

2012-08-01

Domains of Schizotypy and Associations with Cognitive Biases in a Non-Clinical Sample: A Structural Equation Modeling Approach

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UNIVERSITY OF MIAMI

DOMAINS OF SCHIZOTYPY AND ASSOCIATIONS WITH COGNITIVE BIASES
IN A NON-CLINICAL SAMPLE: A STRUCTURAL EQUATION MODELING
APPROACH

By

Stephanie A. Sacks

A DISSERTATION

Submitted to the Faculty
of the University of Miami
in partial fulfillment of the requirements for
the degree of Doctor of Philosophy

Coral Gables, Florida

August 2012

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Domains of Schizotypy and Associations with Cognitive Biases

(August 2012)

In a Non-clinical Sample: A Structural Equation Modeling

Approach

Abstract of a dissertation at the University of Miami.

Dissertation supervised by Dr. Amy Weisman de Mamani.

No. of pages in text. (135)

The spectrum perspective views schizotypy as a subclinical expression of schizophrenic psychopathology resulting from shared etiology (Claridge & Beech, 1995). Research on normative populations scoring high on schizotypy is valuable because performance is not confounded by issues often present in schizophrenia samples. Research on schizotypy is also important because it may help elucidate the predisposition to schizophrenia (Jahshan & Sergi, 2007). Prior efforts to establish the underlying multidimensional construct of schizotypy have not been entirely consistent, but have generally supported a four-factor model when more comprehensive measures of schizotypy are used (Reynolds, Raine, Melling, Venables, & Mednick, 2000). The current study replicated the four-factor model of schizotypy including positive, negative, disorganized and impulsive nonconformity factors via Confirmatory Factor Analysis (CFA). The current study also examined associations between several cognitive biases associated with the pathogenesis and maintenance of psychosis and latent factors of schizotypy. As hypothesized, increased self-certainty (SC), decreased Theory of Mind (ToM) and decreased source memory (SM) were associated with higher ratings in the positive schizotypy factor. Also consistent with our hypotheses, increased SC was associated with higher ratings on the impulsive nonconformity schizotypy factor. We also found several associations that we had not anticipated. Specifically, increased SC

was associated with higher ratings on the negative schizotypy factor. We also found that increased decreased SM was significantly associated with greater impulsive nonconformity schizotypy factor scores. Contrary to our hypotheses, decreased SC and increased ToM were associated with higher ratings in the disorganized schizotypy factor. Our results suggest that cognitive biases present in schizophrenia samples are also present in individuals rating high on domains of schizotypy. Our findings offer new insights by highlighting cognitive biases that may be important to remediate via psychological interventions.

TABLE OF CONTENTS

	Page
LIST OF FIGURES	iv
LIST OF TABLES	v
Chapter	
1 INTRODUCTION	1
Latent Structure of Schizotypy	5
The Role of Cognitive Biases	8
Self-Certainty	11
Knowledge Corruption	14
Theory of Mind	16
Source Memory	21
Interplay of Cognitive Biases	23
The Current Study	24
Summary of Hypotheses	28
Exploratory Analyses	29
2 METHODS	30
Participants	30
Procedures	30
Instruments	30
3 RESULTS	37
Preliminary Analyses	37
Measurement Model	38
Structural Model	42
4 DISCUSSION	46
Limitation and Future Directions	55
Conclusions	57
5 REFERENCES	59
Figures	76
Tables	80
Appendix	88

LIST OF FIGURES

Figure 1.....	76
Figure 2.....	77
Figure 3.....	78
Figure 4.....	79

LIST OF TABLES

Table 1.....	80
Table 2.....	81
Table 3.....	82
Table 4.....	83
Table 5.....	84
Table 6.....	85
Table 7.....	86
Table 8.....	87

CHAPTER 1: INTRODUCTION

Traditionally, psychotic symptoms have been considered to be distributed along a continuum (Eysenck, 1952; Straus, 1969). Subclinical psychotic experiences which do not meet clinical criteria for a psychotic disorder are known as psychosis proneness, schizotypy, or at-risk mental states (Claridge, 1997). Historically, the schizotypy concept was introduced as a genetic diathesis-stress model for schizophrenia (Chapman & Chapman, 1997; Lenzenweger & Korff, 1992; Lenzenweger & Loranger, 1989; Meehl, 1962). Researchers have identified spectrum disorders through genetic (Debbané, Van der Linden, Glaser & Eliez, 2008) and psychometric techniques (Toomey & Schildberg, 1995). However, the practical and financial constraints of using genetic methods (Bosse et al., 2009; Kirov et al., 2009) highlight the usefulness and feasibility of the psychometric approach (Chapman & Chapman, 1985, 1987; Lenzenweger, 1994). Schizophrenia and schizotypy have been found to share common genetic (Siever & Davis, 2004; Lin et al., 2005), neuroimaging (Dickey, McCarley, & Shenton, 2002), neurophysiological (Siever & Davis, 2004; Kiang & Kutas, 2005) and neurocognitive abnormalities (Spaulding, Garbin, & Dras, 1989; Siever & Davis, 2004).

Schizotypy is conceptualized as a non-clinical manifestation of the same underlying biological factors that give rise to schizophrenia and other psychotic disorders (Claridge, 1994; Claridge & Beech, 1995). The spectrum perspective views schizotypy as on the continuum of schizophrenia. That is, schizotypy is a subclinical expression of schizophrenic psychopathology resulting from a shared etiology (Weinstein, McKay, & Ngan, 2008). Patients with schizophrenia (Rossi & Danelizzo, 2002), their healthy relatives (Calkins, Curtis, Grove, & Iacono, 2004; Mechri et al., 2010), subjects in the

premorbid phase (Raine, 2006) and high-risk populations (Johnstone, Ebmeier, Miller, Owns, & Lawrie, 2005) have been found to exhibit higher degrees of schizotypal personality traits. These findings suggest that higher rates of schizotypal traits may reflect the biological or genetic vulnerability to developing psychosis (Mechri et al., 2010; Tsuang, Stone, & Faraone, 1999).

Individuals that meet criteria for Schizotypal Personality Disorder and non-clinical populations rating high in schizotypy often share psychopathological (Lenzewege et al., 2007) and biological abnormalities (Liouta, Smith, & Mohr, 2008; Mohr et al., 2005). However, in most instances, individuals rating high on schizotypy do not meet clinical criteria for a Schizotypal Personality Disorder diagnosis in the DSM-IV-TR (Vollema, Sitskoorn, Appels, & Kahn, 2002). It is important to note that schizotypy characteristics exist in healthy individuals and do not necessarily lead to psychosis. The base rate for schizotypy has been found to be approximately 10% in “healthy” university student samples (Fossati, Raine, Borroni, & Maffei, 2007; Lenzenweger, 1999) when utilizing the top decile scores on measures of schizotypy (Raine, 1991). Schizotypy characteristics in “healthy” samples follow a normal curve, which underscores the continuum distribution of schizotypal manifestation (Claridge & Beech, 1995). These traits have been associated with a variety of alternative and sometimes adaptive phenomena such as out-of-body experiences (McCreery & Claridge, 2002), creativity (Gianotti, Mohr, Pizzagalli, Lehmann, & Brugger, 2001), and belief in the paranormal (Lawrence & Peters, 2004).

Investigators interested in identifying the key features of psychosis value studies of individuals scoring high on schizotypy because performance impairments in these

individuals are not confounded by issues often present in schizophrenia samples. These confounds include long term effects of antipsychotic medication usage and the psychosocial consequences of this psychiatric diagnosis, such as social isolation and recurrent hospitalizations (Jahshan & Sergi, 2007; Noguchi, Hori, & Kunugi, 2008). Therefore, research that examines schizotypal features and traits can likely advance our understanding of the etiology of schizophrenia (Lenzenweger, 1994).

Examining schizotypal traits in non-clinical populations may help to elucidate factors related to the predisposition to schizophrenia, given that the presence of psychotic-like symptoms during adolescence significantly increases the risk for later development of schizophrenia-spectrum disorders (Gooding, Tallent, & Matts, 2005; Poulton et al., 2000). For example, Kwapil (1998) found that after a ten-year follow-up study 24% of individuals who scored high on the Social Anhedonia Scale (Chapman, Chapman, & Raulin, 1976), a measure of schizotypy, were diagnosed as having a schizophrenia-spectrum disorder, as compared to 1% of controls. Similarly, in a birth study cohort from Dunedin, Poulton, and colleagues (2000) found that children who reported hallucinations or delusions at 11 years of age had more than a 16-fold higher risk for developing a psychotic disorder by 26 years of age. While the validity of these measures as pure indicators of future risk is controversial, they assisted with the successful identification of individuals with cognitive impairments similar to those with schizophrenia (Toomey & Schuldberg, 1995).

Schizotypy is not a monolithic construct, but instead, is a multidimensional one (Mason, 1995; Mason & Claridge, 2006). In response to the evident heterogeneity of schizotypy, there have been attempts to establish the underlying structure of schizotypy

by scale and item analysis of a number of well-developed self-report scales that measure schizotypy in non-clinical populations (Mason & Claridge, 2006). Over the last decade, factor analyses of schizotypy have failed to present a unified picture of the underlying structure seemingly because measures included failed to capture the comprehensive nature of the construct (Mason & Claridge, 2006). Factor analytic studies (see Reynolds, Raine, Mellinger, Venables, & Mednick, 2000) have yielded the following underlying domains: one (a general schizotypy factor), two (positive and negative factors), three (positive, negative and disorganized factors) or four factors (positive, negative, disorganized and impulsive nonconformity factors). To date, four factors appear to best capture the dimensions of schizotypy (Mason, 1995) when items tapping more DSM-IV-TR components of Schizotypal Personality Disorder are included. However, many factor analytic studies utilized measures that tap into only one aspect of each latent domain of schizotypy (e.g., magical ideation as a proxy for the positive factor). Thus, in order to comprehensively capture each component of schizotypy, factor analytic studies should utilize several well-validated measures that tap into distinct components of each factor. This would lead to more extensively defined factors of schizotypy.

While several demographic features (e.g., lower income, living alone, urban residence) have been associated with an increased likelihood of endorsing schizotypy traits, it remains unclear which cognitive mechanisms may be associated with these subclinical characteristics (Reynolds et al., 2000). Identifying cognitive mechanisms prevalent in schizotypy may shed light onto the thinking patterns that may predispose to the development and/or maintenance of psychosis (Beck et al., 2004). Furthermore, identifying whether these cognitive biases are prevalent in psychometrically high-risk

populations, prior to the onset of psychosis, is important because it may provide insights into types of premorbid interventions that may be useful. Some cognitive biases that have been found in individuals with schizophrenia include increased self-certainty (SC) increased knowledge corruption (KC), deficits in Theory of Mind (ToM) and diminished source memory (SM) (Cangas, Errasti, Garcia-Montes, Alvarez & Ruiz, 2006; Debbane et al., 2008; Fyfe, Williams, Mason & Pickup, 2008). The current study will examine whether these cognitive biases are associated with latent domains of schizotypy in a non-clinical undergraduate sample. An identification of cognitive factors that are associated with schizotypy domains might improve prognosis, given that they might be targeted in interventions such as Cognitive Behavioral Therapy and Metacognitive Training (Beck, Rector, Stolar, & Grant, 2004).

Latent Structure of Schizotypy

Evidence of schizotypy's multidimensional structure has come from a series of factor-analytic studies utilizing scale and item data (Claridge et al., 1996). The results have varied depending on the range and type of measures included; however, some consistent patterns have emerged. A one factor "general schizotypy" model was hypothesized and supported by Kelley and Coursey (1992). These authors concluded that one key latent trait ("general schizotypy") underlies all nine features of the DSM-III-R Schizotypal Personality (Raine et al., 1994). However, these researchers acknowledged that their data was based from an unusually homogenous sample of subjects. The vast majority of factor-analytic studies have yielded more than one component of schizotypy. Even relatively small studies (Raine & Allbutt; 1989) have revealed a simple two-factor model (Crow, 1980) including a positive and negative schizotypy factor. Siever and

Gunderson (1983) and Widiger and colleagues (1986) conceptualized a “cognitive-perceptual dysfunction” and an “interpersonal functioning deficit” as two main factors that mapped onto positive and negative schizotypy respectively. These factors mirror the positive and negative symptoms of schizophrenia, albeit to a lesser degree (Crow, 1980). The positive factor included features such as ideas of reference, magical thinking, unusual perceptual experiences, odd speech and paranoid ideation, while the negative factor included social anhedonia, lack of close friends, and constricted affect (Crow, 1980; Raine & Allbutt, 1989; Siever & Gunderson, 1983; Widiger, Frances, & Trull, 1987).

A three-factor model of schizotypy was introduced in a comprehensive published analysis which included the largest number of scales to date (Bentall, Claridge, & Slade, 1989). This study utilized a multi-scale questionnaire, the Combined Schizotypal Traits Questionnaire (CSTQ), which assessed schizotypy and psychosis proneness using 18 existing scales, including the Eysenck Personality Questionnaire (EPQ), ten of the most prominent schizotypy scales in use at the time, and four clinical scales that assessed delusional beliefs. These researchers carried out two separate principal component analyses, one with and one without the four delusional scales. When the delusional scales were included, a third schizotypy factor emerged (Bentall et al., 1989) which subdivided the positive/negative distinction and represented a mixture of cognitive disorganization and social anxiety (Claridge et al., 1996). This three-factor model was also found by Arndt and colleagues (1991) and Raine and colleagues (1994).

A fourth factor was detected by Claridge and colleagues (1996) and Mason (1995). Claridge and colleagues (1996) performed an exploratory factor analysis

utilizing the aforementioned CSTQ. These researchers concluded that their “findings left little room for doubt that four factors are necessary to account for variations” in schizotypy. Mason's (1995) analysis also supported a four-factor model of schizotypy including unusual experiences (related to positive symptoms), introverted anhedonia (related to negative symptoms) cognitive disorganization, and impulsive non-conformity. The fourth factor found (impulsive non-conformity), captures disinhibited and asocial behavior (Mason, 1995). The authors argue that the reason why this fourth factor had not yet emerged was because prior factor analyses failed to include measures which represented disinhibition/asocial behavior. The inclusion of measures that tap into these characteristics (e.g., the P scale in the MMPI-II or the Delusional Scales) which are subsumed under the DSM-IV-TR Schizotypal Personality Disorder criteria (Foulds & Bedford, 1975) reliably yield a fourth schizotypy factor (Muntaner, Garcia, Fernandez, & Torrubia, 1988; Kenler & Hewitt, 1992). As a result of this four-factor model, Mason and colleagues (1995) developed a new measure of schizotypy, the Oxford Liverpool Inventory of Feelings and Experiences (O-LIFE).

Taken together, these results offer evidence for the multidimensional nature of schizotypy traits, although the number of factors that emerge strongly depend on which measures are used and whether or not they capture all facets of schizotypy or of the schizotypal personality disorder diagnosis (Mason et al., 1995). Another important issue in the multidimensional assessment of schizotypy is whether measures used in factor analyses comprehensively define each latent domain of schizotypy. For example, previous research has utilized magical ideation or delusional propensity as a proxy for the positive schizotypy factor. While both of these constructs load onto the positive factor,

individually, they only define one component of the positive schizotypy factor. Similarly, social anhedonia has been used as a proxy for the negative schizotypy factor. Thus, in order to comprehensively capture each component of schizotypy, research should include a number of well-validated measures which define a number of features of each factor of schizotypy.

The Role of Cognitive Biases

In the literature, there are many theories that implicate cognitive biases in the development and maintenance of psychosis (Bentall, 1990; Morrison, 2001; Morrison, Haddock, & Tarrier, 1995). In fact, Garety and colleagues (2001) proposed that the route to psychosis begins with a precipitating event, either environmental or neurobiological, that disrupts usual cognitive processes and leads to unusual experiences. There is mounting evidence that specific cognitive processes pose as risk factors for the transition from subclinical experiences to clinically significant psychotic disorders. According to the diathesis-stress model of schizophrenia, psychosis begins with a premorbid biological predisposition for mental illness (Kingdon & Turkington, 2006). Stress may then trigger perceptual aberrations, such as hearing voices, and specific emotional and/or cognitive changes, such as specific reasoning or information processing biases which facilitate appraisals of these anomalous experiences as external or significant. Cognitive models of psychosis posit that ongoing appraisals of experiences are crucial for the development and persistence of many positive symptoms of psychosis. Thus, the experience of hearing a voice is not necessarily psychotic; instead, when an individual appraises a voice in a particular way, such as that it comes from an external source, or that it is significant

and uncontrollable, these symptoms cause distress and develop into full-blown psychotic symptoms (Garety, Bebbington, Fowler, Freeman, & Kuipers, 2007).

