (SI-M) with those in Part III (SI-E), our findings indicated that contextual cues only benefited the SZ group. The addition of text cues improved performance of only the SZ group and raised recognition and identification abilities to those of the BP+ group. The performance of both SZ and BP+ groups was impaired relative to the BP- and HC groups. In a recent study involving other component parts of TOM, irony, individuals with SZ were able to accurately perceive contextual information, but struggled to properly integrate contextual cues to facilitate recognition and interpretation of irony (Champagne-Lavau et al., 2012). In the present study, participants with SZ were more likely to correctly recognizing and interpreting sarcasm if the social exchange occurs for a longer period of time, as opposed to visually displaying objects that are inconsistent with the message. In Part III of TASIT, social exchanges with a visual load lasted approximately 20 seconds whereas exchanges characterized by text cues lasted approximately 41 seconds. Future investigations could seek to ascertain specific factors which contribute to differential performance between visual and text contextual cues; one possible explanation could be that the longer exchanges last, the more social and non-social cognitive skills participants are able to apply towards correctly recognizing and interpreting the exchange. In this study, we discovered that group differences in participants' ability to correctly recognize and interpret sarcastic exchanges remained significant after controlling for the effects of emotion recognition abilities. When TASIT Part III items were separated by contextual load (e.g., visual or text) and emotion recognition skills controlled, there were no group

differences. The BP+ group was observed to perform worse than all other groups when the effects of emotion recognition were statistically controlled. Findings pertaining to differential TOM performance between individuals with BP+ and SZ, after controlling for emotion perception, should be replicated; future studies pursuing this observation may facilitate understanding of relationships between social cognitive subdomains and the effects of psychosis.

Finally, hypothesis four was partially confirmed such that TASIT subscales predicted functional capacity and social adjustment in our serious mental illness group. Results indicated that correct recognition and interpretation of deceitful and sarcastic exchanges explained overall UPSA performance; recognition and interpretation of sarcasm and deceitful exchanges contributed significantly to the model of predicting the overall UPSA scores. Estimated current IQ did not contribute meaningfully to the regression model in predicting UPSA performance. UPSA performance by our SZ group was similar to other SZ cohorts reported in the literature and these studies also found moderate correlations between performance on sarcasm items in TASIT with UPSA (Horan et al., 2011; Mancuso et al., 2011). Our findings of TOM impairment predicting lower functional outcome are, therefore, consistent with existing literature (Couture, Penn, & Roberts, 2006; Fett et al., 2011; Pijnenborg et al., 2009), but also advance understanding of this relationship by suggesting the predictive utility of specific rather than general TOM abilities among individuals with serious mental illness. When the same TASIT subscales were used to predict social adjustment, as measured by the SFS, participants' ability to recognize emotional expressions, particularly positive emotions, predicted Independent Performance in the SFS. Estimated current IQ did not contribute

to the regression model in predicting SFS performance. Findings that report emotion processing abilities as viable predictors of social functioning in serious mental illness exist in the literature (Bora et al., 2006; Kee, Green, Mintz, & Brekke, 2003). These findings advance the literature by suggesting that the frequency of individuals engaging in social activities (e.g., looking for a job, using transportation, purchasing items from the store, etc.) are predicted by affect perception abilities in serious mental illness. The relationship between independent performance and emotion perception warrant further investigation. Our findings also add to the literature by suggesting that impaired recognition of positive emotions, not just negative emotions, can serve as a predictor of social adjustment. Other studies have recently used TASIT as a social cognition outcome measure in a larger effort to improve social cognitive abilities (Kurtz & Richardson, 2012) with mixed findings that recognition and interpretation of sarcasm change over time with social cognitive rehabilitation (Green et al., 2012; Horan et al., 2011, 2012; Kurtz & Richardson, 2012; Roberts & Penn, 2009). Rehabilitation programs have reported that affect perception and TOM abilities are adequate predictors of functional outcome (Horan et al., 2009; Mancuso et al., 2011). Adding our findings to the growing literature base of TASIT utilization with serious mental illness implicates the criterion-references, norm-based measure as a potentially valuable predictor of functional capacity and social adjustment.

Limitations and Future Directions

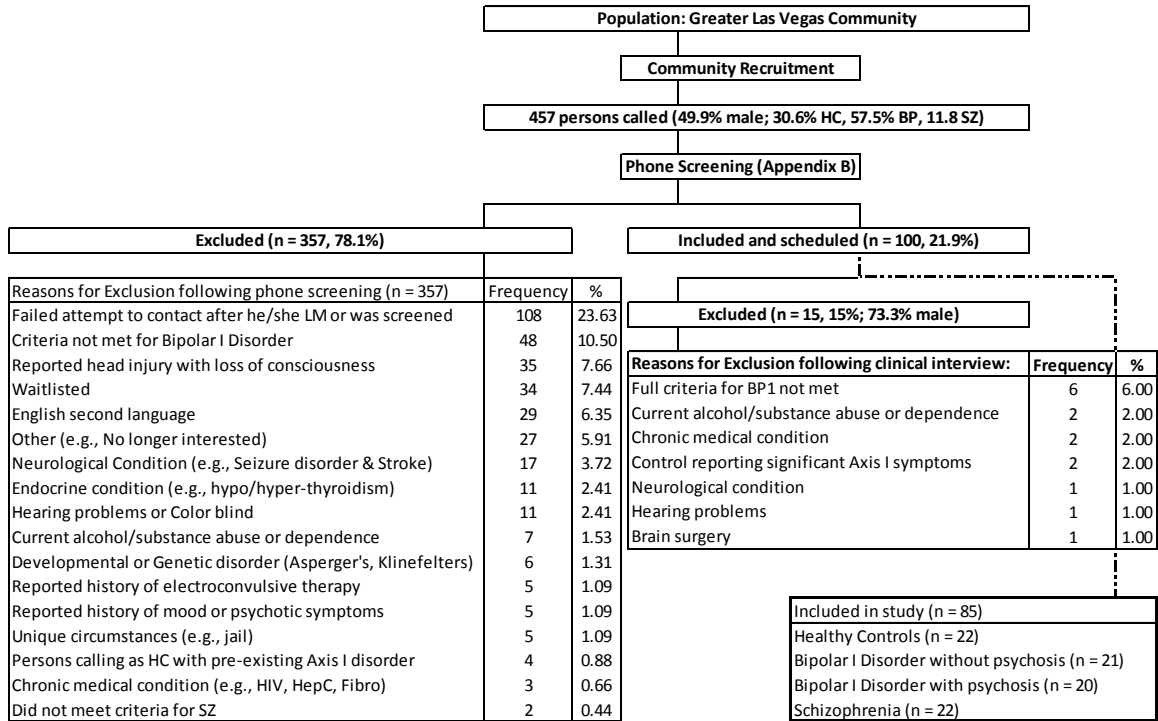
Although this study offers insight into differential TOM performance between individuals diagnosed with BP+ and BP-, the findings should be interpreted with the acknowledgment of several methodological limitations. Differences between the HC and

clinical groups would likely have been larger if the control group more closely approximated population means on demographic and social variables. However, since the HC group was similar to the clinical groups in many respects, the findings of significant differences cannot be easily accounted for by these secondary sources and probably indicate real differences in TOM and emotion identification among the groups. Also, much of the SZ group was recruited from an outpatient community mental health facility which provides services to individuals with serious mental illnesses who are disabled. Thus, the sample consisted of those with a relatively chronic and severe course of illness. The extent to which the current results would generalize to those experiencing their first episode of psychosis, or who have a shorter duration or less severe course, is presently unclear. There is evidence to suggest that even individuals with milder forms of SZ demonstrate significant impairment in social cognitive abilities and that such deficits are present early on in the illness; this matter requires further investigation particularly in relation to individuals diagnosed with BP, grouped on the basis of presence or absence of psychotic symptom during affective episodes.

