

ABSTRACT

Title of dissertation: BEHAVIORAL INDICATORS OF SCHIZOTYPY IN THE BIOLOGICAL PARENTS OF SOCIAL ANHEDONICS: A PRELIMINARY EXAMINATION OF THE FAMILIALITY OF SCHIZOTYPAL SIGNS

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Social anhedonia appears to be related to risk for schizophrenia-spectrum disorders and thus is a promising indicator of Meehl's construct of schizotypy. Findings from diagnostic, cognitive, and psychophysiological studies have supported the validity of social anhedonia as an indicator of schizotypy, but only recently have the behavioral characteristics of these putative schizotypes been examined. This study replicated previous findings of atypical behavioral characteristics in social anhedonics and expanded upon prior research through an examination of their biological parents, serving as a preliminary investigation into the familiarity of schizophrenia-spectrum behaviors.

A community sample of 88 18- to 19- year-olds (48 social anhedonics, 40 controls) and their biological parents (42 mothers of social anhedonics, 37 mothers of controls; 24 fathers of social anhedonics, 20 fathers of controls) received diagnostic evaluations that were videotaped as part of an ongoing study and served as the basis for ratings of behavioral signs of schizoidia and schizotypy in the present study. Proband social anhedonics exhibited atypical interpersonal behaviors characteristic of schizoid and schizotypal personality disorders as well as clinical symptoms of schizoid and schizotypal personality disorders. Mothers of social anhedonics displayed atypical interpersonal behaviors characteristic of schizotypal personality disorder but did not show elevations on clinical symptoms of schizophrenia-spectrum personality disorders. Meaningful, though not statistically significant, effects were observed for behavioral sign ratings and clinical symptom ratings of schizoid and schizotypal personality disorders in the smaller sample of fathers of social anhedonics. Correspondence on schizoid behavioral ratings was observed for probands, particularly males, and their fathers. Results provide preliminary support for the familiarity of atypical interpersonal behavior in social anhedonics, as putative schizotypes.

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OF SOCIAL ANHEDONICS: A PRELIMINARY EXAMINATION OF THE
FAMILIALITY OF SCHIZOTYPAL SIGNS

by

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Chapter 1: Introduction

Historical Background of Schizotypy

Schizophrenia is a persistent serious mental disorder affecting a variety of aspects of behavior, thinking, and emotion. Meehl (1962, 1989) proposed the construct of schizotaxia, a heritable neural integrative defect, as the basis of his genetic model for the etiology of schizophrenia. This defect produces a pervasive abnormality in the central nervous system. Meehl's proposition of a genetic basis for schizophrenia does not neglect the impact of an individual's environment upon developing the disorder. Rather, schizotaxia is described as a specific etiology, one that must be present for its interaction with other variables to cause schizophrenia, but the genetic basis alone does not cause schizophrenia – it simply predisposes an individual to schizophrenia. A substantial amount of research has supported Meehl's genetic theory of schizotypy, with environmental factors (e.g., obstetric complications, stressful life events, hostile and critical family environment) also believed to play an important role in the development of schizophrenia. This research will be reviewed in detail in a later section as part of the present study rationale.

Social learning is theorized to act upon schizotaxic individuals, resulting in a personality organization that Meehl (1962, 1989) referred to as schizotypy, following Rado's (1956) use of the term. Meehl's schizotype is characterized by four behavioral traits universally learned by schizotaxic individuals: cognitive slippage (mild thought disorder), anhedonia (pleasure deficit), ambivalence, and interpersonal aversiveness. Social anhedonia, the decreased capacity to experience pleasure through social interaction, is a primary focus of this study and will be discussed in detail in later

sections. Dependent on the social reinforcement regimes existing for a schizotaxic individual, a spectrum of outcomes is possible (Gottesman, 1991; Kwapil, 1998). Most schizotypes will fall in the normal range, never manifesting symptoms of mental illness. Approximately 10% of schizotypes will develop clinical schizophrenia (Meehl, 1990). Others will decompensate to a less extreme state, displaying schizophrenia-spectrum characteristics including those associated with schizoid, schizotypal, and paranoid personality disorders, as defined by the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (DSM-IV, APA, 1994).

Clinical Significance of Schizotypy

Individuals with schizophrenia who receive treatment early in the course of their illness have been shown to have better outcomes compared to patients receiving treatment later in the course of their illness, as evidenced by fewer cognitive deficits, less severe negative symptoms, less treatment resistance, better psychosocial functioning, and decreased risk of relapse (Edwards, Maude, McGorry, Harrigan & Cocks, 1998; Haas, Garratt & Sweeney, 1998; Johnstone, Crow, Johnson & MacMillan, 1986; Larsen, McGlashan, Johannessen & Vibe-Hansen, 1996; Loebel et al., 1992; Wyatt, 1995). Research aimed at advancing knowledge of the etiology of schizophrenia and permitting the accurate identification of individuals at risk for schizophrenia-spectrum disorders (schizoid, schizotypal, and paranoid personality disorders) serves the ultimate goal of facilitating early treatment and, ideally, preventative treatment. With the ability to identify at-risk individuals comes the ability to study the development of psychosis (a type of serious mental disorder that includes schizophrenia and involves losing touch with reality and the experience of hallucinations or delusions), to examine environmental

factors that serve to potentiate this risk or, in contrast, serve as protective factors, and to search for genetic markers of psychosis. The development of valid and reliable measures of schizophrenia proneness is necessary to achieve these goals. Meehl's (1962, 1989) model proposes that schizotypes will demonstrate aberrant, schizophrenia-like psychological and interpersonal functioning related to their latent diathesis. Meehl recommended the use of objective measures, as opposed to clinical judgment, for assessing schizotypy. Research on schizophrenia proneness has focused on the psychometric measurement of schizotypal characteristics in an attempt to understand the etiology of the disorder.

Current Definitions of Schizotypy

The *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, (DSM-IV, APA, 1994) defines three diagnostic classes that resemble Meehl's (1962, 1989) schizotypy: schizotypal, schizoid, and paranoid personality disorders. In 1980, the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III, APA, 1980) introduced the classification of schizotypal personality disorder. Criteria for schizotypal personality disorder were based on clinical profiles of patients with "borderline schizophrenia" and their relatives (Spitzer, Endicott & Gibbon, 1979). The current definition of schizotypal personality disorder is "a pervasive pattern of social and interpersonal deficits marked by acute discomfort with, and reduced capacity for, close relationships as well as by cognitive or perceptual distortions and eccentricities of behavior" (APA, 1994, p. 645). Schizoid personality disorder is currently defined as "a pervasive pattern of detachment from social relationships and a restricted range of expression of emotions in interpersonal settings" (APA, 1994, p. 638). Schizoid

personality disorder has been described as extreme introversion (Widiger, Trull, Clarkin, Sanderson & Costa, 1994). Paranoid personality disorder is conceptualized as “a pervasive distrust and suspiciousness of others such that their motives are interpreted as malevolent” (APA, 1994, p. 637), emphasizing the tendency for paranoid individuals to consider others as malevolent rather than simply being apprehensive or wary of others.

While the DSM-IV definitions are the most widely accepted attempt to classify Meehl’s schizotypy, the diagnostic nomenclature has been disputed in the literature. Tyrka et al. (1995) have argued that schizotypal personality disorder describes a limited number of schizotypes. Some researchers propose that schizotaxia be developed as a separate diagnostic class (Faraone, Green, Seidman & Tsuang, 2001). Others propose that schizotypal personality disorder be moved from Axis II (personality disorders) to the schizophrenia section of Axis I (major mental disorders) (Siever, Bernstein & Silverman, 1991). A more fundamental objection is that schizotypy cannot be classified by current DSM-IV methodology due to its dimensional nature (Kendler et al., 1991) and that a unidimensional view is inadequate for describing this complex, multidimensional construct (Kendler, McGuire, Gruenberg & Walsh, 1995).

Indexes of Schizotypy

Early attempts to develop measures of personality traits associated with a predisposition toward schizophrenia include the Minnesota Multiphasic Personality Inventory, the Goldstein-Scheerer Object Sorting Test, and the Rorschach and Thematic Apperception Tests. These measures have shown very little promise in differentiating between schizotypes and non-schizotypes (Grove, 1982). Because research supports the heritability of schizotypy, the failure of these measures to identify individuals with

genetic liability toward developing schizophrenia is not presumed to reflect a lack of transmissibility of schizophrenia-spectrum characteristics but, rather, is thought to be the result of invalid schizotypy indicators.

Loren and Jean Chapman have been the primary developers of measures of psychosis proneness based on Meehl's (1962, 1989) diathesis-stress model for schizophrenia (Chapman & Chapman, 1978; Chapman et al., 1984; Chapman, Chapman & Raulin, 1978; Eckblad & Chapman, 1983; Eckblad, Chapman, Chapman & Mishlove, 1982). The original intent of these scales was to measure risk for schizophrenia specifically. However, an examination of the predictive validity of the scales (Chapman, Chapman, Kwapil, Eckblad & Zinser, 1994), which will be reviewed in more detail shortly, revealed that the majority of the scales predict risk for developing psychosis more generally. Thus, the broader term of psychosis proneness is commonly used to describe the Chapman scales. Psychosis proneness describes both individuals who will eventually become psychotic and those with an elevation in psychotic-like experiences, which have been shown to be effective predictors of later psychosis. Examples of psychotic-like experiences are odd beliefs or unusual perceptual experiences. They represent attenuated forms of Schneiderian first rank symptoms of psychosis, which are particularly characteristic of schizophrenia and include symptoms such as hearing voices commenting on one's actions and thought withdrawal.