Additional evidence that cognitive biases play a crucial role in the development of psychosis comes from Cognitive Behavioral Therapy (CBT) intervention studies in individuals identified as High-Risk. CBT directly targets cognitive biases. Specifically, it teaches the importance of the gathering evidence prior to arriving at conclusions, and it encourages integration of disconfirmatory evidence, graded reality testing and inference chaining (Kingdon & Turkington, 2006). In a pilot study, Bechdolf and colleagues (2005) found preliminary indication that CBT for individuals in "pre-psychosis," who displayed sub-threshold symptomatology prevented or delayed the progression into full-blown psychosis. Similarly in a randomized controlled trial, Morrison and colleagues (2004) found that CBT for individuals at High-Risk for psychosis reduced the likelihood of progression to psychosis, the likelihood of being prescribed antipsychotic medication, and of meeting criteria for a DSM-IV diagnosis of a psychotic disorder. After a 3-year follow-up, Morrison and colleagues (2007) found that after controlling for baseline cognitive factors, CBT significantly reduced the likelihood of progression to psychosis as defined on the PANSS. These results highlight the possibility that targeting cognitive biases prior to the onset of full-blown psychosis may lead a delayed onset of the illness or improved prognosis.

In consensus with the view that the schizophrenia spectrum is on a continuum (Claridge & Beech, 1995), certain cognitive biases that have been found in individuals with schizophrenia also exist in non-clinical populations rating high on schizotypy (Gray & Snowden, 2005; Langdon & Coltheart, 1999; Laws & Bhatt, 2005; Sellen, Oaksford, &

Gray, 2005). However, only a few cognitive biases have been examined across the schizophrenia spectrum. Additionally, studies that have explored cognitive mechanisms in schizotypy have rarely considered the different sub-domains of schizotypy associated with each bias, and have instead used an aggregate score of schizotypy. Given these limitations, the current study aims to extend on prior literature by exploring the relationship between cognitive biases which have been found in individuals with schizophrenia (e.g., increased self-certainty (SC), increased knowledge corruption (KC), decreased Theory of Mind (ToM) and decreased source memory (SM)), and elevations in subdomains of schizotypy.

These specific biases are examined because they hang together in important ways, and because they have serious implications and consequences for individuals who display these thinking styles. For example, individuals who are less likely to incorporate corrective feedback from others (high SC) and who tend to hold incorrect memory information with high confidence (high KC) seem to hold on to cognitive interpretations of their internal experiences (i.e., thoughts, beliefs) which are skewed and inflexible. Thus, these individuals seem to have difficulty monitoring and correctly evaluating their own cognitive processes during retrieval of their memories or thoughts. Mental flexibility, which underlies SC and KC, is important because it has been found to be one of the best predictors of functional outcomes, such as vocational functioning, in individuals with psychosis (Lysaker, Bryson, Davis, & Bell, 2005).

Individuals who have difficulty labeling the emotions/intentions of others (low ToM) and who have difficulty discriminating whether they, themselves, or others are the source of information (low SM) may have difficulty navigating the external world

because their understanding of their social environment may be confused and biased. This bias may lead to erroneous interpretations of the intentionality of others and incorrect attributions of one's own thoughts to external sources. These experiences have been found to be associated with the prevalence and severity of paranoia and hallucinations (Bentall, Kaney, & Dewey, 1991). Given the deleterious impact of these biases, it is important to examine which internal and external cognitive misinterpretations may be associated with the development of psychotic-like experiences.

Examination of these biases has been scarce, and the few studies that have been conducted have yielded quite mixed findings. For example, to date, only a handful of studies have explored the prevalence and impact of SC and KC in schizophrenia, and even less research (i.e., less than 10 articles) has examined these biases in schizotypy. Research on the correlates of ToM and SM deficits in schizotypy is quite mixed. This may be because previous studies have often utilized an aggregate schizotypy score or have considered positive schizotypy as a proxy for the entire construct. The methodological strengths of the current study will allow us to tease apart specific aspects of schizotypy that may be associated with these biases and may, therefore, clarify previously mixed findings.

Self-Certainty

Beck and colleagues (2004) proposed that patients with psychosis may be impaired in their ability to critically examine their beliefs and to skeptically interpret their experiences. Additionally, these individuals were considered to have limited ability to incorporate corrective feedback from others about their potentially flawed beliefs (Beck, Baruch, Balter, Steer, & Warman, 2004; Bora et al., 2007). It was hypothesized that this

inability to question one's beliefs when faced with discordant information from others may contribute to the pathogenesis and maintenance of delusional beliefs (Beck et al., 2004). In order to assess these hypotheses, the Beck Cognitive Insight Scale was developed (Beck et al., 2004). This measure was originally developed for and validated in individuals with schizophrenia (Beck et al., 2004; Pedrelli et al., 2004) but has since been used with individuals with bipolar disorder and non-clinical populations (Engh et al., 2007; Warman & Martin, 2006).

Exploratory and confirmatory factor analyses led to the identification of two factors: self-reflectiveness and self-certainty, in inpatient and outpatient clinical samples, as well as non-clinical individuals (Beck et al., 2004; Pedrelli et al., 2004; Warman, Lysaker, & Martin, 2007). Self-reflectiveness is a measure of introspection and ability to acknowledge fallability in one's interpretations of their experiences. Self-certainty measures over-confidence in beliefs, and unwillingness to consider feedback provided by others. Overall cognitive insight is an index summary score that is derived from subtracting the total score of self certainty from the total score of self reflectiveness (Beck et al., 2004). Cognitive insight is of great importance as it directly taps into the thinking styles that underlie distorted cognitions, which may feed into delusional thinking patterns (Buchy et al., 2009; Moritz et al., 2005). Given that only one article has examined the relationship between cognitive insight and psychosis-proneness in a healthy sample, we will utilize the schizophrenia literature in order to provide a context for our hypotheses.

Patients with schizophrenia have been found to have diminished cognitive insight, when compared to healthy controls (Warman et al., 2007) and depressed inpatients (Beck

et al., 2004). Engh and colleagues (2007) found that patients with schizophrenia did not differ significantly in cognitive insight from bipolar patients. However, this null finding may have been due to the fact that most of the bipolar patients in the Engh and colleagues (2007) study endorsed at least one prior psychotic episode. Within schizophrenia samples, there is mixed evidence regarding whether patients with schizophrenia have reduced self-reflectiveness (Beck et al., 2004; Warman et al., 2007), increased self-certainty (Engh et al., 2007), or both (Bora, Erkan, Kayahan, & Weznedaroglu, 2007). More specifically, research has explored whether these thinking styles impact patient symptom profiles, or the presence of active delusions or hallucinations.

Authors have posited that self-reflectiveness may be more of a state-characteristic, while self-certainty may be more of a trait-characteristic (Warman et al., 2007; Bora et al., 2007). Bora and colleagues (2007) found that changes in acute symptom recovery were not associated with changes in overall cognitive insight, or self-certainty, but were associated with improvements in self-reflectiveness in patients with delusions. These findings suggest that overconfidence (self-certainty) in schizophrenia patients with delusions may be more of a persistent feature that extends beyond active psychotic states (Bora et al., 2007). Thus, it may be that high belief certainty spans both the presence and absence of delusions in chronic and early disease process, suggesting that this thinking style may represent a vulnerability factor for psychosis (Buchy et al., 2009). As a result, overconfidence in one's own judgments may be a more stable characteristic of delusion-prone schizophrenia individuals rather than a temporary feature in acute psychosis (Bora et al., 2007). Because self-certainty appears to be trait-based, rather than state-based, the current study will only utilize this index.

To date, only one study has explored the relationship between self-certainty (SC) and delusion proneness, a component of positive schizotypy, in a non-clinical sample (Warman & Martin, 2006). This study found that greater SC was associated with higher delusion proneness, as measured by the Delusions Inventory (Peters, Joseph, & Garety, 1999). It is important to note that although SC has been found to be associated with delusion proneness, this is only one aspect of positive schizotypy.

Research has found that individuals who fail to take alternative, conflicting information into account when making a decision have higher scores on the impulsive nonconformity factor of schizotypy (Sellen, Oaksford, & Gray, 2005). Thus, biases in data gathering, or being less open to information provided by others, has been shown to be related to greater endorsement of disinhibited asocial behaviors. Sellen, Oaksford and Gray (2005) did not measure SC via the Beck Cognitive Insight Scale; instead, they utilized an experimental paradigm that assessed participants' ability to access and utilize implicit information when drawing conclusions. Similarly, Tsakanikos and Reed (2005) found that mental flexibility, which underlies SC, was associated with the impulsive nonconformity component of schizotypy in nonclinical college students. While the relationship between SC, as assessed via the Beck Cognitive Insight Scale, and the impulsive nonconformity factor of schizotypy has not been empirically tested, the aforementioned research suggests that there may be an association. Thus, research is needed that explicitly examines this relationship.

Knowledge Corruption

Knowledge refers to information that is held with strong conviction, whether it be true or false (Moritz, Woodward, Whitman, & Cuttler, 2005; Moritz, Woodward, &

Chen, 2006). On the other hand, information that an individual places doubt upon is not considered knowledge, regardless of its validity (Moritz et al., 2006). Knowledge corruption, a term coined by Moritz and colleagues (2005), refers to increased errors coupled with overconfidence in those errors.

Both healthy participants and schizophrenia patients make mistakes. However, patients with schizophrenia seem to have a more liberal acceptance bias of information entering the memory system than healthy controls. Healthy individuals generally have more appropriate and comparatively low confidence ratings in instances where they commit errors (Moritz et al., 2006), compared to individuals with schizophrenia. On the other hand, schizophrenia subjects, compared to healthy controls, tend to put more trust in incorrect memory information (Moritz et al., 2005). This means that while inadequate or contradictory information may dissuade a healthy individual from making strong inferences, it may not be enough evidence to dissuade individuals with schizophrenia from making high-confidence judgments (Moritz et al., 2006).

Moritz and colleagues (2005) have posited that knowledge corruption (KC) may represent a potential mechanism for the emergence of delusions, given that this faulty framework of corrupted beliefs may not provide an adequate basis for reality assessment. Indeed, research shows that higher KC is associated with a greater endorsement of delusions in patients with schizophrenia (Moritz et al., 2005; 2006). This tarnished information system may also make it more challenging to navigate the external world because it offers an incorrect context from which to interpret current and new information (Moritz et al., 2005). When incorrect memory information is not detected and doubt is

not imposed, we may hold inaccurate memories or beliefs, and this may interfere with our assessment of reality (Moritz et al., 2006).

Moritz and colleagues (2005; 2006) have posited that KC presents a vulnerability mechanism for schizophrenia, which may begin prior to the onset of psychosis (Moritz et al., 2005). However, to date, no research has assessed whether KC is present in schizotypy. Further, no research has explored the relationship between KC and specific subdomains of schizotypy. Therefore, research is needed that examines these unanswered questions.

Theory of Mind

Theory of mind (ToM) or “mentalizing” refers to the cognitive ability to attribute mental states (e.g., thoughts, beliefs, intentions) to others where the content of these thoughts cannot be derived directly from objective information (Baron-Cohen, 1995; Langdon & Coltheart, 2004; Sprong, Schothorst, Vos, Hox, & Van England, 2007). ToM abilities allow individuals to explain, manipulate and predict behavior (Sprong et al., 2007), and facilitate engagement in adaptive and appropriate social behaviors (Corcoran, 2001; Leudar, Costall, & Francis, 2004).

There is agreement about the definition of ToM; however, because the definition is broad, there is significant variation in the operationalization of the construct (Sprong et al., 2007). One of the most frequently used ToM tasks is the false belief or deception task. During this task, participants are assessed for their ability to understand that others can hold beliefs that are different from the actual state of affairs. A second frequently utilized ToM task is an intention-inferencing task. This task assesses the ability to infer the intentions of a character from the information in a short story. A third type of ToM

task assesses the ability to understand indirect speech, such as irony, banter, hints and metaphors. This way of assessing ToM is based on the notion that in order to understand indirect speech, individuals must possess an understanding of another person's mental state. However, Langdon and Coltheart (2004) found that the ability to comprehend irony and metaphors are unrelated to each other. Further, they found that in order to understand irony, one must possess ToM abilities, but in order to understand metaphors, ToM is not necessary (Sprong et al., 2007). Another task used to assess ToM is the Reading the Mind in the Eyes task, where participants have to infer mental states from looking at pictures of eyes (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001). Another, less commonly used task requires participants to attribute mental states to animated geometric shapes that are shown interacting in a 'socially' complex way. However, this type of task may not be fully comparable with other ToM tasks because of the higher level of abstraction that it demands (Sprong et al., 2007).

The current study utilizes the Reading the Mind in the Eyes Task. This task has received praise because of its sensitivity to reveal subtle impairments in mentalizing (Baron-Cohen et al., 2001). This task is also ideal because it is composed of a larger number of items than other tasks, thus providing a bigger window to reveal individual differences in ability on this test. This decreases the risk that normal performance might reach ceiling effects, as it does on other tasks, such as the false belief test (Baron-Cohen et al., 2001). This measure's strength also lies in its inclusion of complex mental states, which makes the task more difficult and increases the likelihood of obtaining a wider range of performance.

Frith (1992) proposed that ToM is impaired in schizophrenia, and that several symptoms could be explained by ToM deficits. In the next decade that followed, a substantial body of research has concluded that patients with schizophrenia have ToM deficits (Brune, 2005; Harrington, Siegert, & McClure, 2005a; McCabe, 2004; Pinkham, Penn, Perkins, & Lieberman, 2003). In schizophrenia samples, ToM deficits have been found to be associated with positive symptoms, such as paranoid delusions (Randall et al., 2003; Craig et al., 2004; Harrington et al., 2005b), negative symptoms (Frith & Corcoran, 1996; Corcoran et al., 1997; Pickup & Frith, 2001; Mazza, De Risio, Surian, Roncone, & Casacchia, 2001; Bell & Mishara, 2003; Martino, Bucay, Butman, & Allegri, 2007) and cognitive disorganization (Safarti & Hardy-Bayle, 1999).

Researchers have also investigated whether deficits in ToM psychosis are state- or trait-dependent (Janssen, Krabbendam, Jolles, & Van Os, 2003). Initially, Frith (1992) proposed that individuals with psychosis had intact ToM abilities, but these abilities become impaired during acute stages of the illness. In early studies, researchers found that actively psychotic patients had deficits in ToM, while patients who were symptom-free at the time of testing performed normally (Corcoran et al., 1995; Frith & Corcoran, 1996). However, more recently, studies have found evidence that ToM is a trait-deficit. For example, Herod and colleagues (2002) and Randall and colleagues (2003) found that individuals who were in remission also exhibited deficits in ToM. Further evidence that ToM is a trait-deficit lies in family studies of individuals with psychosis. Wykes and colleagues (2001), Toomey and colleagues (1999), and Janssen and colleagues (2003) found that first-degree relatives of individuals with schizophrenia perform worse than healthy controls on ToM tests.

Additional evidence for ToM as a trait-deficit lies in the schizotypy literature. Studies that utilized a total score for schizotypy have found associations between ToM abilities and the total score across symptom domains of schizotypy. Findings include that individuals who have more difficulty understanding false-beliefs and attributing mental states to others endorsed more “total” schizotypal traits (Langdon & Coltheart, 1999, 2001; Platek et al., 2003a). Additionally, individuals with higher “total” schizotypy scores show impairments in their ability to detect deception (Malcolm & Keenan, 2003), appreciate ironical statements (Langdon & Coltheart, 2004), and process information about the self (Platek & Gallup, 2002; Platek et al., 2003b).