Findings from this study may also be more robust and generalizable with a larger sample size, which would have increased power to detect significant differences among the groups, as well as allowed us to conduct regression analyses without combining all three clinical groups. Regarding the measures used in this evaluation, use of the TASIT had a number of appealing features for this type of investigation, but was limited in the breadth of TOM domains assessed. Additional differences among groups are likely present, and could be directly investigated using other TOM measures which differently assess cognitive and affective TOM abilities. Finally, functional outcome measures, such

as the UPSA and SFS were originally constructed for individuals with SZ (Birchwood et al., 1990; Patterson et al., 2001). Because BP is generally associated with higher levels of functioning than typically observed in SZ, it could be that the measures used to assess functional abilities in our BP sample were less sensitive to impairments in functional domains. Thus, inclusion of psychometrically sound contemporary scales that assess functioning in BP, such as the Functioning Assessment Short Test (FAST; Rosa et al., 2007) or the Quality of Life in Bipolar Disorder scale (QoL.BD; Michalak & Murray, 2010) may add meaningfully to future studies. Future studies may desire to employ TASIT with groups who are at high-risk for developing either SZ or BP and should continue to use TASIT with persons diagnosed with BP to validate the findings reported in the present study. Also while some studies have utilized functional neuroimaging to map brain regions and networks associated with recognition and identification or sarcasm (Rankin et al., 2009; Pride et al., 2013), it will be important to employ similar paradigms with individuals diagnosed with SZ and BP to ascertain whether similar patterns of brain activation are present in these groups. Despite these limitations, this study offers new information into relationships between TOM performance in euthymic persons with BP who do and do not display psychotic symptoms during affective episodes. Findings discussed in the current study provide additional support for the importance of considering psychotic features when designing studies to investigate BP.

APPENDIX A: Screening, exclusion, and inclusion procedures



Pre-screening consent – to be read verbatim:

You are being asked to participate in a study being conducted by Dr. Daniel Allen and his graduate students who work in the Psychology Department at the University of Nevada, Las Vegas. The purpose of this study is to gain knowledge regarding how people process social information and learn to maximize their outcome in certain situations.

If you consent to the study now, you are only consenting to the initial phone screening portion in which I will be asking you questions about your personal history. This process should take approximately 15 minutes. During this time, I will ask you questions concerning your psychiatric and medical history to determine if you are appropriate for the current study. Please notify me if you are uncomfortable answering any questions. Your participation is voluntary and you may choose not to answer questions or stop this screening process at any time. Please know that all information gathered in this study will be kept as confidential as possible outside of the research team. No reference will be made in written or oral materials that could link you to this study. Right now, this is just a verbal consent to conduct the screening questions. If you are eligible for the study, a full consent form detailing the rest of the study will be issued to you during the first session, and you will be able to consent to the study by signing that form. The rest of the study will take approximately five hours. If you are not eligible for the study, the information gathered will not be used in any research and will be shredded.

Do you consent to be administered these screening questions and are at least 18 years of age?

Consent Obtained? (If "No" then discontinue)

Date:

Phone Screening:

How did you hear about our study? _____

Have you participated in a study with us before? _____

 If so, do you remember when or with who? _____

1 What is your age? _____

2 How many years of formal education have you completed? _____

3 What is the first language you learned? _____

 If English is not your first language, at what age did you begin learning English? _____

4 Have you ever had a head injury (e.g., automobile accident, fall, sports injury)? _____

5 Have you ever been unconscious? _____

 If so, for how long? _____

6 Have you ever or do you now have seizures? _____

7 Do you have any medical conditions (include neurological disorders)? _____

 Please describe: _____

8 Have you ever had any kind of brain surgery? _____

 If yes, what type? _____

9 Have you been diagnosed with any mental or psychiatric condition? _____

 If yes, please describe: _____

10 If no history of psychiatric diagnosis: "*Do you suspect that you may have a mental or psychiatric condition?*" _____

 If Yes, please describe: _____

11 Have you ever been diagnosed with any learning disability or ADHD? _____

 Has this been formally diagnosed? _____

 Diagnosis: _____

12 At any point in your life have you received treatment or attended support groups for substance or alcohol use (NA, AA, etc.)? _____

13 In the last 6 months how many times have you used illicit drugs and/or alcohol? _____

 If a notable amount: "*Has this been a problem for you or anyone one else?*" _____

14 Are you color-blind? _____

15 Do you wear glasses/contacts? _____

 If yes, if you are eligible will you please wear them to your appointment _____

16 Do you have severe visual impairments, such as cataracts or glaucoma? _____

17 Do you have any hearing problems (hearing aid, tinnitus)? _____

18 At any point, have you been perscribed medication for a psychological condition?

19 Are you **currently** taking any medications for a psychological or neurological condition?

20 Please list the medication(s) you are **currently** taking.

Current Medications	Dosage	Reasoning	Date Started

21 In the last 4 weeks has there been a change in your medication?

--

Changes:

<p>If formally diagnosed with a mental condition (e.g., BP or SZ), but has chosen not to take medication, ask "<i>What are the reason that have contributed to you chosing not to take your medication ?</i>":</p>

22 "*What medication have you been perscribed most recently, but have chosen **not** to take?*":

--

Current Medications	Dosage	Reasoning	Date Started
DO NOT CODE THIS SECTION AS CURRENT MEDICATION			

Depression and Manic Episode Screen:

- 1 Has there ever been a period of time when you were feeling depressed or down most of the day, nearly every day, for at least two weeks?
a. If yes, please explain:
b. How old were you when you had your first depressed episode?
c. How long was your longest depressed episode?
d. **When was your most recent depressed episode?**
e. Approximately how many depressed episodes (≥ 2 w w/ described sx) have you had?
f. Have you ever received electroconvulsive therapy?
If yes, please explain:
- 2 Has there ever been a period of time when you were feeling so good, high, excited or hyper that other people thought you were not your normal self or you were so hyper that you got into trouble?
a. If yes, please explain:
b. How old were you when you had your first manic episode?
c. How long was your longest manic episode?
d. **When was your most recent manic episode?**
e. Have you ever been hospitalized for manic behavior (w/o drugs)?
f. Approximately how many manic episodes (≥ 1 w w/ described sx) have you had?