The Chapmans' approach differs from previously developed scales in that these researchers have separated different groups of hypothesized psychosis proneness characteristics into different scales, as opposed to developing a single scale for assessing numerous characteristics. Five psychometric measures have been developed to assess

schizotypy. The Perceptual Aberrations Scale (PerAb Scale, Chapman et al., 1978) is a 35-item true-false measure of distortions in the perception of one's own body and the environment, which includes items such as "I have felt that my body and another person's body were one and the same" (keyed true). Second, the Magical Ideation Scale (MagicID Scale, Eckblad & Chapman, 1983) is a 30-item true-false scale measuring beliefs about causation that deviate from the norm, including items such as "I have sometimes felt that strangers were reading my mind" (keyed true). Third, the Physical Anhedonia Scale (Chapman, Chapman & Raulin, 1976), originally a 40-item measure, has been revised (Revised Physical Anhedonia Scale, PhyAnh Scale, Chapman & Chapman, 1978) to eliminate heterosexual items and currently includes 61 true-false items measuring deficit in the experience of pleasure from physical, sensory experiences, such as touch and taste. An example of an item from this scale is "The beauty of a sunset is greatly overrated" (keyed true). Fourth, the Social Anhedonia Scale (Chapman et al., 1976) is a 48-item true-false scale designed to assess a deficit in the experience of interpersonal pleasure. The original scale has been revised (Revised Social Anhedonia Scale, SocAnh Scale, Eckblad et al., 1982) to focus on schizoid lack of interest in social interaction by excluding items that measured social anxiety, resulting in a 40-item revised scale. This scale includes items such as "Although I know I should have affection for certain people, I don't really feel it" (keyed true). Finally, the Impulsive Non-Conformity Scale (NonCon Scale, Chapman, et al., 1984) includes 51 true-false items that measure impulsivity, lack of empathy, and failure to incorporate societal norms through items such as "When I want something, delays are unbearable" (keyed true).

Longitudinal analysis over a 10-year period has been used to evaluate the utility of the Chapman scales for detecting psychosis proneness. Although early findings showed elevated schizotypal features, including social withdrawal, in high-scorers on the PhyAnh Scale (Chapman, Edell & Chapman, 1980), the PhyAnh Scale has not been shown to predict either schizophrenia or psychosis proneness (Chapman et al., 1994). The NonCon Scale has not demonstrated the ability to predict clinical psychosis but has shown a modest relationship to dimensional differences on psychotic-like experiences, paranoid scores, and schizotypal scores. High-scorers on the PerAb Scale, MagicID Scale, or both have been shown to have more psychosis (both mood and non-mood related), more psychotic-like experiences, higher schizotypal dimensional scores, and more psychotic relatives than control participants at follow-up (Chapman et al., 1994). These findings were especially true for those individuals with high scores on these two scales who also reported moderate levels of psychotic-like experiences at the initial interview. Although the PerAb and MagicID Scales have thus demonstrated utility in the prediction of psychosis generally, neither scale predicted schizophrenia specifically (Chapman et al., 1994).

The SocAnh Scale was not used to select a social anhedonic group in the study by Chapman et al. (1994). However, MagicID-SocAnh participants (individuals scoring high on the MagicID Scale and above the mean on the SocAnh Scale) were identified and at follow-up evidenced the highest rate of clinical psychosis (21%), had elevated ratings of psychotic-like experiences, and elevated levels of schizotypal symptoms. These

results suggest strong predictive utility for this combination of scales while highlighting the need for further analysis to determine whether the SocAnh Scale alone is related to psychosis proneness, an issue which will be discussed further in the following section.

Chapter 2: The Role of Social Anhedonia in Schizotypy

Social Anhedonia as a Predictor of Schizophrenia Proneness

The historical roots of anhedonia date back to Kraepelin (1919) and Bleuler (1950), who described anhedonia, the decreased ability to experience pleasure, as a symptom of schizophrenia. Anhedonia is one of the four core symptoms of schizotypy proposed by Meehl (1962, 1989). Meehl conjectured that anhedonia is a “quasi-pathognomonic sign” of schizotypy that is “one of the most consistent and dramatic behavioral signs of the disease” (Meehl, 1962, p. 829). Meehl (1990) later reduced the role of anhedonia to one of several normal-range individual differences capable of altering the probability of decompensation into clinical psychosis. However, recent findings suggest that social anhedonia, the decreased capacity to experience pleasure through social interaction, is a promising predictor of schizophrenia proneness.

Accordingly, researchers continue to investigate Meehl’s original conjecture as to the role of anhedonia as a putative indicator of schizotypy (Blanchard, Collins, Leung & Adams, 2005; Blanchard, Gangestad, Brown & Horan, 2000; Gooding, Tallent & Matts, 2005; Horan, Blanchard, Gangestad & Kwapil, 2004; Kwapil, 1998).

The SocAnh Scale may detect the interpersonal aversiveness and anhedonia proposed by Meehl to be core features of schizotypy. Social anhedonia has been shown to be elevated within individuals with schizophrenia (Blanchard, Mueser & Bellack, 1998; Chapman et al., 1976; Katsanis, Iacono & Beiser, 1990). Within this disorder, social anhedonia is related to poor social functioning (Blanchard et al., 1998; Katsanis, Iacono, Beiser & Lacey, 1992). Social anhedonia is a stable condition in individuals with schizophrenia, whereas it appears to be transiently related to the depressed state in

depressed patients (Blanchard, Horan & Brown, 2001; Katsanis et al., 1992). These findings have been demonstrated independent of schizophrenia symptom status (Blanchard, Bellack & Mueser, 1994; Blanchard et al., 2001; Katsanis et al., 1992).

Cross-Sectional Studies of Social Anhedonia

Using a psychometric high-risk paradigm (e.g., Blanchard et al., 2005; Chapman et al., 1994; Gooding et al., 2005; Kwapil, 1998), individuals, typically college students, who score high in social anhedonia have been found to evidence cognitive deficits and psychophysiological abnormalities consistent with those seen in schizophrenia, though in weaker form. In social anhedonics, cognitive deficits have been found in working memory (Gooding & Tallent, 2003; Tallent & Gooding, 1999) and executive functioning (Gooding, Kwapil & Tallent, 1999; Gooding, Tallent & Hegyi, 2001; Tallent & Gooding, 1999). Social anhedonics also evidence aberrant smooth pursuit tracking (Gooding, Miller & Kwapil, 2000) and antisaccade performance (Gooding, 1999) in eye tracking tasks.

Diagnostic and symptom evaluations have typically found that social anhedonics report elevated dimensional ratings for schizophrenia-spectrum personality disorders compared to individuals without elevated scores on the SocAnh Scale (Blanchard & Brown, 1999; Blanchard et al., 2005; Mishlove & Chapman, 1985). Mishlove and Chapman (1985) found that women who scored high on the SocAnh Scale reported more schizotypal features and psychotic-like experiences than women who scored low. Men scoring high on the SocAnh Scale did not differ from controls. However, men who scored high on the PerAb and MagicID Scales of psychosis proneness in addition to scoring high on the SocAnh Scale had more schizotypal features and psychotic-like

experiences than men who scored high on the PerAb and MagicID Scales but not on the SocAnh Scale. These results suggest that high PerAb-MagicID SocAnh males may be at increased risk for decompensation into clinical psychosis. In summary, cross sectional data suggests that social anhedonics, as identified by the SocAnh Scale, display cognitive deficits, physiological abnormalities, and clinically-relevant schizotypal characteristics. However, longitudinal research is necessary to explore the predictive power of these findings related to schizophrenia proneness.

Predictive Validity of Social Anhedonia

Longitudinal data obtained over a 10-year follow-up has been used to examine the specificity of the Chapman measures of psychosis proneness. As discussed above, individuals who scored high on the PerAb and MagicID Scales were shown to be at increased risk for a range of psychotic disorders including bipolar disorder with psychotic features, delusional disorder, and psychosis not otherwise specified, but not schizophrenia-spectrum disorders specifically (Chapman et al., 1994). However, of those individuals who scored high on the MagicID Scale, those who also scored above the mean on the SocAnh Scale were at a heightened risk for developing psychotic disorders (21%).

Kwapil (1998) later reanalyzed the same longitudinal data to examine the utility of social anhedonia as an indicator of risk for schizophrenia-spectrum disorders. The group of high scorers on the SocAnh Scale from the previous study by Chapman et al. (1994) was reexamined while statistically controlling for the effects of the other psychosis proneness measures. At 10-year follow-up, 24% of this social anhedonia group had been diagnosed with schizophrenia-spectrum disorders, as compared to only 1% of

the control group. The SocAnh Scale was the only measure that predicted schizophrenia-spectrum personality disorders. These results further support the SocAnh Scale as a specific predictor of schizophrenia-spectrum disorders. In contrast, the PerAb and MagicID Scales appear to predict the development of general psychosis.