While Rapp and colleagues (2010) did not find a significant relationship between behavioral performance on an irony task and schizotypy in a non-clinical sample, there was a significant association between psychometric schizotypy and individuals' Blood Oxygen Level Dependent Hemodynamic response (BOLD) during irony comprehension. This means that during an irony comprehension task, individuals who had a higher SPQ total score had less brain activation in the medial temporal gyrus and were less effective at recruiting neural substrates that are critical for processing ToM information. And, although behavioral performance on the irony task did not differ depending on level of schizotypy, functional impairments were found in the middle temporal gyrus, an area that has been implicated in ToM abilities.

Other research has failed to find an association between ToM capacity and schizotypy. A study by Toomey and Schulberg (1995) found that individuals whom had more difficulty judging emotions from facial expressions did not have higher ratings of an aggregate schizotypy score. These researchers used the Facial Meaning Sensitivity

Task (FMST), which has never been used with schizophrenia spectrum participants.

When identifying individuals who were high on schizotypy, the researchers took those participants that scored two standard deviations above the mean on any of three separate measures of schizotypy (PAS, MIS, and PABS). They did not account for differences in individuals that score high on certain questions that tap into different domains of schizotypy. Additionally, they found that all participants performed well on the FMST, suggesting a possible ceiling effect, which may limit the test's effectiveness in identifying group differences.

A study by Jahshan and Sergi (2007) found no differences in ToM performance in individuals scoring high on schizotypy versus low on schizotypy. However, these researchers used a composite score of schizotypy based on the SPQ-B, without considering that different symptom components of schizotypy may have differential associations with ToM abilities. Additionally, the measure used to assess ToM in this sample was The Awareness of Social Inference Test (TASIT). Although the TASIT has demonstrated sensitivity to social cognitive deficits after traumatic brain injury (McDonald, Flanagan, Rollins, & Kinch, 2003), it may not be the best measure of ToM in persons rating high on schizotypy (Johanshan & Sergi, 2007). Lastly, Fyfe and colleagues (2006) found no relationship between ToM capacity, as assessed by the Stories task, and those whom had greater schizotypy or delusional ideation.

Meyer and Shean (2006) found that individuals with worse ToM had higher ratings in Magical Ideation, a component of positive schizotypy. Similarly, Langdon and Coltheart (2004) found that greater difficulty appreciating irony was associated with greater positive schizotypy traits in adults. Langdon and Coltheart (2004) found that poor

recognition of irony was associated with positive but not negative dimensions of schizotypy. Additionally, Pickup (2006) found that worse ToM was associated with higher ratings on a positive schizotypy factor. These three studies suggest that ToM deficits may be associated with the positive features of schizophrenic phenomenology.

Given the mixed evidence in the Theory of Mind (ToM) literature, research is needed that may help clarify the relationship between ToM abilities and schizotypy. Additionally, it remains unclear which schizotypy factors are associated with ToM deficits (Fyfe et al., 2006), given that prior studies have generally utilized a positive schizotypy score or an aggregated total score.

Source Memory

Source memory (SM) refers to the ability to recall the source or origins of information stored in memory (Johnson et al., 1993). One type of source memory includes distinguishing between internally generated information (e.g., thoughts, fantasies) and externally derived information (Johnson et al., 1993). Some fleeting SM errors are common in healthy individuals (Henquet et al., 2005). However, individuals with schizophrenia consistently perform worse on SM tasks when compared to controls (Henquet et al., 2005) and thus, have difficulties with their ability to attribute information to the correct source or origin. Several authors have even argued that some positive symptoms of schizophrenia may arise from deficient monitoring of one's own willed intentions, actions, and thoughts (Heilbrun, 1980; Johnson, 1993; Bentall, 1990; Vinogradov, Luks, Schulman, & Simpson, 2007). SM deficits are independent of

generalized cognitive deficits, such as deficits in attention, working memory, and executive functioning (Brebion et al., 1996; Henquet et al., 2005; Vinogradov et al., 1997).

A number of SM studies have shown that greater difficulty discriminating between self-generated items and items generated by a researcher was found in individuals in the acute phase of schizophrenia (i.e., when patients experience more positive symptoms) (Keefe et al., 1999; Brebion et al., 2000). Often, patients tend to attribute information that was self-generated to outside sources. In patients, greater SM deficits are associated with more pronounced positive symptoms and cognitive disorganization (Nienow & Docherty, 2004). Given that SM deficits may impact symptom development and maintenance, it is important to consider whether SM deficits are evident prior to the onset of psychosis. To date, the research that has explored SM impairments in schizotypy has been limited to only the positive domain of schizotypy. Thus, studies are needed that examine the relationship between SM impairments and all latent domains of schizotypy.

Peters and colleagues (2007) and Asai and Tanno (2008) found that more SM errors were found in individuals rating in the top quartile of the Schizotypal Trait Questionnaire (STQ), a measure which loads highly on the positive factor of schizotypy. Peters and colleagues (2007) found that greater difficulty differentiating whether an action was performed versus imagined was found in undergraduates who rated higher on the STQ, compared with those with lower scores. Laroi and colleagues (2004) found that the tendency to misattribute self-generated words to an external source was greater in hallucinatory-prone individuals, compared to those in the non-hallucination-prone group.

One limitation of these studies is that the STQ loads highly on the positive symptoms factor of schizotypy, and does not capture or represent the other domains of schizotypy. Another limitation of these studies was their small sample sizes, with participants in each group of each study being limited to less than 20. Samples were limited to seventeen in each group (high- and low-hallucination-proneness) in the Peters and colleagues (2007) study. In the Asai and Tanno (2008) study, there were ten participants in the high hallucination-proneness group and eight in the low hallucination-proneness group. Given the sizes of these samples, results should be considered with caution. Additionally, these studies utilized top- and bottom-score quartiles to identify high- and low-responders, respectively, which fails to consider the continuity of symptom presentation.

Debbane and colleagues (2007; 2009) found that adolescents who tended to incorrectly recall imagined-experimenter actions (an external source) as repeat-actions (another external source) endorsed more items assessing positive schizotypy (via the Schizotypal Personality Questionnaire) and were genetically at higher-risk for the development of psychosis (i.e. had 22q11.2 deletion syndrome). Additionally, individuals from normative samples who made more source misattributions and were less sure of the source when listening to their own distorted speech endorsed greater delusional ideation and hallucination proneness (Allen et al., 2006).

Interplay of cognitive biases

Recently Moritz and colleagues (2010) explored whether cognitive biases prevalent in schizophrenia were independent or whether they significantly overlap. This study lent tentative support to the fact that cognitive biases (jumping to conclusions, bias against disconfirmatory evidence) only partially overlapped. Very few studies have been

performed that explore whether certain cognitive biases are associated with each other. Thus, research in this area is needed.

Morrison and colleagues (1995) argued that confidence in erroneous knowledge (i.e., KC), may lead to the misattribution of intrusive thoughts or other internal experiences to an external source (SM), resulting in passivity phenomena (e.g., hallucinations, thought insertion, thought broadcasting). However, no research has actually examined the relationship between KC and SM.

Frith (1992) suggested that the ability to represent the mental states of the self or others (ToM) may lead to faulty attributions of internal events to an external agent (SM deficits). To date, the only research that has explored the relationship between ToM and SM deficits has done so with children and those in the autism-spectrum. It was found that in the healthy comparison group, ToM performance significantly correlated with SM abilities (Lind & Bowler, 2009). Additionally, Bright-Paul and colleagues (2008) found that when attributional style was controlled for, SM performance and ToM capacities were significantly correlated in children 3 to 6 years old. Again, no research has examined the relationship between ToM and SM performance in the schizophrenia spectrum; therefore, research is needed in this area.

The Current Study

The current study has two main aims (1) to replicate the four-factor solution of schizotypy (positive, negative, disorganized, impulsive nonconformity) via Confirmatory Factor Analysis utilizing a number of measures that are believed to comprehensively capture all four factors, and (2) to examine which cognitive biases (SC, KC, ToM and SM) are associated with which aspects of schizotypy. In order to address our first aim,

we included a range of measures that contain items that tap into all four previously found factors (i.e., positive, negative, disorganized and impulsive nonconformity), in order to best capture all latent domains of this syndrome.

A limitation of a number of prior studies is that aggregate schizotypy scores were utilized when exploring correlates of schizotypy without considering the multidimensional nature of schizotypy or the latent structure of the construct. Thus, one of the current study's strengths lies in our methodology, which allows us to tease apart each domain of schizotypy. The current study improves upon prior research in that we include a number of measures which tap into subcomponents of each latent domain of schizotypy. This allows us to more comprehensively capture each feature of schizotypy. Prior studies have tended to utilize only one indicator for each latent domain. For example, prior studies have used the Magical Ideation Scale as the only indicator for positive schizotypy. This is incomplete because positive schizotypy encompasses magical ideation, as well as paranoid and delusional ideation and perceptual aberrations. The current study builds upon prior research by utilizing a number of well-established measures which allows us to capture each domain of schizotypy in a richer, more complete way.

Another strength of the current study is our consideration that schizotypy characteristics fall on a continuum. The concept of continuity has impacted methodological approaches to schizotypy research (Langdon and Coltheart, 2004). For example, many studies use 10% high-low cutoffs or upper-lower quartiles to identify high and low schizotypy groups (Raine, 1991), whereas other studies use median splits to differentiate between individuals who are “high scorers” or “low scorers” on measures of

schizotypy (Langdon & Coltheart, 1999; Platek & Gallup, 2002). In the current study, we did not use arbitrary high-low cutoffs as the majority of studies do (Assai & Tanno, 2008; Langdon & Coltheart, 2004; Noguchi et al., 2008; Rapp et al., 2010). Instead we considered schizotypy, and its subdomains, as genuine continua of personality traits (Claridge & Beech, 1995).

The current study examined the relationships among potentially detrimental cognitive mechanisms and components of schizotypy. The cognitive biases that we investigated include the following: decreased SC, increased KC, impairments in ToM and SM deficits. Until now, only one study has explored the relationship between SC and schizotypy. However, one limitation of this study is that it utilized a measure of delusion proneness as a proxy for schizotypy. Thus, the current study examined the relationship between SC and multidimensional components of schizotypy. We modeled our hypotheses after findings in the schizophrenia literature, which indicate that increased SC is associated with positive symptoms in schizophrenia. Thus, we hypothesized that increased SC would be associated with greater positive schizotypy scores. Additionally, given the schizotypy literature, we hypothesized that greater SC would be associated with greater impulsive nonconformity schizotypy.

The current study is the first to date to examine the relationship between KC and subdomains of schizotypy. The schizophrenia literature consistently reports that patients have increased levels of KC, compared to healthy controls (Moritz et al., 2005, 2006; Moritz and Woodward), with some literature indicating that greater KC is associated with positive symptoms, such as delusions and hallucinations (Moritz et al, 2005). Given

these findings in the schizophrenia literature, in the current study, we hypothesized that greater KC would be associated with greater positive schizotypy.

In schizophrenia samples, ToM deficits have been associated with positive symptoms (Randall et al., 2003; Craig et al., 2004; Harrington et al., 2005b), negative symptoms (Frith & Corcoran, 1996; Corcoran et al., 1997; Pickup & Frith, 2001; Mazza et al., 2001; Bell & Mishara, 2003; Martino et al., 2007; Mizrahi et al., 2007), and cognitive disorganization (Sarfati & Hardy-Bayle, 1999). The schizotypy literature, however, is more mixed. A number of studies have found significant associations between ToM deficits and higher ratings on aggregative schizotypy index scores (Langdon & Coltheart, 1999, 2001; Platek et al., 2003a, Malcolm & Keenan, 2003), while other studies have found that greater ToM deficits are associated with elevations in the positive schizotypy factor (Langdon & Coltheart, 2004; Meyer & Shean, 2006; Pickup, 2006; Platek & Gallup, 2002; Platek et al., 2003b). On the other hand, other studies have found no significant associations between ToM and schizotypy (Toomey & Schulberg, 1995; Rapp et al., 2010). Studies with null findings either utilized aggregate schizotypy scores (Jahshan & Sergi, 2007; Johanshan & Sergi, 2007) or utilized measures of ToM that have never been used with schizophrenia spectrum subjects (Jahshan & Sergi, 2007; Toomey & Schulberg, 1995). The current study addresses previous limitations by explicitly teasing apart components of schizotypy and by utilizing a ToM measure that is appropriate for individuals in the schizophrenia spectrum. We drew from these previous findings in the schizophrenia and schizotypy literature to hypothesize that poorer ToM abilities will be associated with increased positive, negative and disorganized schizotypy factors.

Prior research that has examined the relationship between SM impairments and schizotypy only utilized a positive schizotypy factor, without considering the other domains of the construct. These studies have found that SM deficits were associated with positive schizotypy (Allen et al., 2006; Asai & Tanno, 2008; Debbane et al., 2007, 2009; Laroi et al., 2004; Peters et al., 2007). Given this, it was hypothesized that SM impairments would be associated with greater positive schizotypy. Additionally, we drew from the schizophrenia literature to support our hypothesis that SM will be associated with greater disorganization schizotypy.

Regarding the interrelationship between the various cognitive biases examined in this study, we hypothesized some significant associations between KC and SM (Morrison et al., 1995) and between ToM and SM (Bright-Paul et al., 2008, Lind & Bowler, 2009).

Summary of Hypotheses

Based on the literature reviewed above, the following specific hypotheses will be tested in the current study.

1. A confirmatory factor analysis will replicate a four-factor model of schizotypy which includes the following latent domains: a positive schizotypy factor, a negative schizotypy factor, a cognitive disorganization factor, and an impulsive non-conformity schizotypy factor.
2. Greater SC will be associated with greater positive and impulsive nonconformity schizotypy factors.
3. Greater KC will be associated with greater positive schizotypy factor.
4. Lower ToM capacities will be associated with greater positive, negative, and cognitive disorganization schizotypy factors.

5. Lower SM will be associated with greater positive and cognitive disorganization schizotypy factors.
6. With respect to the interplay between cognitive biases, we hypothesized the following significant associations:
 - a. Higher SM scores will be associated with better ToM.
 - b. Lower SM scores will be associated with increased KC.

Exploratory Analyses

Although there is no literature to inform any further hypotheses than those named above, on an exploratory basis, we also examined relationships among all cognitive biases and all latent domains of schizotypy in order to test alternative conceptualizations. These analyses will help to generate ideas for future research.

CHAPTER 2: METHODS

Participants

Participants included 420 undergraduates recruited from the University of Miami psychology research pool (See Table 2). The mean age was 19.18 years ($SD = 2.73$) and the majority of subjects were female (62.9%, $N = 264$). Forty six percent of participants identified as Caucasian, 22.6% as Hispanic, 16.2% as “other”, 11.2% were Asian Americans and 4.5% self-identified as African American. Participants were awarded credit for their participation in the current study.

Procedures

This study was approved by the Institutional Review Board of the University of Miami. A trained research assistant administered the questionnaires in a quiet room of 5 to 15 participants at a time. Participants completed the questionnaires in conventional paper-and-pencil form and they worked at their own pace.

Instruments

All instruments are listed below and are included in the appendix section.

Magical Ideation Scale (MIS; Eckblad & Chapman, 1983)

The Magical Ideation Scale is a measure of positive schizotypy and consists of 30 true-false items inquiring about physically impossible and illogical or magical cause-and-effect belief structures (i.e., beliefs in extra-sensory perceptions, superstitions, and paranormal phenomena) embedded in participant’s interpretations of personal experiences. The scale includes items such as “I sometimes have a feeling of gaining or losing energy when people look at me or touch me” or “some people can make me aware of them just by thinking about me”. “Yes” answers are awarded one point each and “No” scores are awarded zero points. Scores on the scale range from 0 to 30, with a higher

score indicating more pronounced magical thinking. Previously, Chapman, Chapman, & Miller (1982) found the MIS to have good internal consistency (Cronbach's $\alpha = .79$ to $.89$). In the current study, the MIS was also found to have good internal consistency (Cronbach's $\alpha = .82$).