NOTE: Hospitalization must be associated with manic episode and/or related symptoms.

If formally diagnosed with a mental condition (e.g., BP or SZ), but has never been hospitalized, despite all their symptoms, ask what factor(s) have contributed to this:

Psychotic Screen:

*** Ensure psychotic symptoms are legitimate and not merely endorsing questions.

*** Attempt to distinguish between delusions, hallucinations, odd but non-pathological beliefs, potential Axis-II pathology, and socially desirable responding.

Now I'm going to ask you about unusual experiences that people sometimes have.

1 Has it ever seemed like people were talking about you or taking special notice of you?

2 What about anyone going out of their way to give you a hard time, or trying to hurt you?

3 Have you ever felt that you were especially important in some way, or that you had special powers to do things that other people couldn't do?

4 Have you ever felt that something was very wrong with you physically even though your doctor said that nothing was wrong... like you had cancer or some other terrible disease?

5 Did you ever hear things that other people couldn't hear, such as noises, or the voices of people whispering or talking?

6 Did you ever have visions or see things that other people couldn't see?

7 Have you ever had any unusual religious experiences?

8 **ASK ONLY IF PSYCHOTIC FEATURES AND MOOD EPISODES ARE PRESENT:**
Do your delusions/hallucinations occur only during your depressed/manic episodes OR do they also occur outside of your depressed/manic episode?

Family History Questionnaire:

The following questions concern your family. **DO NOT** list any specific names in your answers.

- 1 Have either of your parents been diagnosed with a mental disorder or neurological condition?
- Schizophrenia / SZ Spectrum disorder
- Affective disorder
- Please Specify
- Alcoholism / Substance Abuse
- Parkinsonism / Movement Disorder
- Please Specify
- Please List any others:
- 2 Have any of your siblings been diagnosed with a mental disorder or a neurological condition?
- Schizophrenia / SZ Spectrum disorder
- Affective disorder
- Please Specify
- Alcoholism / Substance Abuse
- Parkinsonism / Movement Disorder
- Please Specify
- Please List any others:
- 3 Have any of your children been diagnosed with a mental disorder or neurological condition?
- Schizophrenia / SZ Spectrum disorder
- Affective disorder
- Please Specify
- Alcoholism / Substance Abuse
- Parkinsonism / Movement Disorder
- Please Specify
- Please List any others:
- 4 Have any of your grandparents been diagnosed with a mental disorder or neurological condition?
- Schizophrenia / SZ Spectrum disorder
- Affective disorder
- Please Specify
- Alcoholism / Substance Abuse
- Parkinsonism / Movement Disorder
- Please Specify
- Please List any others:
- 5 Have any of your aunts or uncles been diagnosed with a mental disorder or neurological condition?
- Schizophrenia / SZ Spectrum disorder
- Affective disorder
- Please Specify
- Alcoholism / Substance Abuse
- Parkinsonism / Movement Disorder
- Please Specify
- Please List any others:

APPENDIX C: Informed consents



INFORMED CONSENT

Department of Psychology

TITLE OF STUDY: Cognitive and Behavioral Processes of Daily Functioning

INVESTIGATOR(S): Daniel N. Allen, Ph.D., Sally J. Vogel, M.A., Erik N. Ringdahl, M. A.

CONTACT PHONE NUMBER: (702) 895-3314

Purpose of the Study: You are being asked to participate in a study being conducted by Daniel N. Allen, Ph.D., Sally J. Barney, M.A., and Erik Ringdahl, M.A., from the Psychology Department at the University of Nevada, Las Vegas. During this study we will investigate reinforcement learning and theory of mind. Reinforcement learning refers to a learning style that maximizes outcome, whereas theory of mind involves making inferences to another's intentions, dispositions, and beliefs. It is hoped that information from this study will help us to better understand important cognitive and behavioral processes associated with daily functioning as they apply to most individuals, as well as those with schizophrenia and bipolar disorder.

Participants: You are being asked to participate in the study because you meet one of the following criteria: 1) You have a history of bipolar disorder; 2) You have a history of schizophrenia.

Procedures: If you choose to participate in this study, you will be asked to complete between five and six hours of testing, interviews, and surveys. You will be interviewed and asked to respond to questions about your personal history and personality. The interview may also include questions concerning psychiatric and substance use history. This information will be used to determine if you meet the criteria to participate in the rest of the research study. Researchers in this study are also trained therapists and will provide on-site help if needed.

If you continue on in the research study you will then be given many different types of tests measuring reinforcement learning, theory of mind, and functional outcome. Most of these tests are administered on the computer, but some are paper-and-pencil based. Many of these tests are quite easy while others may seem more difficult. Some have time limits while others do not. You will be provided with rest breaks as needed.

You will not receive individual feedback after the testing, but you will be given information on how to contact the researchers when the project is completed to receive the general results of the project.

Benefits of Participation: Your participation will add to the understanding of reinforcement learning and theory of mind, as well as how these domains are associated with daily functioning. Participation in this study could lead to improvements in the detection and treatment of mental illness, which may also facilitate a greater understanding of the overlapping characteristics of these schizophrenia and bipolar disorder.



INFORMED CONSENT

Department of Psychology

TITLE OF STUDY: Cognitive and Behavioral Processes of Daily Functioning

INVESTIGATOR(S): Daniel N. Allen, Ph.D., Sally J. Vogel, M.A., Erik N. Ringdahl, M. A.

CONTACT PHONE NUMBER: (702) 895-3314

Risks of Participation: There are risks involved in all research studies. This study includes only minimal risks and we anticipate that such risks are lessened by the potential benefits that may come from this study. There is a chance you may experience some mental fatigue during the assessments. To decrease the chance of fatigue, the researcher will allow breaks as necessary for your comfort. You will also be asked questions regarding your personal history. Although it is not expected to occur, should you feel uncomfortable answering any of the questions or performing any of the tasks, you are encouraged to discuss concerns with the researcher. Please notify the researcher if you are uncomfortable answering any questions or if you become upset. Your participation is voluntary and you may refuse to answer questions or withdraw from the study at any time.

Cost /Compensation: There will not be financial cost to you to participate in this study. The study should take between 5 and 6 hours to complete. If you complete the entire study, you will be reimbursed at a rate of \$5.00 for every half-hour (\$10/hour). Therefore, if you complete the entire study, your total compensation will amount to between \$50.00 and \$60.00. If you are unable or unwilling to complete all of the study procedures, you will be paid for the time at a rate of \$2.50 for each half-hour. The University of Nevada, Las Vegas may not provide compensation or free medical care for an unanticipated injury sustained as a result of participating in this research study.

Contact Information: If you have any further questions about the study or if you experience any harmful effects as a result of participation in this study, you may contact Dr. Daniel Allen at the UNLV Psychology Department at 895-0121. For questions regarding the rights of research subjects, you may contact the **UNLV Office for the Protection of Human Subjects at 702-895-2794.**

Voluntary Participation: Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with the university. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Confidentiality: All information gathered in this study will be kept completely confidential. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for at least 5 years after completion of the study. After the storage time the information gathered will be destroyed.