More recently, Gooding et al. (2005) reassessed a group of 135 college students approximately 5 years after their initial assessment with the Chapman scales. Psychometric risk (elevated scores on either the PerAb and MagicID Scales or on the SocAnh Scale) predicted schizophrenia-spectrum diagnoses between the baseline assessment and 5-year follow-up, while neither psychophysiological deviance (as indexed by nailfold plexus visibility, smooth pursuit eye tracking impairments, and antisaccade task deficits) nor ratings of psychotic-like experiences were significant predictors. Both the PerMag and SocAnh groups were characterized by higher rates of schizophrenia-spectrum disorders compared to the control group at follow-up. However, the SocAnh group had significantly higher rates of schizophrenia-spectrum diagnoses than the PerMag group (15.6% and 3.4%, respectively). Both the PerMag and SocAnh groups endorsed higher rates of psychotic-like experiences than the control group, but the two at-risk groups did not differ. Interestingly, no group differences in the proportion of participants with a family history of psychosis in first-degree relatives (parent, sibling, or child) or second-degree relatives (grandparent, aunt, uncle, niece, or nephew) were observed. These results further support both the validity and usefulness of the SocAnh Scale and suggest that some at-risk individuals may be identified by the psychometric high-risk paradigm whom would not be identified by a genetic risk paradigm.

Behavioral Characteristics of Social Anhedonics

The above findings have begun to illuminate the subtle neuropsychological deficits and clinical symptoms occurring in social anhedonics. However, the social behavioral characteristics of these putative schizotypes have only recently been examined. Prior research has sought to evaluate the generally lower social accomplishments of social anhedonics, as indexed by self-report or global clinical interview measures indicating poorer overall social adjustment (Kwapil, 1998; Mishlove & Chapman, 1985), less social support (Blanchard & Brown, 1999), lower number of friends and greater reticence with friends (Mishlove & Chapman, 1985), lower rates of dating and marriage (Kwapil, 1998), and lower quality of intimate relationships (Kwapil, 1998). However, until recently, psychosis proneness research has relied primarily on symptom ratings derived from self-report. Recent research has examined the utility of behavioral sign ratings in the assessment of schizotypy. Whereas symptom ratings assess experiences reported by an individual, sign ratings focus on an interviewer's observation of the respondent's behavior.

Examination of interpersonal behavior in this population is important for a variety of reasons. First, a closer examination of behavior may yield insights as to why social anhedonics demonstrate difficulties in social relationships. For example, in a study of first-degree relatives of schizophrenia patients, Nuechterlein et al. (2002) found that the schizotypal personality disorder sign rating of odd or eccentric behavior loads on a factor with three neurocognitive measures of sequential visual conceptual tracking, rapid perceptual encoding and search, and focused, sustained attention. This finding suggests

that cognitive disorganization contributes to the odd behavior or appearance observed in schizotypes which may result in impaired interpersonal relationships.

As another example, a relationship has been observed between individuals scoring high on the PerAb and MagicID Scales and negative effect on interviewers during a brief interaction, whereby interviewers are left feeling more anxious, angry, and less curious during the interview (Shean & Wais, 2000; Zborowski & Garske, 1993). These subtle individual characteristics increase our understanding of the interpersonal difficulties reported by PerMag participants and would not be revealed by symptom ratings. Several explanations may account for the ability of signs to reveal information not accessed through symptom assessment. Principally, many psychiatric disorders, especially psychotic disorders, are accompanied by unawareness of deficit (Masson, Azorin & Bourgeois, 2001; Pini, Cassano, Dell'Osso & Amador, 2001). As a result, individuals may unintentionally withhold information relevant to psychiatric diagnosis due to lack of insight into their own symptomatology. Additionally, some individuals respond in a biased manner during face to face interviews, having vague or defensive responses, possibly due to personal discomfort or intentional attempts to appear normal when being judged (Claridge, Robinson & Birchall, 1983; Katsanis et al., 1990; Kendler, Thacker & Walsh, 1996). Finally, behavioral signs may be a more subtle manifestation of psychopathology, possibly having a lower threshold than clinical symptom ratings. Thus, closer examination of behavior may reveal information not attained during a clinical interview and may yield insights as to why social anhedonics demonstrate difficulties in social relationships.

Second, behavioral signs have been shown to be sensitive indicators of genetic risk for schizophrenia, and further examination of behavioral characteristics may help elucidate the schizotypy construct. In a study of the offspring of mothers with schizophrenia, Tyrka et al. (1995) demonstrated that behavioral sign ratings of schizotypy based on psychiatric interviews and teacher reports were useful indicators of the latent taxon of schizotypy. Miller et al. (2002) examined the factor structure and predictive validity of the Structured Interview for Schizotypy (SIS, Kendler, 1988b) in individuals at risk for schizophrenia and patients with schizophrenia. A four-factor solution was derived: social withdrawal, psychotic symptoms, socio-emotional dysfunction, and odd behavior. Interestingly, high-risk individuals who developed schizophrenia during a 39-month follow-up period exhibited the highest scores on odd behavior at initial assessment. In the schizophrenia group, odd behavior was less prominent than psychotic symptoms and deteriorating social functioning, suggesting that odd behavior, particularly in conjunction with other components of schizotypy, may be most useful as an indicator of heightened risk of decompensation in genetically high-risk individuals (Miller et al., 2002).

In a study of first-degree relatives of schizophrenia patients, Kendler et al. (1995) demonstrated that behavioral signs of schizotypy, as measured by the SIS, appear non-redundant with clinical symptoms typically assessed in diagnostic interviews. In addition to their independence from symptom ratings, Kendler et al. found that behavioral signs were more powerful than symptom ratings at detecting schizophrenia-spectrum characteristics in first-degree relatives of individuals with schizophrenia. As a specific example of the utility of behavioral sign ratings, the observed sign of suspiciousness has

been shown to be much more accurate than its corresponding self-reported symptom at identifying relatives of schizophrenia patients (Kendler, Lieberman & Walsh, 1989).

Based on the findings of Kendler et al. (1995), Miller et al. (2002), and Tyrka et al. (1995), as well as accumulating evidence supporting social anhedonia as an indicator of schizotypy, Collins, Blanchard, and Biondo (2005) examined schizophrenia-spectrum behavioral characteristics in a community sample of 85 18- to 19- year-old social anhedonics and 85 18- to 19- year-old controls. This is the only known study to have examined the utility of behavioral sign ratings compared to traditional clinical symptom ratings with social anhedonics serving as a putative schizotypic group. The behavioral coding system used in the study, the Interpersonal Measure of Schizoidia and Schizotypy (IM-SS, Kosson, Byrnes & Park, 1999), was developed to improve the assessment of schizophrenia-spectrum personality disorders by focusing on atypical interpersonal behaviors rather than on self-reported symptoms. The measure examines observable interpersonal behaviors characteristic of schizoid personality disorder (e.g., constricted facial affect, lack of non-verbal expression) and schizotypal personality disorder (e.g., inappropriate affect, odd behavior). A revised version of the IM-SS (IM-SS-R, Kosson, Byrnes, Park, Collins & Kwapil, 2004) is now available and will be discussed in more detail in a later section. Behavioral raters in the Collins et al. study observed approximately 30 minutes of videotaped interaction between participants (social anhedonics or controls) and interviewers during semi-structured clinical interviews.

Collins et al. (2005) found the original IM-SS scales to have good internal consistency and inter-rater reliability, although both characteristics were higher for the IM-SS Schizoidia Scale than for the IM-SS Schizotypy Scale. Compared to control

participants, the social anhedonia group displayed significantly more behavioral signs characteristic of schizoid and schizotypal personality disorders. Within each group, men had higher IM-SS Schizoidia Scale ratings than women. Behavioral signs of schizoidia accounted for a significant amount of group variance even after controlling for clinical symptom ratings, as measured using the International Personality Disorders Examination (IPDE, Loranger et al., 1995) (see Table 1). These results indicate that social anhedonics display interpersonal behaviors consistent with risk for schizophrenia-spectrum disorders and that these behavioral signs convey information about group status that is not accounted for by traditional clinical interview ratings of symptomatology.

Table 1: *Incremental Validity of Behavioral Ratings in Predicting Group Membership (Social Anhedonic vs. Control)*

N=170	<u>R Increment</u>	<u>R² Change</u>	<u>F Change</u>
<u>IM-SS Schizoidia Scale</u>			
Step 1: IPDE (Schizoid, Schizotypal, Paranoid)	.400	-----	-----
Step 2: IM-SS Schizoidia Scale	.427	.023	4.60*
<u>IM-SS Schizotypy Scale</u>			
Step 1: IPDE (Schizoid, Schizotypal, Paranoid)	.400	-----	-----
Step 2: IM-SS Schizotypy Scale	.402	.001	0.27

Note. * $p < .05$, two-tailed; Table reprinted with permission from Collins, L.M., Blanchard, J.J., & Biondo, K.M. (2005). Behavioral signs of schizoidia and schizotypy in social anhedonics. *Schizophrenia Research*, in press; IM-SS = Interpersonal Measure of Schizoidia and Schizotypy; IPDE = International Personality Disorders Examination.

Summary of Current Knowledge

The current diagnostic system has attempted to conceptualize the clinical manifestations of Meehl's schizotypy. The Chapmans have advanced the psychometric measurement of schizotypy with the ultimate goals of prevention and therapeutic advancement. However, it appears that the different Chapman scales are not equal in their predictive utility. While the PerAb and MagicID Scales appear to be valid instruments in the measurement of general psychosis proneness, only the SocAnh Scale has been shown to specifically predict the development of schizophrenia-spectrum disorders. Signs and symptoms of schizotypy have been shown to represent fundamentally different domains of psychopathology. Examination of behavioral characteristics has begun to improve our understanding of social anhedonia as a putative risk factor for schizophrenia, with social anhedonics displaying behavioral signs characteristic of schizoid and schizotypal personality disorders. Despite substantial support for Meehl's genetic theory for the etiology of schizophrenia and growing support for social anhedonia as an indicator of schizotypy, research to date has yielded a limited understanding of the clinical and interpersonal characteristics of biological relatives of schizophrenia patients and social anhedonics, which will be reviewed next.