Schizotypal Personality Questionnaire- Brief Form (SPQ-B; Raine & Banishay, 1995)

The Schizotypal Personality Questionnaire- Brief Form is a 22-item self-report questionnaire with Yes/No format based on the full 74-item SPQ (Raine, 1991). The SPQ-B is a measure of schizotypy, and consists of the Cognitive-Perceptual (SPQ_Pos: 8 items; e.g., do you believe in telepathy?", "have you had experiences with astrology, seeing the futures, UFOs, ESP, or a sixth sense?"), Interpersonal (SPQ_Neg: 8 items; "people find me aloof and distant," "I feel I have to be on my guard, even with friends"), and Disorganization (SPQ_Disorg: 6 items; i.e. "I sometimes forget what I am trying to say", "I often ramble on too much when speaking") subscales; in addition, a total score may be obtained. Usually, "Yes" responses are awarded one point, although a few items are reverse scored. High scores indicate high levels of difficulties in each area. Previously, internal reliabilities for the subscale scores ranged from $.58$ to $.95$ (Raine & Banishay, 1995). In the current study, the SPQ-B was found to have acceptable internal consistencies for all subscales (SPQ_POS Cronbach's $\alpha = .64$, SPQ_NEG Cronbach's $\alpha = .78$, SPQ_DISORG Cronbach's $\alpha = .79$).

Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE; Mason et al., 1995)

This scale measures and identifies high schizotypal traits in participants. This questionnaire contains 104 questions, which require a Yes/No response. Usually, “Yes” responses are awarded one point, although a few items are reverse scored. High scores indicate high levels of difficulties in each area. The O-LIFE measures schizotypal traits on four scales: Unusual Experiences (OLIFE_UE), Introvertive Anhedonia (OLIFE_IA), Cognitive Disorganization (OLIFE_CD) and Impulsive Nonconformity (OLIFE_IN). Additionally, the scale yields a composite score. The Unusual Experience scale represents the positive symptomatology aspect of the schizotypal personality. Items on this scale include “I have felt that I have special, almost magical powers” and “Does your sense of smell sometimes become unusually strong?”. The Introvertive Anhedonia scale assesses negative symptomatology, and is concerned with a lack of enjoyment in social contact and a lack of physical sources of pleasure. Sample items include “There are just not many things that I have ever really enjoyed” and “I don't really feel very close to my friends”. The Cognitive Disorganization scale relates to cognitive difficulties, as well as social anxiety and emotional sensitivity. It is represented by items such as “Do you worry too long after an embarrassing experience?” and “I am easily distracted when I read or talk to someone.” The Impulsive Nonconformity factor taps into poor self-control, mood swings and antisocial tendencies. It includes items such as “Do you often overindulge in alcohol and food?” and “Do people who drive carefully annoy you?”. Previously, the O-LIFE has been found to have high internal consistencies for the subscale scores (OLIFE_UE Cronbach's $\alpha = 0.89$; OLIFE_IA Cronbach's $\alpha = 0.82$; OLIFE_CD

Cronbach's $\alpha = 0.87$; OLIFE_IN Cronbach's $\alpha = 0.77$ (Mason, 1995; Rawlings & Freedman, 1997)). In the current study, the O-LIFE subscales were found to have adequate internal consistencies (OLIFE_UE Cronbach's $\alpha = .86$; OLIFE_IA Cronbach's $\alpha = .76$; OLIFE_CD Cronbach's $\alpha = .86$; OLIFE_IN Cronbach's $\alpha = .70$).

Borderline Symptom List: Short Version Additional Scale (BSL-23; Bohus et al., 2007)

The BSL-23 Additional Scale assesses dysfunctional impulsive behaviors, which have been found to appear across a number of personality disorder diagnoses and schizotypy. This Additional Scale is part of the greater 23-item self-rating instrument that assesses borderline-typical symptomatology and behaviors. This form asks participants to report the extent to which eleven behaviors were performed over the last 7 days. Participants were asked to rate each item on a Likert scale from 0 to 4 (0 = not at all, 1 = once, 2 = 2-3 times, 3 = 4-6 times and 4 = daily or more often). The scale includes items such as "During the last week I had outbreaks of uncontrolled anger or physically attacked others." Previously (Bohus, Limberger, Frank, Chapman, Kuhler, & Stieglitz, 2007; Wolf et al., 2009), the internal consistency for this scale has been found to be high (Cronbach's $\alpha = 0.94$ to 0.97). In the current study, we found the internal reliability for this scale to be acceptable (Cronbach's $\alpha = .61$) for research purposes (Cortina, 1993).

Cognitive Insight: Beck Cognitive Insight Scale (Beck et al., 2004)

This is a 15-item self-report instrument that measures how individuals evaluate their own judgments. Participants rate how much they agree with each statement on a Likert scale from 0 to 4 (0 = do not agree at all, 1 = agree slightly, 2 = agree a lot, 3 =

agree completely). The scale includes two factors, Self-Reflectiveness (BCIS_SR) and Self-Certainty (BCIS_SC). The Self-Reflectiveness factor includes items such as “other people can understand the cause of my unusual experiences better than I can,” “there is often more than one possible explanation for why people act the way they do.” The Self-Certainty factor includes items like “If something feels right, it means it is right,” “I know better than anyone else what my problems are.” Items endorsed are summed for each scale, and a higher score indicates more Self-Reflectiveness or more Self-Certainty. In order to compute a Composite Index, the Self-Certainty score is subtracted from the Self-Reflectiveness score. Previously, internal consistency for the Self-Certainty scale has been found to be acceptable (Cronbach’s $\alpha = .60$ (Beck, 2004)). The internal reliability for the Self-Certainty scale in the current study was comparable to Beck’s reliability (Cronbach’s $\alpha = .63$).

Theory of Mind: Reading the Mind in the Eyes Task-Revised (ToM; Baron-Cohen et al., 2001)

This measure assesses the ability to attribute relevant mental states to others, and it provides an index of the ability to perceive non-verbal aspects of emotional expression. The revised adult Reading the Mind in the Eyes Test includes 36 photographs of the eye regions of anonymous individuals (18 male and 18 female). Each photograph is presented with four response options of emotion or mental state reflected in the eyes. Participants are instructed to choose which of the four words best described what the person in the photograph was thinking or feeling. Participants are asked to read all four words before making their choice. The task was self-paced (i.e., participants could take as long as they desired prior to determining their response). Out of the four words, one of

these options is correct, and three are incorrect. The 36 stimuli include a wide range of positive, negative, and complex expressions of emotions or mental states. Possible scores range from 0-36, with one point awarded for each correct response. Higher scores reflect better Theory of Mind. To date, no psychometric properties on this task have been published. In the current study, the internal reliability was adequate (Cronbach's $\alpha = .78$).

Source Memory Task (SM; Vinogradov et al., 1997)

This task was adapted from a design by Mitchell and Hunt (1989) and used stimuli developed by Mitchell and colleagues (1986). The task includes a Study Phase and a Testing Phase.

Study Phase: Participants are presented with a list of 20 sentences each containing a noun and a verb followed either by a target word (underlined) or by a fill-in-the-blank space. Ten sentences are completely filled in, and ten sentences are missing the final word and have a fill-in-the-blank space. Participants are asked to read each sentence and to "make up a word" for each blank. Participants hand in the paper and the experimenter prints the participant's self-generated target words on a "test list."

Testing phase. The experimenter presents the "test list" to the participant approximately 30 minutes later, after a number of other tasks. This list contains 30 word pairs; 10 word pairs where the target word was generated by the experimenter, 10 word pairs where the target word was generated by the research participant, and 10 new word pairs. The 30 word pairs on the test list are presented in a pseudorandom order, and the ordering of word-pairs is kept consistent for all participants. Participants are asked whether the target word was "written on the page," "made up by the subject," "brand

new.” Correct answers are awarded one point and incorrect answers are awarded zero points. The SM index is calculated by summing these scores. In addition, participants are asked how confident they are for each of their responses on a 5-point Likert scale (0 = Not at all confident to 5 = Very confident). Responses are scored based on the subject’s correct classification of the word-pair as “self-generated,” “other-generated,” or “new”. Previously (Vinogradov et al., 1997), the SM task has been found to have strong internal reliability (Cronbach’s $\alpha = .95$). In the current study, internal reliability for the SM task was high (Cronbach’s $\alpha = .86$).

Knowledge Corruption Index (KC; Moritz et al., 2005)

This index measures the degree to which false information intrudes into someone’s knowledge system. As described in the preceding paragraph in Source Memory Task (Vinogradov et al., 1997), participants were asked after each response how confident they were with their responses on a Likert scale from 0 to 5 (0 = Not confident, 5 = Very confident). The knowledge corruption index is calculated by computing the percentage of high-confident responses (i.e., rated as a 5) that are errors (Moritz et al., 2005; 2006). In other words, when calculating the KC, the numerator represents the number of high confidence responses which were incorrect, whereas the denominator represents the overall number of high confidence responses, regardless of correctness. If participants made no high-confident responses at all, the knowledge corruption index was set at 0. No psychometric properties have been published for this task.

CHAPTER 3: RESULTS

Preliminary Analyses

All variables were checked for outliers and normality, and no variables had to be transformed. The correlation matrix for all primary variables is presented in Table 1. Means and standard deviations were obtained on all continuous variables, and percentages were calculated for categories of responses and all nominal variables (see Tables 2 and 3). Structural Equation Modeling (SEM) with the *Mplus* statistical program (v5.1, Muthén & Muthén, 2007) was used to test primary and exploratory hypotheses.

To estimate the model parameters with missing data, we used full information maximum likelihood (FIML), an approach based on individual functions from each participant's data. This was appropriate because missing data did not exist in any particular pattern and thus, was missing at random. Omitting participants with missing data would have resulted in lower reliability and less power. Parallel measurement assumptions were relaxed for these analyses, meaning that the factor loadings and variances were freely estimated. The maximum likelihood method was employed to estimate path coefficients, loadings, and standard errors for significance tests (two-tailed, $\alpha = .05$). Several indices recommended by Hu and Bentler (1999) were followed to evaluate model fit, including $\geq .95$ for the comparative fit index (CFI), $\leq .06$ for the root-mean-square error of approximation (RMSEA), and $\leq .08$ for the Standardized Root Mean Squared Residual (SRMR).

Prior to examining study hypotheses, initial analyses were performed to assess the relationships between demographic variables (e.g. age, gender, ethnicity) and the dependent variables of the study (see Table 4). It was found that gender was significantly

associated with the impulsive nonconformity schizotypy latent variable ($z = -2.54, p = .01$), where males tended to have more impulsive nonconformity schizotypy than females. Regarding ethnicity, Caucasians were found to have less negative schizotypy than African Americans ($z = 2.6, p = .01$), and those who self-identified as other ($z = 2.04, p = .04$).

Although there were some significant relationships between demographic variables and dependent variables of study, we did not control for these associations or hold demographic variables constant because there are no theoretical reasons to expect associations between cognitive biases and domains of schizotypy to differ as a result of age, gender, or ethnicity. Thus, we did not have strong theoretical reasons for controlling for these variables and doing so would significantly decrease our power, decrease degrees of freedom, and diminish the overall model fit. It is important to note that the inclusion of these covariates in our final model did not change whether any individual paths remained significant or not.

Measurement Model

Before testing our entire model, we tested an *a priori* measurement model of schizotypy based on prior literature (Claridge et al., 1996; Mason et al., 1995), which includes the positive, negative, cognitive disorganization, and impulsive nonconformity factors. The latent variable model specified the OLIFE_UE, SPQ_Pos, and MIS as indicators of the positive schizotypy factor, the OLIFE_IA and SPQ_Neg as indicators of the negative schizotypy factor, the OLIFE_CD and SPQ_Disorg as indicators of the cognitive disorganization factor, and the OLIFE_IN and BSL as indicators of the impulsive nonconformity factor. We found that the SPQ_NEG indicator was found to

have a small negative residual (-.08); therefore, consistent with consensus, this residual was fixed to zero for subsequent analyses.

The measurement model of a four factor solution of schizotypy fit the data well ($\chi^2(22) = 47.32, p = .0013$; Comparative Fit Index (CFI) = .98; root mean squared error of approximation (RMSEA) = .05; standardized root mean squared residual (SRMR) = .03). All standardized loadings from the indicators to each domain of schizotypy were significant and greater than .5 (see Table 5). Specifically, for the positive schizotypy latent variable, the standardized loadings were equivalent for MIS and SPQ_Pos (.78 and .8 respectively) and slightly higher for the OLIFE_UE (.91). For the negative schizotypy latent factor, the standardized loading was higher for the SPQ_Neg (.99) than for the OLIFE_IA (.59). For the disorganization schizotypy latent factor, the standardized loadings were effectively equivalent for the OLIFE_CD (.78) and SPQ_Disorg (.72). For the impulsive nonconformity schizotypy latent factor, the standardized loading was higher for the OLIFE_IN (.92) than for the BSL (.55). Standardized loadings are presented in Figure 1.

We also tested alternative measurement models of schizotypy to ensure that our four factor model was the most appropriate and had the best model fit. First, we examined whether the study indicators captured only one general schizotypy factor, to which all indicators loaded onto well. This model did not fit the data well ($\chi^2(27) = 486.59, p < .001$; Comparative Fit Index (CFI) = .71; root mean squared error of approximation (RMSEA) = .2; standardized root mean squared residual (SRMR) = .11). The standardized loadings from each indicator to the one latent general schizotypy factor were as follows. While some indicators loaded well onto this one general schizotypy

factor (OLIFE_UE = .86, MIS = .75, SPQ_Pos = .8, OLIFE_CD = .64, SPQ_Disorg = .61, OLIFE_IN = .52), other indicators did not (OLIFE_IA = .262, SPQ_Neg = .44, BSL = .3). The fact that three indicators did not load well onto this one general schizotypy factor suggest that they capture another component of schizotypy. Additionally, because all fit indices indicated a poor fit, the model of a one-factor solution of schizotypy is not appropriate, and was, thus, rejected.

Next, we examined whether a two factor solution to schizotypy would be appropriate. We used established literature to derive a two factor model including a positive factor and negative factor, with positive and impulsive nonconformity indicators loading onto the positive factor, and negative and disorganized scales loading onto the negative factor. Although the model fit improved from the one factor model of schizotypy described previously ($\chi^2_{\Delta}(1) = 194.49, p < .001$), this model did not fit the data well either ($\chi^2(26) = 292.1, p < .001$; Comparative Fit Index (CFI) = .83; root mean squared error of approximation (RMSEA) = .16; standardized root mean squared residual (SRMR) = .09). The standardized loadings from the indicators to the positive schizotypy factor were as follows. The OLIFE_UE (.9), MIS (.79), SPQ_Pos (.8) indicators loaded well onto the positive factor, while the OLIFE_IN (.49) and BSL (.27) did not load well. The standardized loadings from the indicators to the negative schizotypy factor were as follows. The SPQ_Neg (.69), OLIFE_CD (.8) and SPQ_Disorg (.7) indicators loaded well onto the negative factor, while the OLIFE_IA (.47) did not. The loadings of several indicators onto their respective latent variables were non-significant and less than .5 indicates that a two factor solution does not adequately capture the construct of schizotypy.

Lastly, we examined whether a three factor solution of schizotypy would be appropriate. We used established literature to derive a three factor model of schizotypy including a positive, negative and cognitive disorganization factor, with positive and impulsive nonconformity indicators loading onto the positive factor, negative indicators loading onto the negative factor, and disorganization indicators loading onto the cognitive disorganization factor. Although the model fit improved from the two factor solution of schizotypy described previously ($\chi^2_{\Delta}(1) = 115.1, p < .001$), this model did not fit the data well ($\chi^2(25) = 177.31, p < .001$; Comparative Fit Index (CFI) = .9; root mean squared error of approximation (RMSEA) = .12; standardized root mean squared residual (SRMR) = .07). The standardized loadings from the indicators to the positive schizotypy factor were as follows. The OLIFE_UE (.9), MIS (.79), SPQ_Pos (.8) indicators loaded well onto the positive factor, while the OLIFE_IN (.49) and BSL (.27) did not load well. These results suggest that the OLIFE_IN and BSL do not, in fact, capture the factor of interest (i.e., positive factor) and may, instead, represent another domain of schizotypy. The standardized loadings from the indicators to the negative schizotypy factor were as follows. The OLIFE_IA (.59) and SPQ_Neg (.99) both loaded well onto the negative factor meaning that these indicators loaded meaning that they appropriately capture the negative schizotypy factor. The standardized loadings from the indicators to the cognitive disorganization schizotypy factor were as follows. Results show that the OLIFE_CD (.8) and SPQ_Disorg (.71) both load well onto the cognitive disorganization schizotypy factor, meaning that both of these indicators truly capture an underlying latent component of cognitive disorganization. Because all fit indices for this three factor model indicated a poor fit and because loadings for several indicators (i.e., OLIFE_IN

and BSL) were non-significant and less than .5, the model of a three-factor solution of schizotypy is not appropriate. Given the findings for the one, two and three factor measurement models of schizotypy, we conclude that there are indeed four factors (positive, negative, cognitive disorganization and impulsive nonconformity) that underlie the comprehensive construct of schizotypy.