INFORMED CONSENT

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Participant Consent: I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

Signature of Participant

Date

Participant Name (Please Print)

Signature of Investigator

Date



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Purpose of the Study: You are being asked to participate in a study being conducted by Daniel N. Allen, Ph.D., Sally J. Barney, M.A., and Erik Ringdahl, M.A., from the Psychology Department at the University of Nevada, Las Vegas. During this study we will investigate reinforcement learning and theory of mind. Reinforcement learning refers to a learning style that maximizes outcome, whereas theory of mind involves making inferences to another's intentions, dispositions, and beliefs. It is hoped that information from this study will help us to better understand important cognitive and behavioral processes associated with daily functioning as they apply to most individuals, as well as those with schizophrenia and bipolar disorder.

Participants: You are being asked to participate in the study because you and your family do not have a history of either bipolar disorder or schizophrenia.

Procedures: If you choose to participate in this study, you will be asked to complete between five and six hours of testing, interviews, and surveys. You will be interviewed and asked to respond to questions about your personal history and personality. The interview may also include questions concerning psychiatric and substance use history. This information will be used to determine if you meet the criteria to participate in the rest of the research study. Researchers in this study are also trained therapists and will provide on-site help if needed.

If you continue on in the research study you will then be given many different types of tests measuring reinforcement learning, theory of mind, and functional outcome. Most of these tests are administered on the computer, but some are paper-and-pencil based. Many of these tests are quite easy while others may seem more difficult. Some have time limits while others do not. You will be provided with rest breaks as needed.

You will not receive individual feedback after the testing, but you will be given information on how to contact the researchers when the project is completed to receive the general results of the project.

Benefits of Participation: Your participation will add to the understanding of reinforcement learning and theory of mind, as well as how these domains are associated with daily functioning. Your performance will be contrasted against individuals diagnosed with bipolar disorder and schizophrenia. Participation in this study could lead to improvements in the detection and treatment of mental illness, which may also facilitate a greater understanding of the causes and overlapping characteristics of these psychiatric disorders.



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Signature of Participant

Date

Participant Name (Please Print)

Signature of Investigator

Date

APPENDIX D: Demographic questionnaire

1. Gender **Male Female**
2. Date of Birth _____/_____/_____
3. What ethnicity do you identify with:
____ Asian American ____ American Indian/Alaska Native ____ African American
____ Hispanic/Latino ____ Hawaiian/Pacific Islander ____ Caucasian ____ Biracial
Other: _____
4. Highest Level of Education Completed ____ (Years of formal education) ____ GED?
5. Highest level of education Father completed _____ Mother _____
 - a. Father's primary occupation _____ Mother's primary occupation _____
6. Subject Marital Status: ____ Married ____ Widowed ____ Divorced
____ Separated ____ Never married ____ Committed relationship
 - a. If married, how many times have you been married? _____
7. Do you have any children? **Yes No** If so, how many children do you have? _____
8. Current Occupation _____
 - a. How long have you been employed in this position? _____
9. Have you ever been homeless? **Yes No**
10. Do you have a twin? **Yes No**
11. Are you left handed, right handed, or ambidextrous? **Left Right Ambidextrous**

HEALTH-RELATED QUESTIONS

12. Have you ever been hospitalized for a psychiatric/mental condition? **Yes No**

Date/Location

13. Have you ever been hospitalized for a physical condition? **Yes No**

Date/Location

14. Have you ever seen a counselor, psychotherapist or other mental health professional?

Yes No

a. If yes, please describe dates and reason:

15. Do you smoke? **Yes No**

a. (*circle all that apply*) Cigarettes Cigars / Pipes / Chewing tobacco

b. How much do you smoke/chew per day? _____

SUICIDE HISTORY

16. Have you had thoughts of suicide in the past? **Yes No**

a. Have you had thoughts of suicide within the last week? **Yes No**

b. Have you had any suicide attempts? **Yes No** If yes, how many? _____

Please use the following lines to note the date and method of past suicide attempts:

Date/Method

Suicide History Rating scale (circle)

1 – No history of any suicidal ideations

2 – History of suicidal ideation only, no self-injury

3 – Minor self-injury / suicidal gesture(s) only

4 – One serious suicide attempt either alone or in presence of prior ideation/self-injury/gestures

5 – More than one serious suicide attempt

Suicide Risk Assessment

Check and describe if present:

____ Yes ____ No

____ Yes ____ No

____ Yes ____ No

____ Yes ____ No

____ Yes ____ No

____ Yes ____ No

Plan:

Lethality:

Availability Means to carry out the plan:

Significant Loss:

Substance Abuse:

Family History of Suicide:

No Suicide Contract

I, _____, agree to not kill myself, or cause
harm to myself during the period of time from _____ to
_____ COMMIT

I agree to get enough sleep and eat well.

I agree to get rid of things that I could use to kill myself (guns, pills, etc.).

I agree that if I have a bad time and feel that I might hurt myself, I will call my counselor,
_____, at _____. I will also call the
Suicide Prevention Center at 731-2990.

Signed: _____

Witnessed: _____

Date: _____

APPENDIX E: Regression equations to estimate premorbid and current IQ

Estimate of Premorbid Full Scale IQ = 45.997 + .652 (VO raw score) + 1.287 (MR raw score) + .157 (Age in years) + 1.034 (Education) + .652 (Ethnicity) – 1.015 (Gender).

Age in years; Ethnicity: 1 = African-American, 2 = Hispanic, 3 = Other, and 4 = Caucasian; Education 1 = 0 to 8 years, 2 = 9 to 11 years, 3 = 12 years, 4 = 13 to 15 years, 5 = 16+ years; Gender: 1 = male, 2 = female

Current IQ Estimate = [(VO Scaled Score x 2.727) + (BD Scaled Score x 2.727) + 42.535] (Ringe et al., 2002).

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CURRICULUM VITAE

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University of Nevada, Las Vegas
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EDUCATION

2011 - *Present* **Doctor of Philosophy (Ph.D.) Clinical Psychology, Neuropsychology Track**

University of Nevada, Las Vegas (Las Vegas, NV) – APA Accredited
Dissertation: *Impaired theory of mind in psychotic and affective disorders*

Advisor: Daniel N. Allen, Ph.D.

Defense Date: February 7, 2014

2013 - *Present* **Wright-Patterson USAF Medical Center, Wright-Patterson AFB, Ohio
Internship in Clinical Psychology, APA Accredited**

Training Director: Lt Col Kirk Rowe, Ph.D.

Associate Training Director: Regina Shillinglaw, Ph.D.

2013 **Officer Training School (OTS), Commissioned Officer Training, Class 13-05**
Air University, Maxwell ABF, Alabama

2011 **Master of Arts (M.A.), Clinical Psychology, Neuropsychology Track**

University of Nevada, Las Vegas (Las Vegas, NV) – APA Accredited

Thesis: *Executive function profiles in pediatric traumatic brain injury*

Advisor: Daniel N. Allen, Ph.D.