Chapter 3: Study Rationale

Genetic Basis of Schizotypy

Dating back to the works of Bleuler (1950) and Kraepelin (1919), family members of individuals with schizophrenia have been observed to have odd personality features, such as social isolation, poor interpersonal relationships, odd speech, and odd thought content (Clementz, Grove, Katsanis & Iacono, 1991; Katsanis et al., 1990; Kendler, 1985; Kendler et al., 1993; Maier, Lichtermann, Minges & Heun, 1994; Silverman et al., 1993). A substantial amount of research has supported Meehl's (1962, 1989) genetic theory of schizotypy by demonstrating elevated rates of schizophrenia and schizophrenia-spectrum personality disorders in the biological relatives of patients with schizophrenia as compared to controls (e.g., Gottesman, 1991; Kendler, 1988a; Loring, Mirsky & Pereira, 1983). Additionally, the prevalence of schizophrenia in relatives of individuals with schizotypal personality disorder is greater than that found in relatives of controls (Battaglia, Gasperini, Sciuto, Scherillo & Bellodi, 1991; Thacker, Adami, Moran, Lahti & Cassidy, 1993). The genetic basis to schizophrenia-spectrum disorders has been demonstrated in both family studies (Kendler et al., 1993) and adoption studies (Kendler, Gruenberg & Strauss, 1981; Kety, Rosenthal, Wender & Schulsinger, 1968). Risk for schizophrenia is higher for adopted children with an affected biological parent (approximately 7-11%) compared to adopted children of unaffected biological parents (0-1%), showing heritability despite elimination of the influence of postnatal environmental interaction between the child and their affected biological parent (Heston, 1966; Rosenthal et al., 1968; Rosenthal et al., 1975).

Previous research has demonstrated a spectrum of expressions of genetic risk such that relatives of individuals with schizophrenia have higher risk of developing the disorder compared to relatives of unaffected controls, and this risk varies depending on degree of common genetics. Third-degree relatives have twice the risk, second-degree relatives have four times the risk, first-degree relatives have, on average, ten times the risk, and monozygotic twins and offspring of two affected individuals have up to 50 times the risk for developing the disorder (Gottesman, 1991). Kety (1987, 1988) found the elevated frequency of schizophrenia-spectrum disorders in the biological offspring of individuals with schizophrenia to be three to five times higher when the offspring had one parent with schizophrenia and the other parent had a schizophrenia-spectrum disorder than for offspring who did not have a second parent with a spectrum disorder.

Fanous, Gardner, Walsh, and Kendler (2001) examined the relationship between positive and negative symptoms in individuals with schizophrenia and symptoms of the schizotypal personality dimension in their first-degree relatives. Positive and negative symptoms in individuals with schizophrenia were found to predict corresponding schizotypal symptoms in their first-degree relatives, suggesting that these constructs are etiologically distinct but appear on a continuum of presentations within family members sharing genetic liability for schizophrenia. Twin and adoption studies of schizophrenia (Cardno et al., 1999) and twin studies of schizotypal personality disorder (Linney et al., 2003) have shown that both constructs are influenced by additive genetic and unique environmental effects, suggesting that the same broad mechanisms influence schizotypy and schizophrenia, which lends further support to the continuity model of psychosis. With regard to behavioral signs, the findings of Kendler et al. (1995), Miller et al. (2002),

and Tyrka et al. (1995) discussed in the previous section support the transmission of schizophrenia-spectrum behavioral characteristics in families of individuals with schizophrenia. These findings of a spectrum of expressions of genetic risk lend strong support to Meehl's genetic etiology of schizophrenia. Although the mode of transmission remains unknown, the extent of genetic determination in schizophrenia has been shown to be significant.

Non-genetic Influences on Schizotypy

Compelling evidence for the genetic basis of schizotypy does not minimize the effect of an individual's environment on the development of schizophrenia-spectrum disorders. The most convincing evidence that environment affects the development of psychosis comes from twin studies showing the rate of schizophrenia in monozygotic twins to be approximately 48% (Gottesman, 1991), which is significantly higher than the 1% rate of schizophrenia in the general population but still noticeably less than 100%, the expected concordance rate for a purely hereditary disorder, as monozygotic twins are genetically identical. Additionally, individuals with schizophrenia typically experience fluctuating symptom severity, which is probably not accounted for by genetic influences alone (Bleuler, 1978; Zubin & Spring, 1977). Thus, although a strong genetic component to the disorder is clearly evident, non-genetic influences are presumed to play an important role in the manifestation of schizophrenia.

Non-genetic influences on the etiology of schizophrenia may be pre- or postnatal, psychological or physical, and include factors such as obstetric complications, family environment, stressful life events, and nutritional deficits. Mounting research supports the role of specific non-genetic factors in schizophrenia. For example, genetically high-

risk individuals who develop schizophrenia show higher rates of history of familial instability or birth complications compared to high-risk individuals who do not develop mental illness or are diagnosed with schizotypal personality disorder (Cannon & Mednick, 1993; Cannon, Mednick & Parnas, 1990; Parnas et al., 1982). Interestingly, these putative environmental risk factors are not associated with an increase in schizophrenia in genetically low-risk individuals (Cannon & Mednick, 1993; Cannon et al., 1990), which suggests an interaction effect between genetic and environmental risk factors. It is presumed that several genes act synergistically with each other and with the environment to cause schizophrenia (Risch, 1990). Thus, current research focuses on developing vulnerability-stress models for the etiology of schizophrenia in which a genetically transmitted vulnerability is exacerbated by specific environmental events, resulting in a deficit in the central nervous system (Zubin & Steinhauer, 1982). Meehl's (1962, 1989) diathesis-stress model for schizophrenia in which both the genetic diathesis (schizotaxia) and environmental stressors (e.g., obstetric complications) must interact to produce the disorder, is an example of current theories for the etiology of schizophrenia.

Familial Influences on Behavior

An examination of specific theories for the role of the family in the etiology of schizophrenia is beyond the scope of this review. However, a discussion of familial influences on atypical behavior is warranted, as this information is necessary for interpreting findings from the present study. The developmental systems perspective assumes that child and family disturbances occur due to multiple, often co-occurring, reciprocal, and interacting risk factors, causal events, and processes (e.g., Eaves et al., 1997; Ge, Conger, Lorenz, Shanahan & Elder, 1995; Rende, 1999; Rutter et al., 1997).

Patterson's Coercive Family Process (1982) provides a cogent portrayal of the effects of family environment on maladaptive behavior. Impaired parent child-rearing practices are seen as inadvertently promoting unwanted behavior in a child through an array of actions including reinforcement of deviant behavior, inattention to positive, prosocial behavior, and coercive interactions between parent and child. Detrimental factors in parent-child interaction occur on a lower level with minor unwanted child behaviors, such as whining, as well as on a higher level. In fact, such factors have been shown to contribute to the escalation of aggressive child behavior seen in conduct disorder (Patterson, Reid & Dishion, 1992). Parent-child interactions are a dynamic process involving reciprocal and mutual influences of the child on the parent and the parent on the child. For example, a child's difficult behavior can promote parental withdrawal, which in turn promotes more difficult behavior on the part of the child, accumulating in a cycle of negative parent-child interactions.

Although much intriguing evidence exists for the role of the family in atypical development, family theories have not been undisputed. Pike and Plomin (1996) propose competing explanations for family effects on child development, noting differing effects on children within the same family and the possibility that findings are mediated by genetic factors. The latter argument is pertinent to a discussion of the role of parental psychopathology in atypical child development. Genetic factors can enhance development of pathological behaviors directly through the transmission of genes from parent to child, indirectly through modeling of parental behaviors (e.g., in the case of alcohol abuse), or through promoting a disrupted environment (e.g., family conflict, violence). For example, a mother prone to depression will transmit genes carrying risk

for the disorder to her child but will also model behavior characteristic of the disorder, which will alter the child's environment, potentially providing the stressor needed to trigger his genetically mediated vulnerability. Reciprocal influences operate such that the child's behavior may affect the mother's risk (i.e., the child engaging in difficult behavior may provide the environmental stimulus necessary to trigger a depressive episode in the mother). Some research has examined the impact of severe psychopathology on parenting, showing that parents with schizophrenia or depression behave differently during interactions with their children compared to normal controls (Oyserman, Mowbray, Meares & Firminger, 2000). For example, mothers with mood disorders tend to be less consistent with their parenting strategies during interactions with their children (Hoffman & Drotar, 1991), use a less positive vocal tone concomitant with more criticism and coercion (Cox, Puckering, Pound & Mills, 1987), and overreact to minor stressors frequently encountered by parents, such as having to wait at the doctor's office (Breznitz & Sherman, 1987). Thus, familial correspondence on atypical behaviors may be due to shared genetics, modeling, reciprocal parent-child influences or shared environmental influences, and disentangling these effects poses a great challenge to psychopathology researchers.