In order to provide a visual representation of the distribution of schizotypy in our sample, we provide the distribution of the O-LIFE scores in Figure 2. We chose to show the distribution for this measure, rather than others, because the O-LIFE includes four subscales, all of which map onto different latent domains of schizotypy (as indicated by the subscale loadings mentioned above). This makes it so that the distribution captures the endorsement of any schizotypy characteristics.

Structural Model

After establishing acceptable measurement model fit and loadings of indicators on the latent domains of schizotypy, the latent variables were used in the SEM model specification and evaluation. The residuals for KC and SM were correlated because these two indices were derived from the same measure. The SEM analyses were conducted in six steps, which are described below. Proposed modification indices that improved model fit and were reasonable in the context of the literature were added to the model step-wise.

Model 1 was the hypothesized model, incorporating the measurement model of schizotypy factors presented previously (see Figure 3). This model was found to fit the data relatively well ($\chi^2(50) = 145.44, p < .001$; Comparative Fit Index (CFI) = .95, root mean squared error of approximation (RMSEA) = .07; standardized root mean squared

residual (SRMR) = .04); however there was a modification index which suggested the inclusion of a direct path from SC to the Cognitive Disorganization factor. Model 2 included this additional path, and was found to fit the data better than did Model 1 (χ^2 (49) = 138.62, $p < .001$; Comparative Fit Index (CFI) = .95, root mean squared error of approximation (RMSEA) = .07; standardized root mean squared residual (SRMR) = .04); however there was a suggested modification index suggesting the inclusion of another direct path from SC to the Negative factor.

Model 3 included a direct path from SC to the Negative factor, and was found to fit the data better than did Model 2 (χ^2 (48) = 130.05, $p < .001$; Comparative Fit Index (CFI) = .95, root mean squared error of approximation (RMSEA) = .06; standardized root mean squared residual (SRMR) = .04). This model yielded a modification index which suggested the inclusion of a direct path from SM to the Impulsive Nonconformity factor. Model 4 included a direct path from SM to the Impulsive Nonconformity factor, and was found to fit the data better than did Model 3 (χ^2 (47) = 124.861, $p < .001$; Comparative Fit Index (CFI) = .957, root mean squared error of approximation (RMSEA) = .063; standardized root mean squared residual (SRMR) = .038). While this model fit the data well, it was found that there was an insignificant path from SM to the Cognitive Disorganization factor. In order to keep our model parsimonious, we deleted this path in Model 5.

Model 5 was found to fit the data well (χ^2 (48) = 125.51, $p < .001$; Comparative Fit Index (CFI) = .96, root mean squared error of approximation (RMSEA) = .06; standardized root mean squared residual (SRMR) = .04); however there was a modification index which suggested the inclusion of a direct path from KC to the

Impulsive Nonconformity factor. Model 6, the final model, fit the data well ($\chi^2(47) = 121.87, p < .001$; Comparative Fit Index (CFI) = .96, root mean squared error of approximation (RMSEA) = .06; standardized root mean squared residual (SRMR) = .04). There were no modification indices suggesting ways to strengthen the model fit, therefore Model 6 was retained. Unstandardized path coefficients, standard errors, and z -values are presented in Table 6. Standardized coefficients are presented in Figure 4.

Higher SC ($z = 2.9, p = .004$), lower SM ($z = -2.06, p = .04$) and lower ToM ($z = -2.33, p = .02$) were associated with greater positive schizotypy. Higher SC ($z = 2.51, p = .01$) was associated with greater negative schizotypy. Lower SC ($z = -3.19, p = .001$) and greater ToM ($z = 2.21, p = .03$) were associated with greater cognitive disorganization schizotypy. Higher SC ($z = 3.17, p = .002$) and lower SM ($z = -2.65, p = .008$) were associated with greater impulsive nonconformity schizotypy.

Latent domains of schizotypy were all significantly associated with each other (see Table 7). The positive schizotypy factor was significantly associated with the negative schizotypy factor ($z = 4.12, p < .001$), the disorganization factor ($z = 16.65, p < .001$), and the impulsive nonconformity factor ($z = 8.88, p < .001$). The negative schizotypy factor was significantly associated with the disorganized schizotypy factor ($z = 6.65, p < .001$) and the impulsive nonconformity schizotypy factor ($z = 1.42, p = .001$). The disorganized schizotypy factor was significantly associated with the impulsive nonconformity schizotypy factor ($z = 8.51, p < .001$).

In terms of the associations among cognitive biases, we found that greater SC was associated with greater KC ($z = .05, p < .001$) and decreased ToM ($z = -.10, p < .001$). SC was not associated with SM ($z = -.71, p = .23$). Greater KC was significantly

associated with decreased ToM ($z = -.10, p < .001$) and decreased SM ($z = -.23, p < .001$).

Greater ToM was associated with greater SM ($z = 3.41, p < .001$). See Table 8 for details.

CHAPTER 4: DISCUSSION

To date, most research on schizotypy has either considered the positive schizotypy factor as a proxy for the entire construct, or has utilized a schizotypy summary score without teasing apart the underlying latent domains. Factor analyses performed over the last decade have yielded a four-factor structure of schizotypy (Mason, 1995; Mason & Claridge, 2006) when measures which tap into all components of the DSM-IV-TR Schizotypal Personality Disorder criteria are included. However, many factor analyses have utilized only one measure of schizotypy, or have included measures which only capture one component of each latent domain (e.g., magical ideation for the positive factor). Our findings for the measurement model of schizotypy were consistent with our hypotheses and prior research in that it yielded a four-factor solution including positive, negative, cognitive disorganization and impulsive nonconformity factors. This four-factor solution of schizotypy is thought to more completely capture each latent domain given our inclusion of measures which tap into numerous components of each latent factor.

These findings confirm the importance of considering schizotypy as a multidimensional construct with distinct characteristic clusters. Thus, it is important for future research on psychosis proneness to utilize measures which assess the full range of characteristics which underlie the multidimensional construct known as schizotypy. Research that utilizes positive characteristics as a proxy of the entire syndrome, or which combine aspects of schizotypy for a “total” schizotypy score oversimplify the complex cluster of characteristics that make up schizotypy.

Our preliminary findings yielded some interesting results with regards to relationships between demographic variables and domains of schizotypy. We found that males endorsed more impulsive nonconformity characteristics than did females. These findings are consistent with prior research that has documented that men show increased impulsive nonconformity (Fonseca-Pedrero, Lemos-Giraldez, Muniz, Garcia-Cueto, & Campillo-Alvarez, 2008) and increased general impulsivity when compared to females (Labouvie & McGee, 1986; Miller, 1991; Nagoshi, Wilson, & Rodriguez, 1991). This preliminary finding warrants further attention given that research has found that elevations on measures of impulsivity are related to delinquent behaviors and increased substance abuse (Labouvie & McGee, 1986; Windle, 1990).

We also found that Caucasians had less negative schizotypy than African Americans and those who self-identified as other. Although interesting, these results should be interpreted with caution because of the small sample size of our African American group ($N = 19$) and because of difficulties with interpretation due to the heterogeneity of participants who self-identified as “Other”. One previous study found that African Americans rated significantly higher on Chapman’s Social Anhedonia Scale (one component of negative schizotypy) than did Caucasians (Chmielewski, Fernandes, Yee, & Miller, 1995). However, other researchers (Goulding, McClure-Tone, & Compton, 2009) found no ethnic differences in the negative schizotypy domain of schizotypy. The schizophrenia literature has shown more consistent ethnic differences with regards to prevalence and symptomatology. Specifically, African-American patients have the highest likelihood, when compared to other ethnic groups, of being misdiagnosed with schizophrenia when they actually have mood or organic disorders

(American Psychiatric Association, 1997). Thus, researchers and clinicians should use precaution when examining clinically relevant issues in minority populations.

Additionally, future research might produce ethnically sensitive norms for assessment materials in order to avoid misdiagnosis.

The current study is also notable for identifying a number of associations between domains of schizotypy and several information processing biases. The investigation of cognitive factors in individuals who are psychometrically at high-risk for psychosis may provide clues that facilitate understanding of the transition from subclinical psychotic experiences to actual clinical presentation (Debbane et al., 2009). Consistent with hypotheses, we found that higher SC, lower SM, and lower ToM were associated with higher ratings on the positive factor of schizotypy. This means that greater confidence in one's beliefs (higher SC), greater difficulty correctly attributing mental states to others (lower ToM) and greater difficulty differentiating the source of information (lower SM) were associated with increased positive schizotypy.

The current research is the first to examine, in a non-clinical sample, whether high SC is associated with a range of positive schizotypy domains (rather than with only one component of positive schizotypy, such as delusion-proneness). Our construct of positive schizotypy encompasses delusion-proneness, but also includes perceptual aberrations and magical ideation. Our study findings indicate that SC is associated not only with the delusion-proneness components of positive schizotypy, but with other positive spectrum symptoms as well (perceptual aberrations and magical ideation). In attempting to understand the relationship between SC and positive schizotypy, we turn to literature on the emergence of delusions in psychosis.

Everyone, healthy or otherwise, occasionally draws incorrect conclusions about situations. Usually, individuals have some degree of recognition of this fallibility, and may turn to others in order to gain a broader perspective of their experiences. According to Beck and colleagues (2009) beliefs may become delusional when they are held with high confidence and when they are impermeable to doubt (Beck, Rector, Stolar, & Grant, 2009). Being closed off to alternatives because of high certainty does not allow for corrective feedback to be incorporated into one's belief system, and, thus, might lead to unusual rationalizations or incorrect interpretations. Interestingly, schizophrenia patients' willingness to consider contradictory information has been found to improve their prognosis (Garety, Fowler, Kuipers, Freeman, Dunn, Bebbington et al., 1997). Our findings suggest that greater confidence in one's beliefs and decreased incorporation of others' feedback is associated with subclinical positive symptomatology. Thus, approaching one's thoughts with confidence and being closed off to the perspectives of others seems to be a building block towards delusional propensity. This way of approaching one's beliefs and interpretations might put one at-risk for the development of clinically significant positive symptomatology.

While the schizophrenia literature has consistently found significant associations between two biases we examined- ToM and SM- and positive symptoms of the illness, the schizotypy literature has been somewhat mixed. Regarding ToM, prior research has yielded significant associations between decreased ToM and magical ideation and an index of total schizotypy (Meyer & Shean, 2006), but not with delusional ideation (Fyfe et al., 2006). The current study is notable because our operationalization of positive schizotypy is comprehensive and includes magical ideation, perceptual aberrations and

delusion ideation. Thus, we can conclude that impairments in ToM might impact the development of a number of experiences underlying positive schizotypy, beyond magical ideation. Research has posited that analytic and probabilistic reasoning capacities are crucial for ToM and for reality testing (Ziv, Leiser, & Levine, 2010). ToM impairments reflect difficulties with representing multiple simultaneous, and possibly contradictory viewpoints of reality, (Langdon, 2003; Langdon, 2005). Thus, these deficits compromise general reality testing and appear to promote the acceptance of thoughts that are improbable or far-fetched (Langdon, Ward, & Coltheart, 2010). Individuals with compromised ToM also have trouble overriding the automatic salience of first-person evidence and struggle to accept the views of others. This difficulty may lead one to make incorrect inferences about the intention of others. For individuals who are genetically predisposed to psychosis or paranoia incorrect identification of others' affective states might fuel suspicions against the intentions of others, leading them to view neutral interchanges as hostile or negatively valenced.

Impairments in SM, or difficulties differentiating the source of information, are significantly associated with positive symptoms in schizophrenia, such as delusions and hallucinations (Keefe et al., 1999; Brebion et al., 2000). In the schizotypy literature, SM deficits have been found to be associated with greater total schizotypy (Asai & Tanno, 2008; Peters et al., 2007; Peters et al., 2007) and greater hallucination-proneness (Laroi et al., 2004). Previous studies were limited by small sample sizes and the utilization of top and bottom score quartiles. The current study is the first large-sample size project to provide evidence that deficits in the ability to differentiate whether the source of information comes from within oneself or from another person is linked to greater

positive schizotypy (as measured comprehensively and continuously). Difficulty differentiating the source of information might lead to the belief that ideas or actions that are your own, actually came from an outside source. This cognitive mechanism seems to not only perpetuate positive symptoms in individuals with a clinical psychotic disorder, but also presents a vulnerability for the development of positive sub-clinical symptom experiences, such as believing that one's thoughts actually belonged to someone else.

Contrary to hypotheses, higher KC was not associated with significantly higher levels of positive schizotypy. The reason for this lack of significance may be due to the fact that this hypothesis was derived from the schizophrenia literature. Thus, it may be that greater confidence in incorrect information (higher KC) is only associated with the positive symptom cluster of a diagnosable psychotic disorder, rather than a subclinical syndrome. This may be because it takes a corrupted knowledge system to continue to hold on to fixed false beliefs (delusions), but not to consider or contemplate unusual beliefs. Closer inspection of items tapping into positive schizotypy reveals wording is less absolute, and less confident. For example, positive schizotypy items include words such as "sometimes," "seemed," "got a momentary feeling," "occasionally," and "had a passing thought." This leads us to believe that a corrupted knowledge system is not necessary for the experience of positive schizotypy because ideation that is magical or delusional still can exist with some doubt. Only experiences that cross the clinical threshold into delusions, which are fixed, rely on a corrupted knowledge system.

Overall, our findings are consistent with research that has proposed that overconfidence and high belief certainty (SC), difficulty detecting the emotional experience of others (ToM) and difficulty differentiating the source of information (SM)

may present vulnerability factors for the development of delusional thinking and perceptual aberrations. These findings also provide additional evidence for the fact that these cognitive biases may be trait-based and emerge in individuals who have been found to be psychometrically at higher risk for developing positive symptoms of psychosis. The identification of information processing biases implicated with positive schizotypy might provide direction for treatment aimed at remediating prodromal or subclinical positive symptoms.

We had an unexpected finding in that higher SC, or mental inflexibility, was associated with higher ratings on the negative schizotypy factor. To date, no research has examined the relationship between SC and the negative schizotypy factor; thus, this finding is novel in the schizotypy literature. One reason for this finding may be that greater refusal to incorporate corrective feedback from others and greater confidence with one's interpretations of their experiences may provide motivation to isolate socially. Additionally less cognitive flexibility may make social interactions less rewarding and/or interesting given that others' feedback is not being incorporated into one's holistic understanding of their experiences. Because this was not one of our *a priori* hypotheses, results will need to be replicated before we can be confident that this was not a chance finding.

The current study yielded interesting findings with regard to correlates of the cognitive disorganization schizotypy factor. Specifically, *lower* SC and *greater* ToM were significantly associated with greater cognitive disorganization. These findings are significant, but in the *opposite* direction than anticipated. We did not find the hypothesized association between SM and cognitive disorganization. A possible reason

for the contradictory findings regarding SC and ToM , and for the null findings regarding SM may be because the cognitive disorganization latent factor was derived from self-reported endorsements of cognitive difficulties. According to the literature on populations with diminished cognitive functioning (e.g., schizophrenia, Alzheimer's disease, fronto-temporal dementia), individuals with these difficulties tend to have limited awareness of their own cognitive limitations, and thus, may report inflated cognitive capacities (Bacon & Izaute, 2009; Medalia & Thysen, 2008; Williamson et al., 2010). In fact, studies on these populations report an absence of correlation between objective cognitive scores and subjective measures of cognition deficits (Proteau, Verdoux, Briand, Lesage, Lalonde, Nicole, Reinharz & Stip, 2004). It is possible that utilizing a performance-based cognitive disorganization factor, rather than an individual's self-evaluation of their cognitive abilities might have yielded findings more similar to the study hypotheses. A closer examination of some items tapping into the cognitive disorganization schizotypy factor supports our conceptualization of our contradictory findings. Specifically, questions include the following: "Some people find me a bit vague and elusive during conversation," and "People sometimes comment on my unusual mannerisms and habits." These items necessitate insight into of one's own cognitive abilities, as well as awareness of others' perceptions of one's cognitions. Because individuals with cognitive deficits also often experience diminished ability to consider the perspectives of others (Bora, Yucel, & Pantelis, 2009), this poses an additional challenge to being able to answer questions about one's cognitions accurately.