2009 **Bachelor of Arts (B.A.), Psychology**

University of Nevada, Las Vegas (Las Vegas, NV) – APA Accredited

PREDOCTORAL TRAINING

Wright-Patterson USAF Medical Center

Dayton, OH

Summer 2013 - *Present*

Training Director: Lt Col Kirk Rowe, Ph.D.

Resident: Core clinical rotations include the Outpatient Mental Health Clinic, Clinical Health Psychology, Neuropsychology, and Primary Care Clinic. Training is supplemented by experiences in Deployment Psychology, Leadership/Administration, Community Psychology, Family Advocacy/ Domestic Violence Prevention and Treatment, Alcohol and Drug Abuse Prevention and Treatment, and various weekly didactics.

Supervision: Weekly individual supervision with developmental approach. Methods of supervision included case discussion and professional development.

VA Southern Nevada Healthcare System (VASNHS)
Las Vegas, NV

Spring 2012 - Summer 2013
Supervisor: Carl D. Williams, Ph.D.

Doctoral Practicum Student: Evidence-based psychotherapy (EBP) for Alcohol and Drug Treatment Program (ADTP): Rotations have a strong EBP focus and include training in Cognitive Behavioral Therapy for Depression, Motivational Interviewing, relapse prevention, 12-Step facilitation, Cognitive Processing Therapy, social skills, Integrated Cognitive Behavioral Therapy for depression and substance abuse. Patient diagnoses include PTSD and other anxiety disorders, bipolar disorders, depression, substance abuse and dependence, personality disorders, TBI, pain, general medical condition.

Responsibilities: Co-lead Integrated Cognitive Behavioral Therapy for Comorbid Substance Use and Depression group; Co-lead Cognitive Processing Therapy group; Motivational Interviewing; Coding Motivational Interviewing tapes for fidelity; Structured psychodiagnostic assessment; and structured intake.

Supervision: Weekly individual supervision took a developmental approach. Method of supervision included case discussion; role-play; and intense attention paid to professional development.

VA Southern Nevada Healthcare System (VASNHS)
Las Vegas, NV

Summer 2011 - Summer 2013
Supervisor: Robert F. Mirabella, Ph.D.

Doctoral Practicum Student: Evidence-based psychotherapy for PTSD.

Responsibilities: Conduct Cognitive Processing Therapy and Prolonged Exposure therapy; Attend weekly group supervision from regional CPT trainer towards obtaining CPT Provider Status; Attend monthly national case conference calls for PE; Attend national conference calls for Cognitive Behavioral Therapy for Insomnia (CBT-I). Patient diagnoses include: PTSD (related to combat and non-combat related military trauma, military sexual trauma (MST), civilian-related trauma, and childhood sexual and physical trauma); and PTSD comorbid with affective disorders, substance use, pain management problems, and personality disorders.

Supervision: Weekly individual supervision taking a developmental and 'training to mastery' approach with a ratio of 1:1 supervision to therapy hours. Method of supervision included *in vivo* co-facilitation of therapy session; thorough case discussion; and audiotape review. Intense attention paid to oversight and review of evidence-based treatments and protocol adherence as well as professional development.

VA Southern Nevada Healthcare System (VASNHS)
Las Vegas, NV

Summer 2011 - Spring 2012
Supervisor: Carl D. Williams, Ph.D.

Doctoral Practicum Student: EBP for Mental Health Intensive Case Management (MHICM).

Responsibilities: Conducted Cognitive behavioral therapy for depressed veterans; Motivational Interviewing; Coding Motivational Interviewing tapes for fidelity; and Structured psychodiagnostic assessment. Patient diagnoses include Schizophrenia, Bipolar disorders, TBI, PTSD and other anxiety disorders, depression, substance abuse and dependence, personality disorders.

Supervision: Weekly individual supervision took a developmental approach ensuring thorough and effective learning of evidence-based therapies. Method of supervision included thorough case discussion and role-play. Attended weekly practicum seminar at UNLV. Methods included clinical case conference and special didactic topics including clinical supervision and military psychology.

Lewis M. Etcoff, Ph.D. and Associates
Las Vegas, NV

Spring 2011 - Summer 2012
Supervisor: Lewis M. Etcoff, Ph.D.

Doctoral Practicum Student: Clinical and forensic neuropsychological and psychodiagnostic assessment in an outpatient setting. Clinical cases seen were predominantly children and adolescents referred by schools, pediatricians, parents, and therapists. Forensic cases were civil in nature and consisted of adults referred by the Defense for a one- or two-day psychological or neuropsychological evaluation, respectively.

Responsibilities: Assisted in all aspects of comprehensive assessment including clinical interviews, testing, scoring, interpretation, and writing/dictation. Examinee diagnoses included pervasive developmental disorders, oppositional defiant disorder, ADHD, learning disabilities, speech/language disorder, and developmental coordination disorder. Forensic duties involved reviewing forensic records, observing clinical interview, administering psychodiagnostic tests and neuropsychological, scoring tests, interpretation, report writing/dictation, attorney consultation with supervisor (when applicable), court appears to observe supervisor testifying as an expert witness.

Supervision: Consisted of at least one-hour per week of individual meetings to discuss case conceptualization and skill development, as well as *in vivo* co-assessment. Attended a weekly practicum seminar at UNLV, which included didactic training and clinical case conference.

Center for Individual, Couple, and Family Counseling
University of Nevada, Las Vegas

Fall 2010 - Fall 2011
Supervisor: Paula Emke-Francis, Ph.D.

Doctoral Practicum Student: Provided long-term individual therapy to a consistent caseload of eight patients. The OQ-45 was administered before every session for feedback and outcome purposes. Diagnoses included affective disorders, personality disorders, and adjustment disorders. Primary theoretical approach used was based on a biopsychosocial model.

Supervision: Consisted of weekly individual and weekly small-group meetings for case discussion and videotape review. Attended weekly practicum seminar at UNLV, which included clinical case conference with focus on Acceptance and Commitment Therapy (ACT) model of psychotherapy.

Psychological Assessment and Testing Clinic
University of Nevada, Las Vegas

Fall 2009 - Fall 2010
Supervisors: Michelle G. Paul, Ph.D.

Doctoral Practicum Student: Conducted patient interview, neuropsychological and psychodiagnostic assessment, report writing, and patient feedback to adults presenting with learning and psychiatric disorders. Diagnoses included affective disorders, personality disorders, adjustment disorders, pervasive developmental disorders, ADHD, and learning disabilities.

Supervision: Consisted of *in vivo* co-assessment (early on), supervisor-student case consultation and conceptualization, and feedback on written report.