Family Studies of Social Anhedonia

Family studies of schizophrenia have examined the genetic basis of social anhedonia. Katsanis et al. (1990) found that first-degree relatives of schizophrenia patients, as well as relatives of patients with schizophreniform disorder and psychotic affective disorders, show elevated levels of social anhedonia compared to controls. Kendler et al. (1996) also reported elevated levels of social anhedonia in relatives of

schizophrenia patients, but this finding was specific to relatives of schizophrenia patients and was not observed for relatives of patients with non-affective psychoses, psychotic affective illness, or non-psychotic affective illness. This trend has not been established for the constructs measured by the PerAb or MagicID Scales (Kendler et al., 1996). Findings that relatives' scores on the SocAnh Scale correlate with paranoid, schizoid, and avoidant personality disorders (Lyons et al., 1995) support Meehl's genetic theory of a spectrum of outcomes for schizotypes. Thus, family studies of social anhedonia further suggest that unlike the PerAb or MagicID Scales, which broadly measure psychosis proneness, the SocAnh Scale appears to be a more specific indicator of genetic risk for schizophrenia-spectrum disorders.

In summary, an accumulation of evidence supports the genetic basis of schizophrenia-spectrum symptoms, and behavioral signs have been observed in first-degree relatives of individuals with schizophrenia. Social anhedonia also appears to be heritable, with one study finding that it is specific to schizophrenia and is not observed in relatives of patients with affective, psychotic, or psychotic affective disorders. Behavioral signs have been observed in social anhedonics. However, current knowledge on the characteristics of family members of social anhedonics, both clinical and interpersonal, is limited. A void in the literature exists examining similarities between social anhedonics and their relatives in the behavioral domain. Given support for the genetic basis of schizophrenia and social anhedonia, first-degree relatives of social anhedonics would be expected to display the same pattern of atypical interpersonal

behavior. Such a finding would support Meehl's genetic theory for the etiology of schizophrenia, advance our understanding of the construct of schizotypy, and would have implications for improving the assessment of schizotypy.

Chapter 4: Study Overview

The present study involved a large community sample of 18- to 19- year-olds and their biological mothers and fathers. Proband (primary individual being examined in a family study) adolescents were recruited as part of the Maryland Longitudinal Study of Schizotypy (MLSS, Blanchard, Collins, Leung & Adams, 2005), an ongoing study conducted at the University of Maryland at College Park (UMCP), based on results of a self-report survey including the SocAnh Scale. Group differences between social anhedonics and controls as well as their biological parents on observable behavioral characteristics of schizophrenia-spectrum disorders were examined under the assumption that putatively high-risk individuals (social anhedonics) and their biological parents would display elevated rates of schizophrenia-spectrum behavioral signs. The first aim of this study was to replicate findings by Collins et al. (2005) of elevated rates of schizoid and schizotypal behavioral signs in social anhedonics using the revised version of the Interpersonal Measure of Schizoidia and Schizotypy (IM-SS-R, Kosson et al., 2004). The second aim of this study was to extend the work of Collins et al. through an examination of schizophrenia-spectrum behaviors in the biological parents of social anhedonics as a preliminary investigation of the familiarity of behavioral signs in this group of putative schizotypes. This was the first study to examine the familiarity of these behaviors in a psychometrically-identified putative schizotype group. Third, this study examined correspondence on schizophrenia-spectrum behaviors between probands and their biological parents. Finally, this study sought to replicate the incremental validity findings of behavioral sign ratings in the identification of putative schizotypes (social anhedonics) reported by Collins et al. and to extend these finding to their biological

parents. Of note, the present study design allowed for a preliminary examination of the familiarity of atypical interpersonal behavior but did not allow for an analysis of the relative contribution of genetics and environment on familial transmission of interpersonal behavior (see discussion section for further details).

Hypotheses

1. The IM-SS-R can be used reliably to measure behavioral signs of schizoid and schizotypal personality disorders in social anhedonics and controls as well as their biological mothers and fathers.
2. Social anhedonics, as putative schizotypes, will display elevated rates of schizoid and schizotypal behavioral characteristics (as has been previously shown using the original IM-SS), as measured by the IM-SS-R. Post-hoc analyses were conducted to determine which of the observed behaviors best differentiated between social anhedonics and controls.
3. Biological parents of proband social anhedonics will display elevated rates of schizoid and schizotypal behavioral characteristics, as measured by the IM-SS-R, demonstrating a familial pattern of atypical interpersonal behavior. Post-hoc analyses were conducted to determine which of the observed behaviors best differentiated between parents of social anhedonics and parents of controls.
4. Dimensional ratings of schizoid and schizotypal behavioral characteristics for social anhedonics and their biological mothers and fathers, as measured by the IM-SS-R, will be significantly related, demonstrating within-family correspondence on schizophrenia-spectrum behaviors.

5. Behavioral signs of schizoidia and schizotypy, as measured by the IM-SS-R, will contribute unique variance to proband group differentiation (social anhedonic vs. control), above and beyond that accounted for by clinical symptom ratings, as measured by the IPDE (as has been previously shown for the original IM-SS Schizoidia Scale).
6. Behavioral signs of schizoidia and schizotypy, as measured by the IM-SS-R, will contribute unique variance to the differentiation of mothers and fathers of social anhedonics from mothers and fathers of controls above and beyond that accounted for by clinical symptom ratings, as measured by the IPDE.
7. Proband and parent ratings of behavioral signs of schizoidia and schizotypy, as measured by the IM-SS-R, will be related to family member report of schizophrenia-spectrum behavior as well as global functioning, demonstrating external validity for IM-SS-R ratings.

Chapter 5: Method

The Maryland Longitudinal Study of Schizotypy

A noteworthy limitation of prior psychometric high-risk research with social anhedonics is the use of non-probabilistic college samples. Compared to community samples, college samples have consistently been shown to have higher levels of socio-economic status, be comprised of fewer ethnic minorities, and have lower rates of severe psychopathology and comorbidity (Newman, Moffitt, Caspi & Silva, 1998; Robins et al., 1984; Sher & Trull, 1996). The present study utilized data from the Maryland Longitudinal Study of Schizotypy (MLSS, Blanchard et al., 2005). The MLSS is based on a community sample from the area surrounding the University of Maryland at College Park (UMCP). This afforded the unique opportunity to examine social behavior within a sample that may be more representative of the general population than would be found in a college student sample.

As part of the MLSS, normal controls and individuals identified by high scores on the Revised Social Anhedonia Scale (SocAnh Scale, Eckblad et al., 1982) were recruited from the UMCP area. Participants were administered diagnostic interviews (Structured Clinical Interview for DSM-IV Axis I Disorders, SCID-I, First, Gibbon, Spitzer & Williams, 1996; International Personality Disorders Examination, IPDE, Loranger et al., 1995), symptom ratings (Schedule for the Deficit Syndrome, SDS, Kirkpatrick, Buchanan, McKenney, Alphas & Carpenter, 1989), and family ratings (Family Interview for Genetic Studies, FIGS, Maxwell, 1992) in addition to several questionnaires, a computerized test of attention, and several tests of memory and cognitive ability. Biological parents of the proband group were then invited to participate in the MLSS and

completed the same assessment battery as the proband group. Findings from the baseline assessment of the MLSS have demonstrated that, compared to controls, social anhedonics evidence significant elevations in schizotypal, schizoid, and paranoid personality disorder symptom ratings as well as lower global functioning (Blanchard et al., 2005). The MLSS received approval from the UMCP Institutional Review Board in February, 2001, and was re-approved in May, 2004 (IRB #00848). The present study contributed uniquely to the MLSS through its examination of behavioral ratings in the assessment of schizophrenia-spectrum disorders in social anhedonics and their biological parents. This study received approval from the Department of Psychology Human Subjects Review Board and from the UMCP Institutional Review Board in May, 2004 (IRB #04-0246).

Participants

Participants included a subset of 2,236 18- to 19- year-olds recruited for the MLSS by the UMCP Survey Research Center using random digit dial methods. Participants came from households within a 20-mile radius of the University, including Prince George's and Montgomery counties in Maryland as well as the District of Columbia. Participants were mailed a consent form and a screening questionnaire including the SocAnh (Eckblad et al., 1982), PerAb (Chapman et al., 1978), and MagicID (Eckblad & Chapman, 1983) Scales. Upon completion of the initial screening questionnaire, participants received \$15.

Subsequent selection and recruitment was based on individuals' responses to the SocAnh Scale. Two MLSS participants from the control group were excluded from the present study because the videotaped clinical interviews necessary for making behavioral sign ratings were not available due to recording errors. Although most of the proband

group in this present study overlapped with the participant group in the Collins et al. (2005) study, the selection criteria and assessment procedure used in the present study differed. Due to the aims of the present study, only those probands for whom at least one parent also agreed to participate in an on-site interview as part of the MLSS were eligible for inclusion in the present study ($N=48$ of 86 (55.8%) social anhedonic probands; $N=40$ of 87 (46.0%) control probands). Additionally, the present study used the revised version of the IM-SS (IM-SS-R, Kosson et al., 2004), so all of the behavioral sign ratings in the present study, including those for probands, mothers, and fathers, are novel data. Group status (social anhedonic vs. control) and demographic group differences between eligible probands (i.e., those having at least one parent who participated in the MLSS) and non-eligible probands were examined. Although eligible and non-eligible probands did not differ on group status ($\chi^2(1, N=173) = 1.67, p > .05$), level of education ($\chi^2(2, N=173) = 0.01, p > .05$), or gender ($\chi^2(1, N=173) = 0.17, p > .05$), a significant group difference was present for race ($\chi^2(3, N=173) = 14.11, p < .01$), with more parents of white probands completing the study than those refusing to participate (see Table 2).