Lastly, consistent with hypotheses, higher SC was associated with an elevated impulsive nonconformity schizotypy factor. Thus, an unwillingness to incorporate the

perspective of others or consider alternatives prior to arriving at conclusions was associated with impulsive asocial behaviors and worse self-control. This finding makes sense given that high confidence in ones' own understanding of their experiences may make one more prepared to respond or react, possibly in a quick-tempered or impulsive way, given that no time is spent collecting or evaluating information from others.

We also found a significant relationship that we did not anticipate, which is novel and interesting. Specifically, lower SM was associated with greater impulsive nonconformity. It seems that difficulty differentiating the origins of information (SM) contribute to an overall fallible, inconsistent, and confused memory system. Given that the content and appraisal of one's memory systems are important for the ongoing regulation and modulation of one's behavior (Finn, Justus, Mazas, & Steinmetz, 1999), false memory information may result in ineffective, poorly planned, or abrupt behavioral consequences. It is important to acknowledge that our explanation of these relationships are speculative given the dearth of literature on the impulsive nonconformity factor of schizotypy; thus, further research is needed to confirm our findings and to better understand the mechanisms underlying these relationships.

We also had interesting findings when we examined intercorrelations among cognitive biases. Consistent with our hypotheses and previous literature (Bright-Paul et al., 2008; Lind & Bowler, 2009; Morrison et al., 1995), we found that diminished SM was associated with greater KC and decreased ToM. Additionally, we found that greater KC was associated with greater SC and decreased ToM. The overlap among information-processing biases is a novel area of study, and demands further attention. Future research might attempt to tease apart information processing biases, and the

potential mechanisms underlying them, given their prevalence and deleterious consequences in the context of psychosis spectrum.

Limitations and Future Directions

The current study is not without limitations. Data was collected cross-sectionally; thus, associations found between cognitive biases and domains of schizotypy cannot be assumed to be causal. It will be important for future research to examine these characteristics longitudinally, in order to examine whether changes in cognitive biases are associated with changes in schizotypy and/or the emergence of clinically significant psychotic symptoms. While research indicates that cognitive biases play a causal role in development and maintenance of psychosis (Bentall, 1990; Garety et al., 2007; Morrison et al., 1995), future research might examine the possibility that the relationship between information processing biases and schizotypy characteristics might be bi-directional. That is, biased cognitive processes might give rise to sub-clinical psychotic experiences, but schizotypy characteristics might also propagate the continual employment of these cognitive shortcuts.

Another potential limitation is that some of the internal reliabilities for study indicators were lower than is generally preferred (i.e. SPQ_POS Cronbach's $\alpha = .64$; BSL Cronbach's $\alpha = .61$, BCIS_SC Cronbach's $\alpha = .63$). Some researchers (Cortina et al., 1993) view reliabilities as low as .6 as appropriate for research purposes; however, unreliable scales are problematic because they indicate differential scoring on items similar to each other. It is important to note that internal consistencies are heavily influenced by the number of items in a scale (Boyle, 1991). All of the scales in the current study with lower internal consistencies (i.e. SPQ_POS Cronbach's $\alpha = .64$; BSL

Cronbach's $\alpha = .61$, BCIS_SC Cronbach's $\alpha = .63$) had 11 or fewer items. It might be that these scales have low internal consistencies because with so few items, even one inconsistent response would significantly spoil an otherwise reliable response pattern. Future research might want to factor analyze scales and remove inconsistent items or include longer scales.

Another limitation of the current study is that we used a sample of college students. Thus, the sample was somewhat limited in age, education, and other SES factors. Also, although participants endorsed a broad range of schizotypy, college students at this private University tend to be high functioning. Therefore, our results may not be generalizable to those who experience subclinical psychotic experiences but are lower functioning.

It is also important to note that participants from this study were all drawn from a psychology research pool. As such, all were currently enrolled in Introduction to Psychology at the University of Miami. It is possible that individuals who choose to take this course might have certain shared characteristics, such as greater awareness of and/or interest in psychopathology. These characteristics might make participants more likely to endorse certain unusual experiences, given that more time may have been spent reflecting upon one's personal history and considering the continuity of abnormal behavior. In future research it will be important to replicate with more diverse samples.

Finally, future researchers may want to examine the relationship between domains of schizotypy and other cognitive biases that are present in individuals with schizophrenia (e.g., jumping to conclusions bias, bias against disconfirmatory evidence; Menon, Pomarol-Clotet, McKenna, & McCarthy, 2006). A greater understanding of each

cognitive bias prevalent in individuals rating high on domains of schizotypy will allow researchers and clinicians to develop comprehensive interventions which address each of these information processing difficulties.

Conclusions

Schizotypal characteristics are important to study because they are considered to constitute a range of biologically determined, enduring, personality and cognitive traits that predispose individuals to schizophrenia (Chapman et al., 1994; Lenzenweger, 2006). Studying the naturalistic variability of the schizophrenia spectrum in non-clinical samples offers novel perspectives from which to understand schizophrenia and other psychotic disorders (Siever & Davis, 2004).

The current study is notable for confirming the four underlying latent domains of schizotypy. Schizotypy is a multidimensional construct with distinct characteristic clusters, including positive, negative, disorganized and impulsive nonconformity. Our findings highlight the importance of utilizing measures of schizotypy which assess the full range of its characteristics. The current study is also noteworthy because it revealed significant associations between several cognitive biases that may play a role in the pathogenesis and maintenance of psychosis, and underlying components of schizotypy (Bentall, 1990; Langdon & Coltheart, 2006; Morrison et al., 1995). Specifically, this research revealed that cognitive biases, such as increased SC, decreased ToM, decreased SM, and increased KC, are associated with the positive, negative, and impulsive nonconformity factors of schizotypy. The identification of the factors that influence the emergence or exacerbation of psychosis, such as cognitive biases, is critical for formulating and tailoring interventions aimed to reduce the distress associated with

symptoms in individuals with schizophrenia (Siever & Davis, 2004). Thus, biases examined in the current study may be important to target prodromally via psychological interventions such as Cognitive-Behavioral Therapy or Metacognitive Training (Cangas et al., 2006; Debbane et al., 2008; Fyfe, Williams, Mason & Pickup, 2008) in order to delay and/or improve prognosis for individuals who are psychometrically at higher-risk for psychosis (Beck & Warman, 2004).

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Figure 1. Measurement model for latent domains of schizotypy. Indicators include OLIFE_UE, MIS, SPQ_Pos, OLIFE_IA, SPQ_Neg, OLIFE_CD, SPQ_Disorg, OLIFE_IN and BSL. Standardized loadings are shown **p < .001, *p < .05.

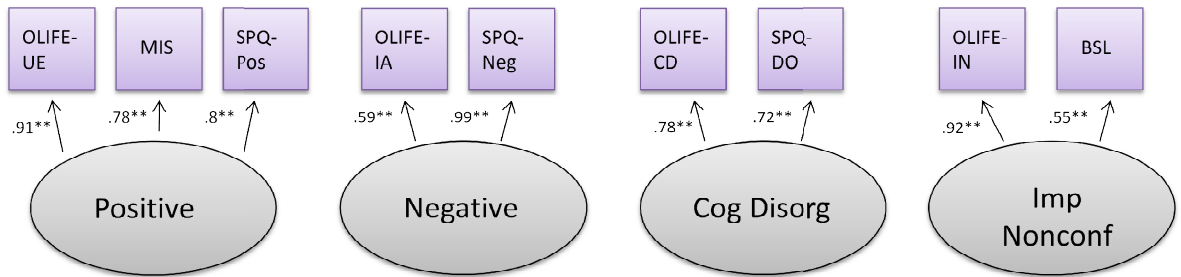


Figure 2. Distribution of schizotypy characteristics as measured by the Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE).

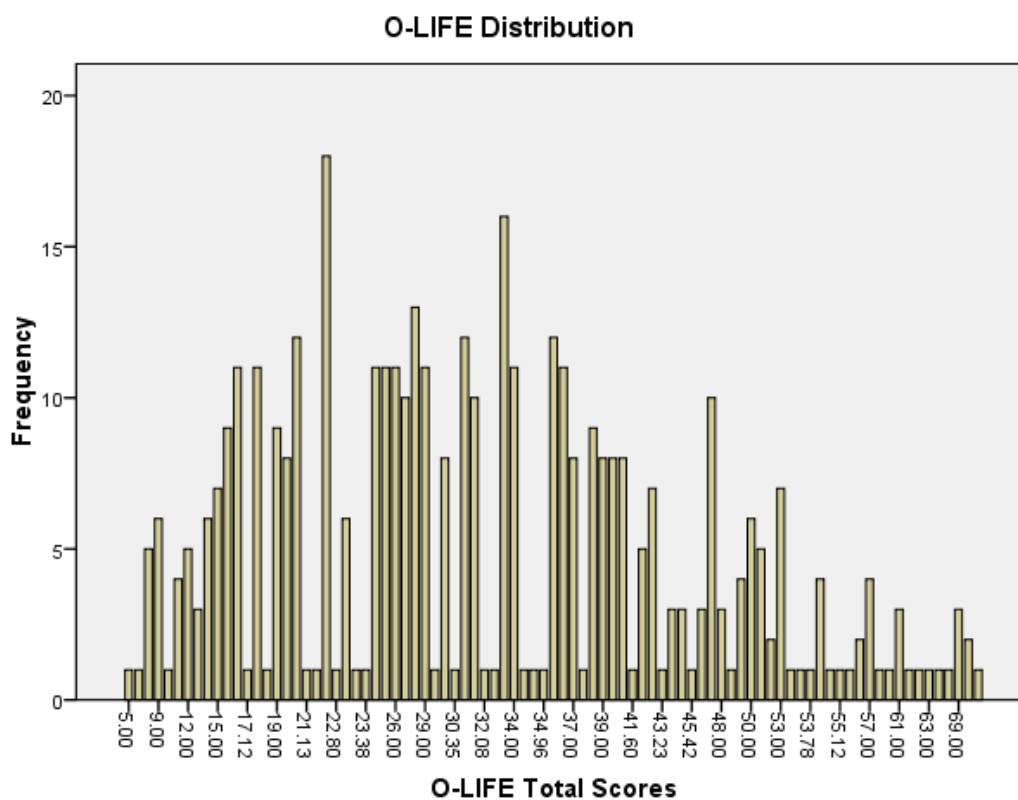


Figure 3. Model 1: Structural model of Knowledge Corruption (KC), Source Memory (SM), Self Certainty (SC) and Theory of Mind (ToM) predicting domains of schizotypy. Significant paths are shown with standardized coefficients $**p < .001$, $*p < .05$.

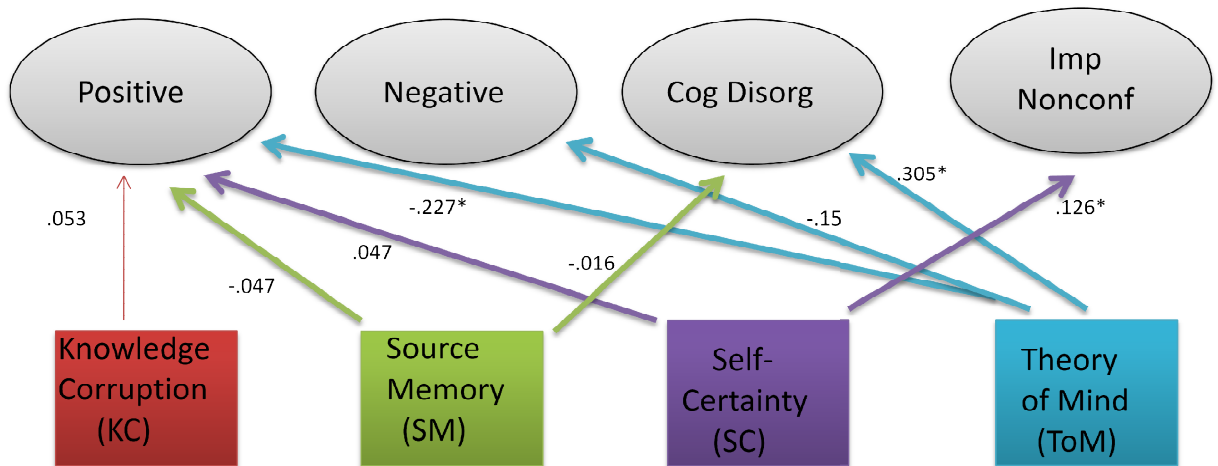


Figure 4. Model 6: Structural model of Knowledge Corruption (KC), Source Memory (SM), Self Certainty (SC) and Theory of Mind (ToM) predicting domains of schizotypy. Significant paths are shown with standardized coefficients $**p < .001$, $*p < .05$.

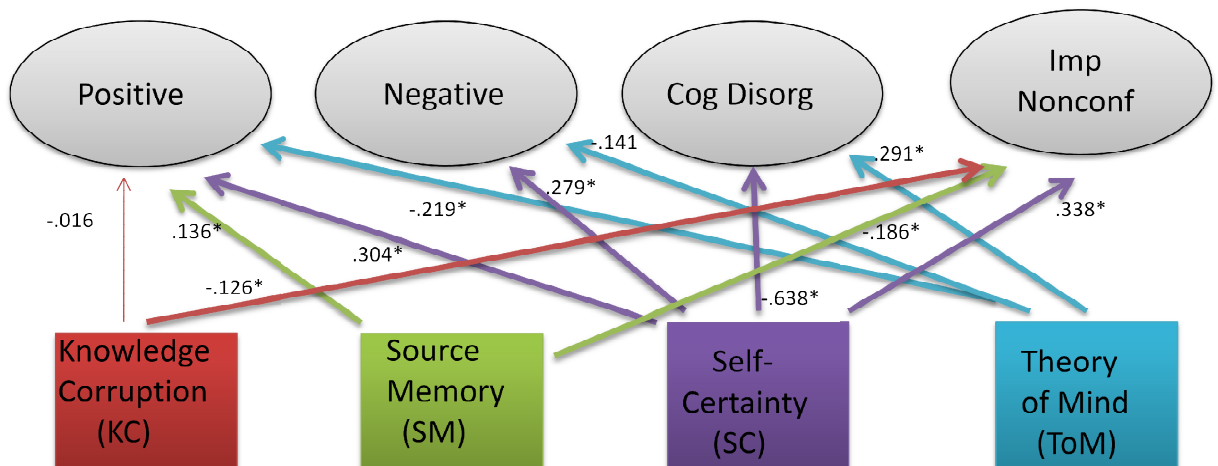


Table 1. Correlation Matrix for Schizotypy and Cognitive Bias Indicators

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. SM	1												
2. SC	-.088	1											
3. MIS	-.067	.113	1										
4. BSL	-.106	.075	.217	1									
5. SPQ_N	.059	.012	.194	.079	1								
6. SPQ_P	-.036	.145	.623	.193	.308	1							
7. SPQ_D	-.011	.034	.383	.266	.45	.444	1						
8. OLIFE_UE	-.072	.081	.722	.172	.317	.724	.453	1					
9. OLIFE_CD	.075	-.09	.369	.259	.548	.479	.566	.498	1				
10. OLIFE_IA	-.051	.017	.144	.059	.588	.132	.254	.141	.315	1			
11. OLIFE_IN	-.104	.159	.372	.511	.178	.356	.431	.413	.377	.174	1		
12. TOM	.186	-.111	-.188	.093	.008	.009	-.011	-.032	.073	.161	.042	1	
13. KC	-.539	.154	.079	.050	.032	.062	.032	.023	-.021	.054	.112	-.192	1

SM, Source Memory Task; SC, Beck Cognitive Insight Scale Self-Certainty Subscale; MIS, Magical Ideation Scale; BSL, Borderline Symptom List Additional Scale; SPQ_N, Schizotypal Personality Disorder Negative Scale; SPQ_P, Schizotypal Personality Disorder Positive Scale; SPQ_D, Schizotypal Personality Disorder Disorganized Scale; OLIFE_UE, Oxford Liverpool Inventory of Feelings and Experiences_Unusual Experiences Scale; OLIFE_CD, Oxford Liverpool Inventory of Feelings and Experiences_Cognitive Disorganization Scale; OLIFE_IA, Oxford Liverpool Inventory of Feelings and Experiences_Introvertive Anhedonia Scale; OLIFE_IN, Oxford Liverpool Inventory of Feelings and Experiences_Impulsive Nonconformity Scale; TOM, Reading the Mind with the Eyes Task Score; KC, Knowledge Corruption Index. All data was collected at one time point.