Competent Administration, Interpretation, and Writing:

APS, Mental Status Exam, SCID-I, SCID-II; BASC-2 (PRS, SRP, TRS), MACI, MCMI-3, MMPI-2, M-PACI, NEO-PI-R, PAI, and Vineland-ABS; BAI, BDI-2, BPRS, BNSS, FAST, HAM-D, IDS-C, PCL (-S, -M, -C), PANAS, SAPS, SANS, YMRS; GORT-4, GORT-5, Woodcock-Johnson III Tests of Achievement and Cognitive Abilities, WRAT-4; WAIS-III, WAIS-IV, WISC-III, and WISC-IV; Boston Naming, Seashore Rhythm test, CPT-II, CVLT-II, D-KEFS, FAS, Finger Tapping, Grip Strength, Grooved Pegboard, Judgment of Line Orientation, Lateral Dominance Exam, Purdue Pegboard, Rey-Osterrieth Complex Figure, Stroop task, Tactual Performance Test, TASIT, TOMAL-2, TOMM, TOVA, Trail Making Test A & B,

WCST, WMS-III, WMS-IV, and WRAML-2; BRIEF, Quality of Life Scale, Social Functioning Scale, UPSA, Wisconsin Quality of Life Index.

RELATED CLINICAL EXPERIENCE

Spring Mountain Treatment Center

January 2009 - August 2009

Las Vegas, NV
(1402.3 hours)

Mental Health Technician: Inpatient mental health service to adults and adolescents. Assisted in patient assessment, monitored and documented patients behavior, facilitated patient intake and discharge; provided role modeling of appropriate behavior, identified personal needs of patients, and promoted a safe environment. Taught social and communication skills, and relationship building skills; assisted in educational groups for life skills, psychoeducation, depression, grief, and anger management. Diagnoses included psychotic disorders, affective disorders, personality disorders, adjustment disorders, pervasive developmental disorders, and conduct disorders.

SUPPLEMENTAL CLINICAL EXPERIENCE

Dayton Area Psychological Association

ACT: Theory, Clinical Model, and Core Interventions
Dayton, OH

Fall 2013

One-day training workshop - Laurie Greco, Ph.D.

Helping Couple Get Past the Affair

Fall 2013

Dayton, OH

One-day training workshop - Douglas K. Snyder, Ph.D.

Center for Deployment Psychology

Deployment 101, Trauma and Resilience, Behavioral Health Care of the Seriously Medically Injured, Deployment and Families, Diversity in the Military, Cognitive Behavioral Therapy for Insomnia (CBT-I)
Bethesda, MD

Two-week workshop, Fall 2013

Cognitive Processing Therapy (CPT), with semi-monthly consultation calls.

Bethesda, MD

Two-day workshop, Fall 2013

Cognitive Behavioral Therapy (CPT) for groups

Dayton, OH

One-day workshop, Fall 2013

Prolonged Exposure Therapy (PE), with follow up semi-monthly consultation calls

Dayton, OH

One-day workshop, Fall 2013

Veteran Affairs Hospital

Cognitive Processing Therapy for PTSD

Cognitive Processing Therapy weekly consultation calls (VISN 22)
Las Vegas, NV

Fall 2011 - Fall 2012

Diane Sakal-Gutierrez, LCSW

Cognitive Processing Therapy for PTSD Training Fall 2011
San Diego VA Hospital, CA - Mental Illness Research, Education and Clinical Center
Three-day Training Workshop - Carie S. Rodgers, Ph.D.

Cognitive Processing Therapy for PTSD Refresher Course Fall 2012
Las Vegas, NV

Prolonged Exposure

Monthly consultations calls directed by Edna Foa, Ph.D. Fall 2011 - Spring 2013
Las Vegas, NV Supervisor: Robert F. Mirabella, Ph.D.

Motivational Interviewing

Coding Motivational Interviewing tapes for fidelity Spring 2012 - Spring 2013
Las Vegas, NV Supervisor: Carl D. Williams, Ph.D.

Lewis M. Etkoff, Ph.D. and Associates

2012 Las Vegas, NV Spring
Supervisor: Lewis M. Etkoff, Ph.D.
Assisted in developing curriculum for a 22-week neuropsychology post-doctoral seminar.

Nevada Psychological Association

Working with Challenging Couples Fall 2011
Las Vegas, NV One-day intensive course - John C. Friel, Ph.D.

Integration of Medication and Psychological Treatment Spring 2011
Las Vegas, NV One-day seminar - Morgan T. Sammons, Ph.D.

Acceptance and Commitment Therapy for Trauma Fall 2010
Las Vegas, NV One-day intensive course - Victoria M. Follette, Ph.D.

Acceptance and Commitment Therapy Fall 2008
Las Vegas, NV One-day intensive course - Steven C. Hayes, Ph.D.

Symptoms Ratings Training Program

University of Nevada, Las Vegas Fall 2010; 2011; 2012
Training Supervisor: Daniel N. Allen, Ph.D.

Completed a training program for administration of the Brief Psychiatric Rating Scale (BPRS), Hamilton Depression Rating Scale (HAM-D), Scale for the Assessment of Negative Symptoms (SANS), Scale for the Assessment of Positive Symptoms (SAPS) and Young Mania Scale (YMS), Brief Negative Symptom Scale (SNSS), and Inventory for Depression Symptomatology-Clinician (IDS-C). Training was comprised of a series of workshops across a two-month period for a total of approximately 40 workshop hours. Training culminated in a final mock interview conducted with Dr. Daniel Allen in order to assess proficiency.

Psychiatry Neuroimaging Laboratory

Department of Psychiatry, Brigham and Women's Hospital Fall 2009
Harvard Medical School, MA Seven-day intensive MRI analysis training
Training Supervisor: Martha E. Shenton, Ph.D.

SCID Training Program

University of Nevada, Las Vegas Fall 2009; Fall 2011; Fall 2012
Training Supervisor: Daniel N. Allen, Ph.D.

Completed (2009) a training program for administration of the Structured Clinical Interview of the DSM-IV-TR Axis I Disorders (SCID). Training consisted of a series of workshops across a two-week period for a total of approximately 40-workshop hours. Training culminated in a final mock interview conducted with Daniel Allen, Ph.D., to assess proficiency. An additional training (2012) has been held in which workshop and mock interview assistance was provided.

PUBLICATIONS

Thaler, N. S., Allen, D. N., Sutton, G. P., Vertinski, M., & **Ringdahl, E. N.** (2013). Differential impairment of social cognition factors in bipolar disorder with and without psychotic features and schizophrenia. *Journal of Psychiatric Research, 47*(12), 2004-2010.

Thaler, N. S., Reger, S. L., **Ringdahl, E. N.**, Mayfield, J. W., Goldstein, G., & Allen, D. N. (2013). Neuropsychological profiles of six children with anoxic brain injury. *Child Neuropsychology, 19*(5), 479-494.

Thaler, N. S., Strauss, G. P., Sutton, G. P., Vertinski, M., **Ringdahl, E. N.**, Snyder, J. S., & Allen, D. N. (2013). Emotion perception abnormalities across sensory modalities in bipolar disorder with psychotic features and schizophrenia. *Schizophrenia Research, 147*(2-3), 287-292.