To further examine possible differences between eligible and non-eligible probands as well as potential differences between their parents, the proband groups were compared on self-reported schizophrenia-spectrum symptomatology and report of parental psychopathology. Based on IPDE dimensional ratings, eligible and non-eligible probands did not differ on schizoid ($F(1, 168) = 0.06, p > .05$) or schizotypal ($F(1, 168) = 1.36, p > .05$) personality disorder symptomatology. However, probands without a parent participating in the study had higher dimensional ratings of paranoid personality disorder symptomatology ($F(1, 168) = 4.60, p < .05$) than probands with a parent participating in

Table 2: *Group Status and Demographic Characteristics of Eligible and Non-Eligible Probands*

	Eligible (<u>N</u> =88) <u>N</u> (%)	Non-Eligible (<u>N</u> =85) <u>N</u> (%)
<u>Group Status</u>		
Control	40 (45.5)	47 (55.3)
Social Anhedonic	48 (54.5)	38 (44.7)
<u>Gender</u>		
Female	48 (54.5)	49 (57.6)
Male	40 (45.5)	36 (42.4)
<u>Ethnicity</u>		
White	48 (54.5)	28 (32.9)**
Black	36 (40.9)	41 (48.2)
Hispanic	4 (4.5)	10 (11.8)
Other	0 (0.0)	6 (7.1)
<u>Level of Education</u>		
Grade 7-12 but not Graduating	1 (1.1)	1 (1.2)
Graduated High School or GED	17 (19.3)	17 (20.0)
Part College	70 (79.5)	67 (78.8)

Note. ** $p < .01$, two-tailed; To be eligible for inclusion in the present study, at least one of the proband's biological parents must have participated in the MLSS.

the study. Only 170 of the 173 participants were examined in the preceding analyses because 3 participants (1 social anhedonic, 2 controls) were not rated using the IPDE due to current Axis I psychotic disorder diagnoses. Based on FIGS dimensional ratings of parental psychopathology, eligible and non-eligible participants did not differ on report of mother schizoid ($F(1, 168) = 0.21, p > .05$), schizotypal ($F(1, 168) = 0.80, p > .05$), or paranoid ($F(1, 168) = 0.67, p > .05$) personality disorder symptomatology or father

schizoid ($F(1, 160) = 1.23, p > .05$), schizotypal ($F(1, 160) = 0.06, p > .05$), or paranoid ($F(1, 160) = 1.33, p > .05$) personality disorder symptomatology. Proband reports of parental psychopathology used in the preceding analyses were available for 170 mothers and 162 fathers of probands. The remaining probands reportedly did not know their biological parent(s) well enough to report on schizophrenia-spectrum psychopathology, typically either because they lived with one biological parent or were adopted. Additionally, two control participants did not have ratable videotaped interactions due to recording errors and were excluded from the above analyses comparing eligible and non-eligible participants. Overall, the group of eligible participants appears to be representative of the total group of probands who participated in the MLSS. However, proband paranoia was associated with lack of parental participation.

Forty-eight 18- to 19- year-olds identified by elevated levels of social anhedonia participated in the present study. Two methods were used to select extreme scorers. The first method involved identifying individuals falling at least 1.9 standard deviations above the SocAnh Scale mean ($N=40; 83.3\%$). This selection method has been established through use in previous studies (e.g., Chapman et al., 1994; Gooding et al., 2005; Kwapil, 1998). Prior research (Chmielewski, Fernandes, Yee & Miller, 1995; Kelley & Coursey, 1992) has shown significant racial group differences on the SocAnh Scale, with white participants having the lowest mean scores, as well as significant gender differences, with men scoring higher than women. Thus, standard deviation cut-offs were determined separately for each gender and race group. The second selection method involved using the taxometric method of maximum covariate analysis (MAXCOV-HITMAX, Waller & Meehl, 1998). Individuals with Bayesian probabilities greater than or equal to 0.50 were

assigned to the social anhedonia taxon group (e.g., Blanchard et al., 2000; Horan et al., 2004). This method identified an additional 8 (16.7%) social anhedonics not already identified using the standard deviation cut-off.

The control group consisted of forty 18- to 19- year-olds without elevated scores on the SocAnh Scale. These participants had scores less than 0.50 standard deviations (determined separately for each gender and race group) above the SocAnh Scale mean (e.g., Chapman et al., 1994; Gooding et al., 2005; Kwapil, 1998) and Bayesian probabilities of being in the social anhedonia taxon below 0.50. An additional inclusion criterion specified that control participants not score higher than 0.50 standard deviations above the mean on the PerAb or MagicID Scales of psychosis proneness. A validity scale, the Infrequency Scale, was intermixed with the screening questionnaire, and individuals who endorsed three or more items in the unexpected direction were excluded from the study (Chapman et al., 1976). Given previous findings that white participants tend to score lower than minority groups on the SocAnh Scale and that men tend to score higher than women on the SocAnh Scale (Chmielewski et al., 1995; Kelley & Coursey, 1992), the MLSS attempted to match available control participants to the SocAnh group on gender and race in an effort to control for these potential sources of error through experimental design, rather than through statistical analyses. No significant differences between the social anhedonia and control groups were found for level of education ($\chi^2(2, N = 88) = 5.14, p > .05$), gender ($\chi^2(1, N = 88) = 1.47, p > .05$), or race ($\chi^2(2, N = 88) = 3.75, p > .05$), and the sample was ethnically diverse (see Table 3).

Table 3: *Demographic Characteristics of Social Anhedonics and Controls*

	Social Anhedonics (<u>N</u> =48) <u>N</u> (%)	Controls (<u>N</u> =40) <u>N</u> (%)
<u>Gender</u>		
Female	29 (60.4)	19 (47.5)
Male	19 (39.6)	21 (52.5)
<u>Ethnicity</u>		
White	24 (50.0)	24 (60.0)
Black	20 (41.7)	16 (40.0)
Hispanic	4 (8.3)	0 (0.0)
Other	0 (0.0)	0 (0.0)
<u>Level of Education</u>		
Grade 7-12 but not Graduating	1 (2.1)	0 (0.0)
Graduated High School or GED	13 (27.1)	4 (10.0)
Part College	34 (70.8)	46 (90.0)

Behavioral sign ratings were made for all biological parents who agreed to participate in the MLSS and had ratable videotaped interactions. Seventy-nine mothers of the proband group (42 mothers of social anhedonics; 37 mothers of controls) and 44 fathers of the proband group (24 fathers of social anhedonics; 20 fathers of controls) were rated on behavioral signs of schizoidia and schizotypy.

Participants assigned to the social anhedonia or control groups and their biological parents were contacted and invited to participate in the MLSS. Participation in the study involved completion of several questionnaires, a diagnostic interview, a computerized test of attention, and several tests of memory and cognitive ability. The length of the assessment typically ranged from 2 ½ to 4 ½ hours. Participants were asked

to refrain from the use of alcohol and drugs in the 24 hours preceding their appointment. Written and oral consent was obtained when participants arrived at the site of the study. Participants were informed in the consent form that the interview section of their session would be videotaped using an unconcealed camera. Additionally, the interviewer reiterated this information orally.

Debriefing

Following completion of the study tasks, advanced doctoral students in clinical psychology who conducted the assessments fully debriefed participants. The nature of the study was described as an examination of the relationship between certain psychological traits and a person's social and psychological functioning as well as how certain traits may run in families. Participants were informed that they were selected based on their responses (or their child's responses) to the screening questionnaire and that while individuals with a range of responses were selected, the interviewer did not know how they (or their child) responded, as it was important that their interaction not be influenced by information other than what was shared during the interview. Relevant Axis I diagnostic feedback based on the SCID-I was relayed as a tentative diagnosis based on minimal assessment and requiring further evaluation. When a psychotic diagnosis was made and the participant was not currently in treatment, the primary investigator was contacted and was involved in sharing diagnostic and referral information with the participant. This information included a description of the diagnostic term, symptoms that characterize the disorder, general information regarding the disorder, and specific information regarding appropriate treatment referrals. Relevant Axis II diagnostic feedback based on the IPDE was relayed as characteristics consistent

with a (schizoid, schizotypal, or paranoid) personality organization that may warrant treatment if the participant were experiencing distress or dysfunction associated with the personality characteristics. When an Axis I or Axis II diagnosis was made or clinically-relevant symptomatology or distress was present and the participant was not currently in treatment, referrals for local mental health services were provided and participants were encouraged to contact the research team should they need further assistance obtaining services. Participants received \$100 for their participation.

Procedures and Measures

Assessment of Social Anhedonia: The Revised Social Anhedonia Scale (SocAnh Scale; Eckblad et al., 1982) was administered in the MLSS as part of the initial screening questionnaire completed by all probands. The SocAnh Scale is a 40-item true-false self-report questionnaire designed to assess decreased pleasure from interpersonal sources (see Appendix 1). Examples of items include “If given the choice, I would much rather be with others than be alone” (keyed false) and “Just being with friends can make me feel really good” (keyed false).

Findings that high scores on the SocAnh Scale are related to interview-based reports of current social withdrawal and isolation (but not loneliness) and reports of less enjoyment from and need for social contact support the construct validity of the SocAnh Scale (Mishlove & Chapman, 1985). Furthermore, taxometric procedures have been used to show that a low base rate taxon of extreme high scorers approximating 0.10 exists for the SocAnh Scale (Blanchard et al., 2000; Horan et al., 2004). These findings are consistent with Meehl’s (1962, 1989) conjecture of a latent class of individuals predisposed to developing schizophrenia. The SocAnh Scale has demonstrated good

internal consistency reliability, with coefficient alphas between 0.79 and 0.84 (Blanchard et al., 1998; Mishlove & Chapman, 1985). Additionally, the SocAnh Scale has been shown to have high test-retest reliability over 90-day and 1-year periods with stability coefficients between 0.69 and 0.79 (Blanchard et al., 2001; Blanchard et al., 1998).