Table 2. Means and Standard Deviations for Demographic Variables

	Mean (SD)	Frequency (Percent)
Gender		
Male		156 (37.1%)
Female		264 (62.9%)
Age	19.18 (2.73)	
Ethnicity		
Caucasian		191 (45.5%)
Hispanic		95 (22.6%)
African American		19 (4.5%)
Asian American		47 (11.2%)
Other		68 (16.2%)

Table 3. Means, Standard Deviations and Ranges for Schizotypy and Cognitive Biases

	M	SD	Range
O-LIFE			
Unusual Experiences	8.85	5.97	0-28
Introvertive Anhedonia	5.59	3.84	0-22
Cognitive Disorganization	9.48	5.55	0-24
Impulsive Nonconformity	7.96	3.67	0-21
SPQ-B			
Positive	2.69	2.12	0-8
Negative	2.98	2.39	0-8
Disorganized	2.06	1.81	0-6
MIS	6.08	4.7	0-24
BSL	1.5	2.41	0-18
SC	7.43	3.00	0-17
ToM	23.58	4.53	6-32
SM	22.92	3.76	8-30
KC	.11	.12	0-.67

Table 4. Estimates, Standard Errors and z-Values for Associations Between Demographic Variables and Latent Variables

	Age			Gender			Ethnicity AA			Ethnicity Other		
	Est.	SE	Z	Est.	SE	Z	Est.	SE	Z	Est.	SE	Z
Positive Schizotypy	.01	.10	.09	.38	.58	.65	2.43	1.38	1.77	1.32	.82	1.62
Negative Schizotypy	-.04	.04	-1.02	-.35	.23	-1.53	1.44	.54	2.6*	.67	.32	2.04*
Disorganized Schizotypy	-.12	.09	-1.32	.47	.53	.89	-.93	1.24	-.81	.49	.73	.59
Impulsive Nonconformity Schizotypy	-.10	.07	-1.57	-.95	.37	-2.54*	-.77	.89	-.98	-.51	.53	-1.1

* $p < .05$

* $p < .001$

Table 5. Standardized Loadings for Confirmatory Factor Analysis of Domains of Schizotypy

	Coefficient	SE	Z
Positive			
OLIFE_UE	.91	.02	55.38**
MIS	.78	.02	34.6**
SPQ_Pos	.8	.02	35.94**
Negative			
OLIFE_IA	.59	.03	18.42**
SPQ_Neg	.99	.00	N/A
Disorganized			
OLIFE_CD	.78	.03	28.10**
SPQ_CD	.72	.03	23.91**
Impulsive Nonconformity			
OLIFE_IN	.92	.06	16.15**
BSL	.55	.05	11.53**

** $p < .001$.

SE = standard errors.

N/A = not interpretable because residual variance was fixed to 0.

Table 6. Unstandardized Path Coefficients, Standard Errors and z-Values for Direct Effects

	Coefficient	SE	Z
Positive on			
SC	.17	.06	2.9*
KC	.00	.001	-.24
ToM	-.18	.08	-2.33*
SM	-.10	.05	-2.06*
Negative on			
SC	.38	.15	2.51*
ToM	-.28	.16	-1.73
Disorganized on			
SC	-.44	.14	-3.19*
ToM	.30	.14	2.21*
Imp Nonconf on			
SC	.31	.10	3.17*
KC	.004	.002	1.89
SM	-.21	.08	-2.65*

* $p < .05$.

** $p < .001$.

SE = standard errors.

NS = path not significant and deleted from model.

Table 7. Standardized z-Values for Associations Among Domains of Schizotypy

	Z
Positive with	
Negative	4.12**
Disorganized	16.65**
Impulsive Nonconformity	8.88**
Negative with	
Disorganized	6.65**
Impulsive Nonconformity	1.42*
Disorganized with	
Impulsive Nonconformity	8.51**

* $p < .05$.

** $p < .001$.

Table 8. Standardized z-Values for Associations Among Cognitive Biases

	Z
SC with	
KC	.05**
ToM	-.10**
SM	-.71
KC	
ToM	-.10**
SM	-.23*
ToM with	
SM	3.41**

* $p < .05$.

** $p < .001$.

Appendix: Measures

Magical Ideation Scale

Instructions: On the line preceding each sentence, please write T if the statement is true or mostly true OR F if the statement is false or mostly false.

- ___ 1. Some people can make me aware of them just by thinking about me.
- ___ 2. I have had the momentary feeling that I might not be human.
- ___ 3. I have sometimes been fearful of stepping on sidewalk cracks.
- ___ 4. I think I could learn to read other's minds if I wanted to.
- ___ 5. Horoscopes are right too often for it to be a coincidence.
- ___ 6. Things sometimes seem to be in different places when I get home, even though no one has been there.
- ___ 7. Numbers like 13 and 7 have no special powers.
- ___ 8. I have occasionally had the silly feeling that a TV or radio broadcaster knew I was listening to him.
- ___ 9. I have worried that people on other planets may be influencing what happens on earth.
- ___ 10. The government refuses to tell us the truth about flying saucers.
- ___ 11. I have felt that there were messages for me in the way things were arranged, like in a store window.
- ___ 12. I have never doubted that my dreams are the products of my own mind.
- ___ 13. Good luck charms don't work.
- ___ 14. I have noticed sounds on my records that are not there at other times.
- ___ 15. The hand motions that strangers make seem to influence me at times.
- ___ 16. I almost never dream about things before they happen.
- ___ 17. I have had the momentary feeling that someone's place has been taken by a look-a-like.

- ___ 18. It is not possible to harm others merely by thinking bad thoughts about them.
- ___ 19. I have sometimes sensed an evil presence around me, although I could not see it.
- ___ 20. I sometimes have a feeling of gaining or losing energy when certain people look at me or touch me.
- ___ 21. I have sometimes had the passing thought that strangers are in love with me.
- ___ 22. I have never had the feeling that certain thoughts of mine really belonged to someone else.
- ___ 23. When introduced to strangers, I rarely wonder whether I have known them before.
- ___ 24. If reincarnation were true, it would explain some unusual experiences I have had.
- ___ 25. People often behave so strangely that one wonders if they are part of an experiment.
- ___ 26. At times I perform certain little rituals to ward off negative influences.
- ___ 27. I have felt that I might cause something to happen just by thinking too much about it.
- ___ 28. I have wondered whether the spirits of the dead can influence the living.
- ___ 29. At times I have felt that a professor's lecture was meant especially for me.
- ___ 30. I have sometimes felt that strangers were reading my mind.

Schizotypal Personality Questionnaire- Brief Form

Instructions: On the line preceding each sentence, please write T if the statement is true or mostly true OR F if the statement is false or mostly false.

- _____ 1. People sometimes find me aloof and distant.
- _____ 2. Have you ever had the sense that some person or force is around you, even though you cannot see anyone?
- _____ 3. People sometimes comment on my unusual mannerisms and habits.
- _____ 4. Are you sometimes sure that other people can tell what you are thinking?
- _____ 5. Have you ever noticed a common event or object that seemed to be a special sign for you?
- _____ 6. Some people think that I am a very bizarre person.
- _____ 7. I feel I have to be on guard even with friends.
- _____ 8. Some people find me a bit vague and elusive during a conversation.
- _____ 9. Do you often pick up hidden threats of put-downs from what other people say or do?
- _____ 10. When shopping, do you get the feeling that other people are taking notice of you?
- _____ 11. I feel very uncomfortable in social situations involving unfamiliar people.
- _____ 12. Have you had experiences with astrology, seeing the future, UFO's, ESP, or a sixth sense?
- _____ 13. I sometimes use words in unusual ways.
- _____ 14. Have you found that it is best not to let other people know too much about you?
- _____ 15. I tend to keep in the background on social occasions.
- _____ 16. Do you ever suddenly feel distracted by distant sounds that you are not normally aware of?
- _____ 17. Do you often have to keep an eye out to stop people from taking advantage of you?
- _____ 18. Do you feel that you are unable to get "close" to people?
- _____ 19. I am an odd, unusual person.
- _____ 20. I find it hard to communicate clearly what I want to say to people.
- _____ 21. I feel very uneasy talking to people I do not know well.
- _____ 22. I tend to keep my feelings to myself.

Oxford-Liverpool Inventory of Feelings and Experiences

These questions relate to your thoughts, feelings, experiences and preferences. There are no right or wrong answers or trick questions so please be as honest as possible. For each question please choose either YES or NO and circle this on the form. Please do not spend too much time thinking about it – choose the answer closest to your own.

- | | | |
|-----|----|---|
| YES | NO | 1. Do you often hesitate when you are going to say something in a group of people whom you more or less know? |
| YES | NO | 2. Do you often overindulge in alcohol or food? |
| YES | NO | 3. Are the sounds you hear in your daydreams really clear and distinct? |
| YES | NO | 4. Do you enjoy many different kinds of play and recreation? |
| YES | NO | 5. Do your thoughts sometimes seem as real as actual events in your life? |
| YES | NO | 6. Does it often happen that nearly every thought immediately and automatically suggests an enormous number of ideas? |
| YES | NO | 7. When in a group of people do you usually prefer to let someone else be the centre of attention? |
| YES | NO | 8. Do you frequently have difficulty in starting to do things? |
| YES | NO | 9. Has dancing or the idea of it always seemed dull to you? |
| YES | NO | 10. When you catch a train do you often arrive at the last minute? |
| YES | NO | 11. Is trying new foods something you have always enjoyed? |
| YES | NO | 12. Do you often change between intense liking and disliking of the same person? |
| YES | NO | 13. Have you ever cheated at a game? |
| YES | NO | 14. Are there very few things that you have ever really enjoyed doing? |
| YES | NO | 15. Do you at times have an urge to do something harmful or shocking? |
| YES | NO | 16. Do you often worry about things you should not have done or said? |
| YES | NO | 17. Are your thoughts sometimes so strong that you can almost hear them? |
| YES | NO | 18. Are you usually in an average sort of mood, not too high and not too low? |
| YES | NO | 19. Would you take drugs which may have strange or dangerous effects? |
| YES | NO | 20. Do you think you could learn to read other's minds if you wanted to? |
| YES | NO | 21. When in a crowded room, do you often have difficulty in following a conversation? |
| YES | NO | 22. No matter how hard you try to concentrate do unrelated thoughts creep into your mind? |
| YES | NO | 23. Are you easily hurt when people find fault with you or the work you do? |
| YES | NO | 24. Do you stop to think things over before doing anything? |
| YES | NO | 25. Have you ever felt that you have special, almost magical powers? |
| YES | NO | 26. Are you much too independent to really get involved with other people? |
| YES | NO | 27. Do ideas and insights sometimes come to you so fast that you cannot express them all? |
| YES | NO | 28. Do you easily lose your courage when criticised or failing in something? |
| YES | NO | 29. Can some people make you aware of them just by thinking about you? |

- YES NO 30. Does a passing thought ever seem so real it frightens you?
- YES NO 31. Have you ever blamed someone for doing something you know was really your fault?
- YES NO 32. Are you a person whose mood goes up and down easily?
- YES NO 33. Does your voice ever seem distant or faraway?
- YES NO 34. Do you think having close friends is not as important as some people say?
- YES NO 35. Are you rather lively?
- YES NO 36. Are you sometimes so nervous that you are "blocked"?
- YES NO 37. Do you find it difficult to keep interested in the same thing for a long time?
- YES NO 38. Do you dread going into a room by yourself where other people have already gathered and are talking?
- YES NO 39. Does it often feel good to massage your muscles when they are tired or sore?
- YES NO 40. Do you sometimes feel that your accidents are caused by mysterious forces?
- YES NO 41. Do you like mixing with people?
- YES NO 42. On seeing a soft thick carpet have you sometimes had the impulse to take off your shoes and walk barefoot on it?
- YES NO 43. Do you often have difficulties in controlling your thoughts?
- YES NO 44. Do the people in your daydreams seem so true to life that you sometimes think they are real?
- YES NO 45. Are people usually better off if they stay aloof from emotional involvements with people?
- YES NO 46. Can just being with friends make you feel really good?
- YES NO 47. Is your hearing sometimes so sensitive that ordinary sounds become uncomfortable?
- YES NO 48. Have you often felt uncomfortable when your friends touch you?
- YES NO 49. When things are bothering you do you like to talk to other people about it?
- YES NO 50. Do you have many friends?
- YES NO 51. Would being in debt worry you?
- YES NO 52. Do you think people spend too much time safeguarding their future with savings and insurance?
- YES NO 53. Do you ever have the urge to break or smash things?
- YES NO 54. Do you often feel that there is no purpose to life?
- YES NO 55. Do you worry about awful things that might happen?
- YES NO 56. Have you ever felt the urge to injure yourself?
- YES NO 57. Would it make you nervous to play the clown in front of other people?
- YES NO 58. Have you felt that you might cause something to happen just by thinking too much about it?
- YES NO 59. Have you had very little fun from physical activities like walking, swimming, or sports?
- YES NO 60. Do you feel so good at controlling others that it sometimes scares you?
- YES NO 61. Are you easily distracted from work by daydreams?

- YES NO 62. Are you easily confused if too much happens at the same time?
- YES NO 63. Do you ever have a sense of vague danger or sudden dread for reasons that you do not understand?
- YES NO 64. Is it true that your relationships with other people never get very intense?
- YES NO 65. Have you sometimes had the feeling of gaining or losing energy when certain people look at you or touch you?
- YES NO 66. Do you worry too long after an embarrassing experience?
- YES NO 67. Do you love having your back massaged?
- YES NO 68. Do you consider yourself to be pretty much an average kind of person?
- YES NO 69. Have you ever taken advantage of someone?
- YES NO 70. Would you like other people to be afraid of you?
- YES NO 71. Have you ever thought you heard people talking only to discover that it was in fact some nondescript noise?
- YES NO 72. Have you occasionally felt as though your body did not exist?
- YES NO 73. Do you often feel lonely?
- YES NO 74. Do you often have an urge to hit someone?
- YES NO 75. Do you often experience an overwhelming sense of emptiness?
- YES NO 76. On occasions, have you seen a person's face in front of you when no one was in fact there?
- YES NO 77. Is it fun to sing with other people?
- YES NO 78. Do you often have days when indoor lights seem so bright that they bother your eyes?
- YES NO 79. Have you wondered whether the spirits of the dead can influence the living?
- YES NO 80. Do people who try to get to know you better usually give up after a while?
- YES NO 81. Do you often feel 'fed up'?
- YES NO 82. Have you felt as though your head or limbs were somehow not your own?
- YES NO 83. When you look in the mirror does your face sometimes seem quite different from usual?
- YES NO 84. Do people who drive carefully annoy you?
- YES NO 85. Would you call yourself a nervous person?
- YES NO 86. Can you usually let yourself go and enjoy yourself at a lively party?
- YES NO 87. Do you ever suddenly feel distracted by distant sounds that you are not normally aware of?
- YES NO 88. Do you sometimes talk about things you know nothing about?
- YES NO 89. When in the dark do you often see shapes and forms even though there's nothing there?
- YES NO 90. Have you sometimes sensed an evil presence around you, even though you could not see it?
- YES NO 91. Is it hard for you to make decisions?
- YES NO 92. Do you find the bright lights of a city exciting to look at?
- YES NO 93. Does your sense of smell sometimes become unusually strong?
- YES NO 94. Do you usually have very little desire to buy new kinds of food?