Allen, D. N., Thaler, N. S., **Ringdahl, E. N.**, Barney, S. J. & Mayfield, J. (2012). Comprehensive trail making test performance in children and adolescents with traumatic brain injury. *Psychological Assessment, 24*(3), 556-564.

Weintraub, D. M., Ramage, E. M., Sutton, G. P., **Ringdahl, E. N.**, Boren, A., Pasinski, A. C., Thaler, N. S., Haderlie, M., Allen, D. N., & Snyder, J. S. (2012). Auditory stream segregation impairments in schizophrenia. *Psychophysiology, 49*(10) 1372-1383. doi: 10.1111/j.1469-8986.2012.01457.x

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Verbiest, R., Thaler, N. S., **Ringdahl, E. N.**, Vertinski, M., & Allen, D. N. (2012). Tone discrimination impairment is uniquely linked to bipolar disorder with psychotic features. *Applied Neuropsychology, 19*.

Thaler, N. S., Vertinski, M., **Ringdahl, E. N.**, Woolrey, H. E., & Allen, D. N. (2012). Affect identification impairments in bipolar disorder with and without psychotic features. *Applied Neuropsychology, 19*. (Poster Award)

Farcello, C., Egan, J., Thaler, N. S., **Ringdahl, E. N.**, & Allen, D. N. (2012). The Assessment of Interpersonal Problem Solving Skills in adults with bipolar disorder. *Applied Neuropsychology, 19*.

Ramage, E., Flores, A., Sutton, G., Barney, S., **Ringdahl, E. N.**, Allen, D., et al., (2012). Concurrent sound segregation is impaired in schizophrenia. Poster presented at the Association for Research in Otolaryngology, February 2012, San Diego, CA.

Ringdahl, E. N., Sutton, G. P., Turner, A., Snyder, J., & Allen, D. N. (2011). Simple auditory processing deficits in schizophrenia. *Archives of Clinical Neuropsychology, 26*(6) 544.

Heisler, D. L., Umuhoza, D., **Ringdahl, E. N.**, Barney, S. J., Thaler, N. S., & Allen, D. N. (2011). Psychometric properties of a new measure of attention and working memory. Poster presented at the 91st Annual Convention of the Western Psychological Association, Los Angeles, CA.

Snyder, J.S., Ramage, E.M., Weintraub, D.M., Sutton, G., **Ringdahl, E. N.**, Boren, A., Thaler, N., & Allen, D.N. (2011). Reduced auditory lateral suppression in schizophrenia. Poster presented at the International Congress on Schizophrenia Research 13th Annual Meeting, Colorado Springs, Colorado.

Turner A., Thaler, N. S., **Ringdahl, E. N.**, Mayfield, J., & Allen, D. N. (2011). Discrete executive functions differentially predict functional outcome in children with acquired brain disorders. *Applied Neuropsychology, 18*, 234.

Hart, J. S., **Ringdahl, E. N.**, Thaler, N. S., Mayfield, J., & Allen, D. N. (2011). Criterion validity of the Comprehensive Trail Making Test in traumatic brain injury. *Applied Neuropsychology, 18*, 234.

Ringdahl, E. N., Thaler, N. S., Umuhoza, D. U., Mayfield, J. & Allen, D. N. (2010). Classification of brain injury severity in pediatric traumatic brain injury. *Archives of Clinical Neuropsychology, 25*(6), 572.

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- Ringdahl, E. N.**, Thaler, N. S., Sanders, L. J., Mayfield, J. & Allen, D. N. (2010). Neuropsychological profiles of children with acquired anoxic brain injury: six case studies. *Applied Neuropsychology*, 17(3), 219.
- Ringdahl, E. N.**, Thaler, N. S., Hodges, T. D., Mayfield, J., & Allen, D.N. (2009). WISC-IV GAI and CPI profile patterns in children with TBI. *Archives of Clinical Neuropsychology*, 24(5), 478.
- Strauss, G.P., **Ringdahl, E. N.**, Barney, S.J., Jetha, S.S., Duke, L.A., Ross, S.A., et al. (2009). Using negative feedback to guide behavior: impairment on the first four cards of the Wisconsin Card Sorting Test Predicts negative symptoms of schizophrenia. *Archives of Clinical Neuropsychology*, 24(5) 498.
- Randall, C., Bello, D., Armstrong, C., Sutton, G., **Ringdahl, E. N.**, Thaler, N., et al. (2009). Spatial memory deficits in Bipolar I and II disorder: evidence in favor of a bipolar spectrum model? *Archives of Clinical Neuropsychology*, 24(5) 450.
- Ringdahl, E. N.**, Sallerson, B. M., Barney, S. J., Mayfield, J., & Allen, D. N. (2009) Executive function deficits resulting from open vs. closed head injury. Presentation at the University of Nevada, Las Vegas Undergraduate Poster Convention. Presented at the annual meeting of the Western Psychological Association conference, Portland, OR.
- Barney, S. J., **Ringdahl, E. N.**, Sallerson, B. M., Mayfield, J., & Allen, D. N. (2009). Factorial validity of the CTMT in adolescents with brain dysfunction. Presented at the annual meeting of the Western Psychological Association conference, Portland, OR.
- Sallerson, B. M., **Ringdahl, E. N.**, Barney, S. J., Mayfield, J., & Allen, D. N. (2009). Influence of type of injury and assessment environment on behavioral disturbances in children with traumatic brain injury. Presented at the annual meeting of the Western Psychological Association conference, Portland, OR.
- Barney, S. J., **Ringdahl, E. N.**, Kazakov, D., & Allen, D. N. (2008). Neurocognitive deficits in bipolar disorder with co-occurring borderline symptomatology. *Archives of Clinical Neuropsychology*, 23 (6).
- Ringdahl, E. N.**, Randall, C., Armstrong, C., Bello, D., & Allen, D. N. (2008). Bipolar disorder: do executive function deficits underpin visuospatial processing impairment? *Archives of Clinical Neuropsychology*, 23 (6).
- Randall, C., Bello, D. T., Armstrong, C. M., Frantom, L., **Ringdahl, E. N.**, Kazakov, D., & Allen D. N. (2008). Working memory deficits in psychotic bipolar disorder: endophenotypes for psychosis. *Archives of Clinical Neuropsychology*, 23 (6).

GRADUATE RESEARCH

Neuropsychology Research Program
University of Nevada, Las Vegas

Fall 2009 - Present
Advisor: Daniel N. Allen, Ph.D.

Study: Dissertation title: Impaired Theory of Mind in Psychotic and Affective Disorders.
(Fall 2012 - Present)

Responsibilities: Screening potential participants and assessing eligible participants as part of my doctoral dissertation. Participants will amount to twenty-five individuals with schizophrenia, twenty-five individuals with bipolar disorder with psychotic features, twenty-five individuals with bipolar disorder without psychotic features, and twenty-five healthy controls. Research contributors are each assessed using a 6-hour-long neuropsychological and neuroscience battery. Assessments include the SCID (computer version), selected WAIS-III subtests, a semi-structured interview for current and most recent episode psychiatric symptomatology, functional outcome assessments, reward learning tasks, and emotion perception and theory of mind tasks.