The SocAnh Scale has also been shown to be a promising measure of schizotypy. Individuals with schizophrenia report elevated levels of social anhedonia (Blanchard et al., 1998; Chapman et al., 1976). Family members of individuals with schizophrenia also show elevated levels of social anhedonia (Katsanis et al., 1990; Kendler et al., 1996). Schizophrenia-spectrum dimensional scores have been shown to be elevated in social anhedonic individuals in both cross-sectional studies (Brown, Blanchard & Horan, 1998; Blanchard et al., 2005) and longitudinal studies (Gooding et al., 2005; Kwapil, 1998). In the present study, individuals identified as high-scorers on the SocAnh Scale served as a putative schizotype group for comparison against normal controls.

The Infrequency Scale was designed by the Chapmans for use with the anhedonia scales (Chapman et al., 1976). It was modeled after Jackson's (1974) Infrequency Scale used with his Personality Research Form. For the MLSS, the Infrequency Scale was intermixed with the SocAnh Scale as part of the initial screening survey for the purpose of identifying invalid responses. This scale is composed of items that are almost universally answered in one direction. An example of an item from this 13-item scale is "I have never combed my hair before going out in the morning" (keyed true) (see Appendix 2). Individuals who endorsed three or more items in the unexpected direction were excluded from the MLSS due to evidence that this criterion suggests invalid responding in general (Chapman et al., 1976).

Assessment of Perceptual Aberrations and Magical Ideation: The Perceptual Aberrations Scale (PerAb Scale; Chapman et al., 1978) and Magical Ideation Scale (MagicID Scale; Eckblad & Chapman, 1983) are measures of psychosis proneness that were used in the MLSS as screening measures. Probands whose scores fell less than 0.5 standard deviations (determined separately for each gender and race group) above the mean on the SocAnh, PerAb, and MagicID Scales were selected as the control group in an effort to identify a group of individuals believed to have low risk for developing psychosis. The PerAb Scale is a 35-item true-false measure of distortions in the perception of one's own body and the environment (see Appendix 3). Examples of items include "I have felt that my body and another person's body were one and the same" (keyed true) and "Now and then when I look in the mirror my face seems quite different than usual" (keyed true). The MagicID Scale is a 30-item true-false scale measuring beliefs about causation that deviate from the norm (see Appendix 4). Examples of items include "I have sometimes felt that strangers were reading my mind" (keyed true) and "Good luck charms don't work" (keyed false). Individuals with schizophrenia show elevations on these measures, which supports their construct validity (Chapman et al., 1978; Laurent et al., 2000). As discussed earlier, high-scorers on the PerAb Scale, MagicID Scale, or both have been shown to have more psychosis (both mood and non-mood related), more psychotic-like experiences, higher schizotypal dimensional scores, and more psychotic relatives than control participants (Chapman et al., 1994). The PerAb and MagicID Scales have thus demonstrated utility in the prediction of general psychosis and do not appear to be specific to the prediction of schizophrenia (Chapman et al.,

1994). Additionally, the PerAb and MagicID Scales have been shown to have good convergent and discriminant validity (Bailey, West, Widiger & Freiman, 1993).

Assessment of Axis I Disorders: Participants were not screened for diagnostic status prior to inclusion in the MLSS. As part of the study, psychiatric diagnoses for probands and their parents were determined using the Structured Clinical Interview for DSM-IV Axis I Disorders, Patient Edition – Research Version (SCID-I, First et al., 1996). The SCID-I is a semi-structured interview that has been widely used in studies of psychosis proneness (e.g., Asarnow et al., 2001; Gooding & Tallent, 2001; Gooding et al., 2005) and provides thorough coverage of current psychiatric disorders and past psychiatric history. The SCID-I begins with an overview section followed by nine diagnostic modules. Modules assessing mood disorders, psychotic disorders, and substance use disorders were included in the MLSS. For the MLSS, consensus Axis I diagnoses were obtained following evaluation of videotaped interviews by an independent rater and a team discussion of all available diagnostic information (for a full discussion, see Blanchard et al., 2005). The SCID-I also contains a 100-point scale called the Global Assessment of Functioning (GAF, see Appendix 5) Scale which rates the lowest level of an individual's functioning in the areas of psychological health, social functioning, and occupational functioning within the past month. The present study used GAF ratings to examine hypothesis 7, the correspondence between behavioral sign ratings and global functioning, in an effort to explore the external validity of behavioral sign findings. Inter-rater reliability has been demonstrated using previous versions of the SCID, with kappas greater than 0.60 (Williams et al., 1992). For the MLSS, SCID-I interviews were conducted by advanced doctoral students in clinical psychology who did

not have access to information regarding group status (social anhedonic vs. control) and were trained by a Ph.D. level clinician with extensive research experience (see Blanchard et al., 2005 for SCID-I results for the complete MLSS sample).

Assessment of Symptoms of Schizotypy: The International Personality Disorder Examination (IPDE, Loranger et al., 1995) is a semi-structured interview for the assessment of Axis II disorders. The IPDE is a modified version of the Personality Disorder Examination (PDE), which yields both DSM-IV categorical diagnoses and dimensional ratings of personality disorders in addition to ratings according to the *International Statistical Classification of Diseases and Related Health Problems* (ICD-10, World Health Organization, 1992). One reason for its frequent use is the flexibility researchers have to administer specific personality disorder modules related to their research goals (Loranger et al., 1994). The IPDE was administered to probands and their parents as part of the MLSS to assess schizoid, schizotypal, and paranoid personality disorders, reflecting the schizophrenia-spectrum personality disorders. As with Axis I diagnoses, consensus ratings for IPDE assessments as part of the MLSS were obtained following evaluation of videotaped interviews by an independent rater and a team discussion of all available diagnostic information (for a full discussion, see Blanchard et al., 2005).

Schizophrenia-spectrum characteristics, both signs and symptoms, are rated on a three-point scale as either not present, present but of uncertain clinical significance, or present and obviously clinically significant. The schizophrenia-spectrum personality disorder sections assess unusual thinking or beliefs, unusual perceptual experiences, suspicious or paranoid ideation, inappropriate or constricted affect, odd or eccentric

behavior or appearance, impaired social relationships, and social anxiety. IPDE ratings were made by the same advanced doctoral students in clinical psychology who conducted the SCID-I interviews. A number of studies have used the IPDE for the assessment of schizophrenia-spectrum disorders in putatively psychosis-prone individuals (e.g., Blanchard & Brown, 1999; Brown et al., 1998; Chapman et al., 1994). The IPDE has demonstrated inter-rater reliability with an overall kappa of 0.57 for the revised third edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM III-R, American Psychiatric Association, 1987) and 0.65 for the ICD-10.

The schizophrenia-spectrum modules of the IPDE incorporate behavioral observation through 5 items involved in the assessment of schizoid and schizotypal personality disorders. These items consist of ratings of “odd thinking and speech,” “odd behavior and appearance,” “emotional coldness, detachment, or flattened affectivity,” “inappropriate or constricted affect,” and “suspiciousness or paranoid ideation.” The last item is rated based on a combination of symptom report and behavioral observation. With respect to findings from Kendler et al. (1995), the IPDE fails to assess five (poor rapport, guardedness, general lack of motivation, occupational functioning below expected, and anxiety) of the nine schizotypal signs shown to identify familial risk for schizophrenia using the SIS. Additionally, the IPDE groups several behaviors under individual items, whereas other measures of schizotypy (e.g., IM-SS-R, Kosson et al., 2004; SIS, Kendler, 1988b) distinguish between these behaviors, thereby giving more weight to each specific behavior. In consideration of Kendler et al.’s (1995) findings that behavioral sign ratings are more powerful than symptom ratings at detecting schizotypal traits in relatives of individuals with schizophrenia, the IPDE may inadequately assess the

behavioral signs of schizotypy. Given its minimal inclusion of behavioral sign items, the IPDE was conceptualized in the present study primarily as a measure of self-reported clinical symptoms of schizophrenia-spectrum disorders. It is important to note that most analyses conducted herein (except where otherwise noted) utilize the IPDE scales in their entirety (symptoms and signs) as a more stringent comparison for IM-SS-R behavioral ratings.

Individuals with high scores on the SocAnh Scale have demonstrated elevated frequency of schizophrenia-spectrum personality disorders, as measured by the PDE (Kwapil, 1998) and the IPDE (Blanchard et al., 2005). In the present study, the social anhedonia group and their biological parents were expected to score higher than the control group and their biological parents on all three schizophrenia-spectrum personality dimensions. IPDE scores were evaluated against IM-SS-R ratings to investigate hypotheses 5 and 6: the incremental validity of behavioral sign ratings for probands and their parents.

Assessment of Signs of Schizotypy: The Interpersonal Measure of Schizoidia and Schizotypy (IM-SS, Kosson et al., 1999) is a coding system for behavioral signs characteristic of schizoid and schizotypal personality disorders. It was developed under the premise that increased attention to interpersonal interactions can improve the diagnosis of schizoid and schizotypal personality disorders (Kosson & Byrnes, 1999). Two assumptions underlie use of the IM-SS: mental health professionals are trained to observe human behavior and schizophrenia-spectrum traits are evident in behavior exhibited during interpersonal interactions. No direct questions are included in the IM-SS; ratings are based almost entirely on observation of interpersonal behavior following

either a semi-structured interview or unstructured professional interaction of sufficient duration. Recently the test developers consulted with other researchers using the IM-SS and revised the measure (IM-SS-R, Kosson et al., 2004), primarily focusing on increasing the quantity and breadth of schizotypal signs assessed by the measure. The revised measure was used in the present study to examine hypotheses 1-4: behavioral signs characteristic of schizoid and schizotypal personality disorders in probands and their biological parents.