- YES NO 95. Do you ever feel that your speech is difficult to understand because the words are all mixed up and don't make sense?
- YES NO 96. Do you often feel like doing the opposite of what other people suggest, even though you know they are right?
- YES NO 97. Do you like going out a lot?
- YES NO 98. Do you feel very close to your friends?
- YES NO 99. Do you ever feel sure that something is about to happen, even though there does not seem to be any reason for you thinking that?
- YES NO 100. Do you often feel the impulse to spend money which you know you can't afford?
- YES NO 101. Are you easily distracted when you read or talk to someone?
- YES NO 102. Do you feel that making new friends isn't worth the energy it takes?
- YES NO 103. Do you believe in telepathy?
- YES NO 104. Do you prefer watching television to going out with other people?
-

Borderline Symptom List- Supplement: Items for Assessing Behavior

During the last week...		Not at all	Once	2-3 times	4-6 times	Daily or more often
1	I hurt myself by cutting, burning, strangling, headbanging, etc.	0	1	2	3	4
2	I told other people that I was going to kill myself	0	1	2	3	4
3	I tried to commit suicide	0	1	2	3	4
4	I had episodes of binge eating	0	1	2	3	4
5	I induced vomiting	0	1	2	3	4
6	I displayed high-risk behavior by knowingly driving too fast, running around on the roofs of high buildings, balancing on bridges, etc.	0	1	2	3	4
7	I got drunk	0	1	2	3	4
8	I took drugs	0	1	2	3	4
9	I took medication that had not been prescribed or if had been prescribed, I took more than the prescribed dose	0	1	2	3	4
10	I had outbreaks of uncontrollable anger or physically attacked others	0	1	2	3	4
11	I had uncontrollable sexual encounters of which I was later ashamed or which made me angry	0	1	2	3	4

Source Memory Task

There are twenty sentences printed on this page. You will notice that the last word in some sentences has been left blank. I would like you to now complete each of the incomplete sentences on the page. There are no right or wrong answers; you can just complete the sentence with any word of your choice.

1. The knight killed the dragon.
2. The goat ate the _____.
3. The president signed the bill.
4. The horse ran the _____.
5. The doctor cured the patient.
6. The owner bought the _____.
7. The sailor sailed the ship.
8. The farmer plowed the _____.
9. The lion ate the meat.
10. The agent sold the _____.
11. The queen ruled the country.
12. The tiger ate the _____.
13. The teacher gave the test.
14. The uncle loved the _____.
15. The spider made the web.
16. The devil tempted the _____.
17. The wolf ate the rabbit.
18. The artist painted the _____.
19. The guest ate the food.
20. The father spanked the _____.

Now I would like you to read all of the sentences silently to yourself, including the ones you completed. Turn in this sheet after you have re-read all sentences.

Source Task-Part 2

Remember back to those sentences you read earlier. Half of those sentences you completed the last word; half were already complete. Now look down at this list and decide whether the second word was one you made up, one you just read, or if it is a new word that you have never seen before. So, just check if each word was created by SELF, OTHER, or if it is a NEW word. In addition, I would like you to rate how confident, or how sure you are in your answer. Circle 1 if you are not confident at all about your choice, and circle 5 if you are very confident about your choice. Speed doesn't matter; go at your own pace.

Word List	Self	Other	New	Not at All	Unsure	Very Confident		
Confident								
camel _____	_____	_____	_____	1	2	3	4	5
doctor _____	_____	_____	_____	1	2	3	4	5
tiger _____	_____	_____	_____	1	2	3	4	5
knight _____	_____	_____	_____	1	2	3	4	5
pilot _____	_____	_____	_____	1	2	3	4	5
lizard _____	_____	_____	_____	1	2	3	4	5
spider _____	_____	_____	_____	1	2	3	4	5
president _____	_____	_____	_____	1	2	3	4	5
owner _____	_____	_____	_____	1	2	3	4	5
crowd _____	_____	_____	_____	1	2	3	4	5
zebra _____	_____	_____	_____	1	2	3	4	5
devil _____	_____	_____	_____	1	2	3	4	5
horse _____	_____	_____	_____	1	2	3	4	5
agent _____	_____	_____	_____	1	2	3	4	5
guide _____	_____	_____	_____	1	2	3	4	5
sailor _____	_____	_____	_____	1	2	3	4	5
farmer _____	_____	_____	_____	1	2	3	4	5
wizard _____	_____	_____	_____	1	2	3	4	5
teacher _____	_____	_____	_____	1	2	3	4	5
team _____	_____	_____	_____	1	2	3	4	5
wolf _____	_____	_____	_____	1	2	3	4	5
lion _____	_____	_____	_____	1	2	3	4	5
artist _____	_____	_____	_____	1	2	3	4	5
uncle _____	_____	_____	_____	1	2	3	4	5
astronaut _____	_____	_____	_____	1	2	3	4	5
father _____	_____	_____	_____	1	2	3	4	5
goat _____	_____	_____	_____	1	2	3	4	5
queen _____	_____	_____	_____	1	2	3	4	5
guest _____	_____	_____	_____	1	2	3	4	5
gambler _____	_____	_____	_____	1	2	3	4	5

Beck Cognitive Insight Scale

Below is a list of sentences about how people think and feel. Please read each sentence in the list carefully. Indicate how much you agree with each statement by placing an X in the corresponding place in the column next to each statement.

	Do not agree at all	Agree slightly	Agree a lot	Agree completely
1. At times, I have misunderstood other people's attitudes towards me.				
2. My interpretations of my experiences are definitely right.				
3. Other people can understand the cause of my unusual experiences better than I can.				
4. I have jumped to conclusions too fast.				
5. Some of my experiences that have seemed very real may have been due to my imagination. (e.g., daydreaming)				
6. Some of the ideas I was certain were true turned out to be false.				
7. If something feels right, it means that it is right.				
8. Even though I feel strongly that I am right, I could be wrong.				
9. I know better than anyone else what my problems are.				
10. When people disagree with me, they are generally wrong.				
11. I cannot trust other people's opinion about my experiences.				
12. If somebody points out that my beliefs are wrong, I am willing to consider it.				
13. I can trust my own judgment at all times.				
14. There is often more than one possible explanation for why people act the way they do.				
15. My unusual experiences may be due to my being extremely upset or stressed.				

Reading the Mind with the Eyes Task (Adult, Revised)

Instructions:

For each set of eyes, choose which word best describes what the person in the picture is thinking or feeling. You may feel that more than one word is applicable but please choose just one word, the word you consider to be most suitable. Before making your choice, make sure you have read all four words. You should try to do the task as quickly as possible but you will not be timed.

PRACTICE



- jealous
- panicked
- arrogant
- hateful

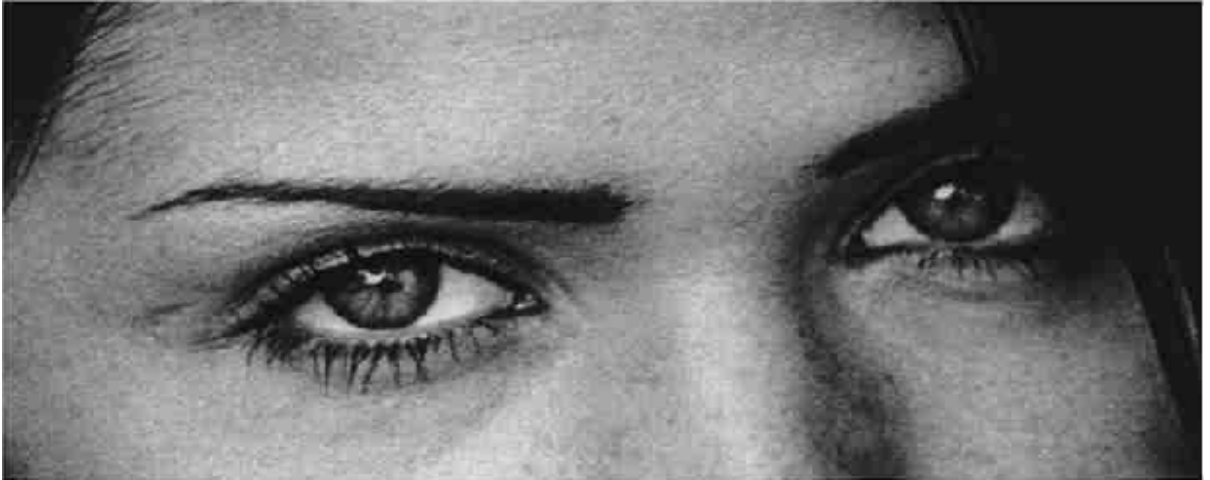


1.
 - playful
 - comforting
 - irritated
 - bored



2.

- terrified
- upset
- arrogant
- annoyed



3.
 joking
 flustered
 desire
 convinced



4.
 joking
 insisting
 amused
 relaxed



5.
 irritated
 sarcastic
 worried
 friendly



6.

- aghast
- fantasizing
- impatient
- alarmed



7.
 apologetic
 friendly
 uneasy
 dispirited



8.
 despondent
 relieved
 shy
 excited



9.

annoyed

hostile

horrified

preoccupied



10.
 cautious
 insisting
 bored
 aghast



11.
 Terrified
 Amused
 Regretful
 Flirtatious



12.

- Indifferent
- Embarrassed
- Skeptical
- Dispirited



13.

Decisive

Anticipating

Threatening

Shy



14.

Irritated

Dissapointed

Depressed

Accusing



15.
 Contemplative
 Flustered
 Encouraging
 Amused



16.

Irritated

Thoughtful

Encouraging

Sympathetic



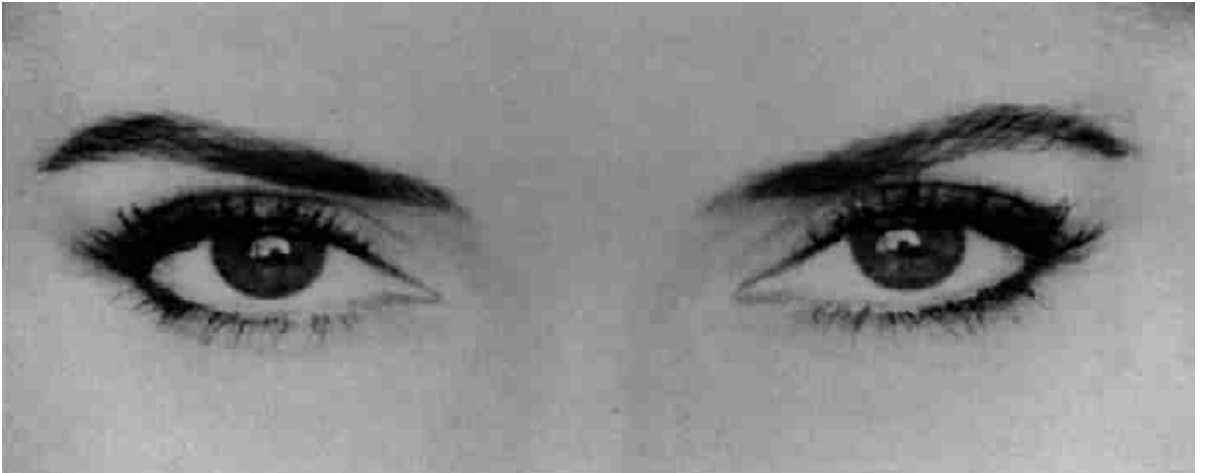
17.

Doubtful

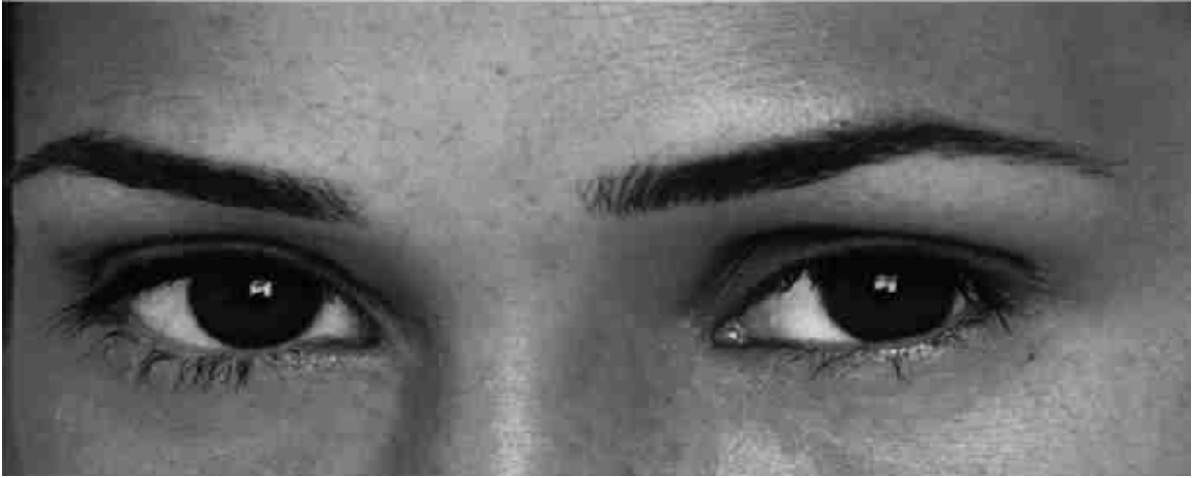
Affectionate

Playful

Aghast



18.
 Decisive
 Amused
 Aghast
 Bored



19.

- Arrogant
- Grateful
- Sarcastic
- Tentative



20.
 Dominant
 Friendly
 Guilty
 Horrified



21.

- Embarrassed
- Fantacising
- Confused
- Panicked



22.

- Preoccupied
- Grateful
- Insisting
- Imploring



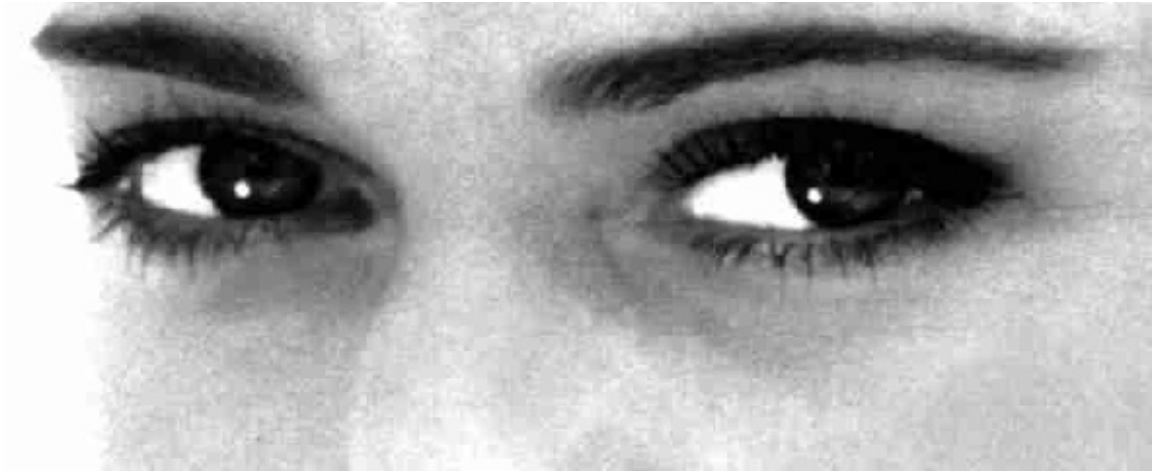
23.

- Contented
- Apologetic
- Defiant
- Curious



24.

- Pensive
- Irritated
- Excited
- Hostile



25.

- Panicked
- Incredulous
- Despondent
- Interested



26.
 Alarmed
 Shy
 Hostile
 Anxious



27.

- Joking
- Cautious
- Arrogant
- Reassuring



28.

Interested

Joking

Affectionate

Contented



29.

- Impatient
- Aghast
- Irritated
- Reflective



30.

Grateful

Flirtatious

Hostile

Dissapointed



31.
 Ashamed
 Confident
 Joking
 Dispirited



32.

- Serious
- Ashamed
- Bewildered
- Alarmed



33.

- Embarrassed
- Guilty
- Fantacising
- Concerned



34.

- Aghast
- Baffled
- Distrustful
- Terrified



35.

Puzzled

Nervous

Insisting

Contemplative



36.

- Ashamed
- Nervous
- Suspicious
- Indecisive