Study: Reliability and validity of the computerized Halstead Category Test. (*Summer 2011 - Present*)

Responsibilities: Currently examining the reliability and validity of a computerized version of the Halstead Category Test. Assessments include the Halstead Category test, both original and computerized versions, selected subtests from the WAIS-III, and established neuropsychological measures including Trails A and B, Finger Tapping test, Grooved Pegboard test, Grip Strength, Stroop task, Wisconsin Card Sorting Test, Test of Variable Attention, and FAS fluency test. Trained and managed a team of undergraduate research assistants on assessment, test scoring, and data entry.

Study: The effects of psychosis on affect identification and interpersonal skills: An in-depth evaluation of social cognition in bipolar disorder. (*Summer 2010 - Spring 2012*)

Responsibilities: Administered a 6-hour-long neuropsychological and neuroscience battery. Assessments included the SCID, selected WAIS-III subtests, quality of life self-report questionnaires, a semi-structured interview to facilitate rating current psychiatric symptomatology, functional capacity measures, and measures of sensory perception, affect identification, perception and interpretation of complex social situations, and theory of mind. Test administration and scoring.

Study: Affect identification and interpersonal skills: An in-depth evaluation of social cognition in schizophrenia. (*Summer 2010 - Fall 2011*)

Responsibilities: Assessment of individuals with schizophrenia using a 6-hour-long neuropsychological and neuroscience battery. Assessments include the SCID, quality of life self-report questionnaires, a semi-structured interview regarding and subsequent ratings of current psychiatric symptomatology, functional outcome measures, and measures of sensory perception, affect identification, perception and interpretation of complex social situations, and theory of mind.

Study: Longitudinal study of neuropsychological and functional deficits in adults with bipolar disorder. (*Fall 2009 - Spring 2010*)

Responsibilities: Test scoring, data entry, and training research assistants in test scoring and entry procedures. Assessments included the SCID, quality of life self-report questionnaires, a semi-structured interview regarding and subsequent ratings of current psychiatric symptomatology, measures of verbal and nonverbal learning and memory, executive functioning and processing speed measures, and functional outcome measures.

Auditory Cognition Neuroscience Laboratory

University of Nevada, Las Vegas

Summer 2008 - Spring 2012

Advisors: Joel S. Snyder, Ph.D., & Daniel N. Allen, Ph.D.

Study: Neural mechanisms of perceptual processing in schizophrenia.

Responsibilities: Subject recruitment and assessment of participants on a 2-hour neuropsychological and neuroscience battery. The battery included the SCID, a semi-structured

interview for current psychiatric symptom ratings, and select WAIS-III subtests. Participants were administered three auditory streaming paradigms utilizing electroencephalography. Organized transportation to Nevada Cancer Institute. Met participants at Nevada Cancer Institute, facilitated paperwork and understanding of all procedures, observed 25-minute MRI scan 1.5T (T1, T2-GRE, T2-flare, PD/T2). Principle brain scan analyzer. Conducted brain scan realignment and manually quantified (via computer tracing with 3D Slicer software) intracranial content, primary auditory cortex, and corpus callosum volumes, which totaled approximately 240 hours. Trained numerous undergraduate students to manually trace for reliability purposes which amounted to approximately 20 hours.

Achievement Center

Summer 2008 - Fall 2010

University of Nevada, Las Vegas Advisors: Bradley Donohue, Ph.D., & Daniel N. Allen, Ph.D.

Study: Concurrent drug abuse treatment and HIV prevention in child neglecting mothers, NIDA funded R01 grant (DA020548-01A1)

Responsibilities: Evaluated substance-abusing mothers who were identified by Child Protective Services to participate in a therapeutic program. Assessments were administered in the clients' residence and included the SCID, urine analysis, home safety ratings, and verbally administered self-report measures of child abuse potential, family interaction styles, and life satisfaction.

AD HOC REVIEWER

Psychological Assessment, 03/2013 Supervised by Daniel Allen, Ph.D.

Applied Neuropsychology: Adult, 02/2013 Supervised by Daniel Allen, Ph.D.

Applied Neuropsychology: Adult, 11/2012 Supervised by Daniel Allen, Ph.D.

PROFESSIONAL AFFILIATIONS

2008 - *Present* National Academy of Neuropsychology (NAN)

2007 - *Present* American Psychological Association (APA)

2011 - *Present* APA Division 19, Society of Military Psychology

2009 - 2012 APA Division 40, Clinical Neuropsychology

2007 - 2012: Nevada Psychological Association (NPA)

LEADERSHIP POSITIONS

2013: Wright-Patterson AFB, Clinical Psychology Internship - Chief Resident

2013: Officer Training School - Flight Academic Officer

2012 - 2013: UNLV Division of Research and Graduate Studies - Marketing and Advertising representative and guest speaker

2012: National Honors Society in Psychology, Psi Chi - Chapter poster competition judge

2011 - *Present*: Nevada Psychological Association - Membership Committee

2010 - *Present*: National Academy of Neuropsychology - Research Grants Committee

2010 - *Present*: Mentor for incoming clinical psychology graduate students

2009 - *Present*: Outreach Undergraduate Mentoring Program - Graduate Student Mentor

2009 - 2010: Outreach Undergraduate Mentoring Program - Growth and Development Coordinator

2009 - 2010: Clinical Student Committee - Secretary

2008 - 2009: International Honors Society in Psychology, Psi Chi - President

2007 - 2008: Psychology Club - President

2006 - 2007: Psychology Club - Historian

2006 - 2007: UNLV Men's swimming team - Team Captain

HONORS AND ACHIEVEMENTS

2013: National Academy of Neuropsychology: Diversity Student Poster Award.

2013: Nevada Regents' Scholar Award: Spring 2013. Competitive state-wide award granted to one graduate student in Nevada's higher educational system who has demonstrated substantial academic, leadership, and service accomplishments.

2012: Theodore Blau Student Poster Award (1st Place), American College of Professional Psychology: Poster: Thaler, N. S., Vertinski, M., Ringdahl, E. N., Woolery, H., & Allen, D. N. (March, 2012). Affect identification impairments in bipolar disorder with and without psychotic features.

2011: Health Profession Scholar, USAF (Commissioned 2Lt: Spring, 2011)

2010: San Diego Rock and Roll Half-Marathon finisher (24th/13,573; 1:20:23)

2009: Las Vegas Rock and Roll Half-Marathon finisher (64th/17,919; 1:20:44)

2009: UNLV, Outstanding Scholar Leader Award

2009: UNLV, Outstanding Emerging Leader Award

2004 - 2007: UNLV, National Collegiate Athletic Association, Academic All-American

2004 - 2007: UNLV, National Collegiate Athletic Association, Academic All-Conference

2004 - 2007: UNLV, Mountain West Conference, Men's Swimming Champions

PROFESSIONAL REFERENCES

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VA Southern Nevada Healthcare System
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