While the validity of the IM-SS-R has not yet been examined, two studies have examined the original IM-SS. In a sample of inmates and a sample of mentally disordered offenders, Kosson et al. (2005) examined the Schizoidia Scale from the original IM-SS and found it to be reliable and to correlate with other measures of schizoid personality disorder. Using both the Schizoidia and Schizotypy Scales from the original IM-SS in a social anhedonic sample, Collins et al. (2005) found satisfactory internal consistency (with coefficient alphas of .82 for the IM-SS Schizoidia Scale and .59 for the IM-SS Schizotypy Scale) and inter-rater reliability (with ICCs of .91 for the IM-SS Schizoidia Scale and .44 for the IM-SS Schizotypy Scale) for the measure. Social anhedonics were found to display atypical behaviors characteristic of schizoid and schizotypal personality disorders. Additionally, schizoid behavioral characteristics were found to contribute to the identification of putative schizotypes beyond traditional clinical symptom ratings. These findings support the validity of the IM-SS and the utility of the measure in the identification of schizotypes.

The IM-SS-R includes two subscales with dimensional scores of schizophrenia-spectrum behaviors. The Schizoidia Scale of the IM-SS-R contains 12 items representing

characteristics of schizoid personality disorder, such as “constricted facial affect” and “detachment (lack of engagement)”. The Schizotypy Scale of the IM-SS-R contains 18 items assessing characteristics of schizotypal personality disorder, including “repetitive behavior” and “odd speech volume or rate or tone.” Although a subscale specific to paranoid personality disorder is not incorporated in the IM-SS-R, characteristics of this disorder are included in the Schizoidia and Schizotypy Scales (i.e., “guardedness” from the IM-SS-R Schizoidia Scale and “suspiciousness/paranoid behavior” from the IM-SS-R Schizotypy Scale). IM-SS-R ratings are based on the typicality (frequency) and extremity of specific kinds of interactions and non-verbal behaviors observed over the course of a single session. The IM-SS-R is scored based on a four-point ordinal scale rating how well each item characterizes an individual. An item may characterize an individual not at all, somewhat, very well, or perfectly (highly), and ratings were coded as scores of 0, 1, 2, or 3 in the present study. Examples of behaviors representative of an item are listed below each item. For example, below the “lack of non-verbal expression” item is a list of three behaviors that may represent this trait manifestation, including “very little head/body movement,” “frozen posture,” and “few expressive hand/arm gestures.” The rater may check examples that apply to the individual or make note of other manifestations of the overarching trait.

For the purpose of this study, seven IM-SS-R items were not relevant and were thus excluded from the ratings. Six items were excluded from the IM-SS-R Schizotypy Scale because the present study utilized the IM-SS-R exclusively for ratings of behavioral characteristics of schizotypy and these items are not purely sign items; IM-SS-R Schizotypy Scale items 13 (“displays signs of experiencing auditory hallucinations or

illusions”), 14 (“displays signs of experiencing visual hallucinations or illusions”), 15 (“spontaneously expresses referential ideation”), 16 (“spontaneously expresses ideation about thought transmission - other than via decoding non-verbal cues or via persuasion”), 17 (“spontaneously expresses ideation about being controlled or controlling others - other than via thoughts or via persuasion or via other plausible channels”), and 18 (“spontaneously expresses paranoid/persecutory ideation”) are redundant with IPDE symptom ratings and thus conceptually inconsistent with use of the IM-SS-R in this study. One item was excluded from the IM-SS-R Schizoidia Scale because the selected portions of the videotapes on which IM-SS-R ratings were based did not include necessary information; for item 11 on the IM-SS-R Schizoidia Scale (“lack of interpersonal synchrony”), the videotapes from the MLSS did not address behaviors such as “lack of convergence with the interviewer’s actions at close of interview.” Thus, the version of the IM-SS-R used in the present study consisted of 11 IM-SS-R Schizoidia Scale items and 12 IM-SS-R Schizotypy Scale items (see Appendix 6).

The developers of the IM-SS advise that ratings be made within the same day as the encounter with the individual on which they are based (Kosson & Byrnes, 1999). The authors specifically note that IM-SS ratings based on videotaped sessions should be completed immediately following the viewing of the videotaped session. In the present study, interpersonal behavior was assessed using videotapes of interviews conducted as part of the MLSS. Raters viewed the overview section of the SCID-I and the IPDE. These measures were selected based on suggestions by the IM-SS developers that ratings be based on partially standardized interactions (Kosson & Byrnes, 1999). Additionally, use of these two measures allowed raters to compare behavior during the beginning of the

interview (SCID-I overview) to behavior later in the session (IPDE), which is relevant to item 7 on the IM-SS-R Schizoidia Scale (“lack of variability in affect/expression over time”). The overview section of the SCID-I provides open and closed questions that gather background information and allow the interviewer to establish rapport with the interviewee before inquiring about more detailed diagnostic symptoms. Information on demographics, work history, medical history, psychiatric history, current stressors, substance use, and the interviewee’s report of current and past problems is obtained during the overview. The IPDE also provides open and closed questions that assess characteristics of schizophrenia-spectrum personality disorders. Because IM-SS-R ratings were based on observation of general interpersonal interactions taking place in a professional setting, the results are presumed to generalize to many different settings. A 30-minute cut-off was imposed to ensure that participant ratings were based on equivalent amounts of observed behavior (length of interview observed by raters: \underline{M} =27.23, \underline{SD} =4.17 for probands; \underline{M} =26.42, \underline{SD} =4.40 for mothers; \underline{M} =26.98, \underline{SD} =4.00 for fathers).

In an effort to minimize the effect of individual rater error, IM-SS-R ratings for each participant consist of an average rating between two raters. This procedure was implemented without regard to observed rater discrepancies because no standard exists for evaluating rater accuracy and thus an average rating was presumed to be most appropriate.

Raters were two advanced doctoral students in clinical psychology and two advanced undergraduate students, none of whom had access to information regarding group status (social anhedonic vs. control) or diagnostic ratings (e.g., SCID-I and IPDE

ratings; with one exception, discussed next) to reduce the potential for expectancy bias. One of the IM-SS-R raters (the primary investigator) also administered SCID-I and IPDE interviews as part of the MLSS. In order to prevent differences in the length of participant interaction to which IM-SS-R raters were exposed, this rater did not rate interactions based on interviews which she originally conducted. There was one exception to this rule, wherein other raters were not available to rate the participant's interaction due to personal conflicts (i.e., the rater and participant were acquaintances) and thus, one of the two IM-SS-R ratings for this participant was conducted by the original interviewer. However, the time interval between the original interview and IM-SS-R ratings was over one and a half years and previous exposure to the participant is not believed to have affected IM-SS-R ratings.

Rater training was conducted by the primary investigator. Training began with a review of schizophrenia-spectrum personality disorders and a discussion of the differentiation between self-report symptoms and behavioral signs, followed by an analysis of IM-SS-R content and the study procedures. Agreement between the raters was established during the training period using videotaped interviews of participants from the MLSS not eligible for the present study (i.e., neither parent participated in the study). Ratings were based on observation of the same type of interviews that were used in the present study (the overview section of the SCID-I and the IPDE). During this training period, raters began by discussing how to make ratings, using examples from the training tapes (approximately 20 tapes), and discussion of their individual ratings continued until disparities were minimized. Once inter-rater reliability was established, the raters began to rate tapes for the present study. The raters rated tapes for all

participants independently. Frequent checks of their agreement were conducted to prevent rater drift. Following conclusion of the study, intra-class correlations (ICCs; Shrout & Fleiss, 1979) were calculated to measure the agreement and consistency between the raters (see results section).

Although raters were exposed to each participant's responses to IPDE questions, this information was not expected to bias ratings, as raters were blind to group status (social anhedonic vs. control) and final diagnostic ratings (except in the one case discussed above). IM-SS-R item content is concrete (e.g., eye contact) and does not permit ratings of symptomatology. Furthermore, the finding by Collins et al. (2005) that controlling for IPDE symptom ratings did not eliminate the contribution of IM-SS ratings of schizoid behaviors in the differentiation of social anhedonics from controls suggests that ratings were not influenced by exposure to patient report of symptomatology. To further explore the possibility of exposure to symptom ratings affecting IM-SS-R behavioral ratings, a subsample ($N=22$, 25%) of randomly selected proband interactions were rated a second time without sound. As is the case for the sound-on ratings, sound-off IM-SS-R ratings for each participant consist of an average rating between two raters. Sound-off ratings were made by two of the four raters who made sound-on IM-SS-R ratings. For 68% of the participants having sound-off IM-SS-R ratings, at least one of the two raters had no prior exposure to the participant interaction. IM-SS-R items for which representative behaviors do not rely on any verbalizations were included in this examination. From the IM-SS-R Schizoidia Scale, four items were rated without sound: "constricted facial affect," "lack of non-verbal expression," "detachment (lack of engagement)," and "lack of variability in affect/expression over time." From the IM-SS-

R Schizotypy Scale, three items were rated without sound: “guarded posture,” “odd behavior (other than repetitive behavior),” and “odd or disorganized appearance.” Following the conclusion of the study, the relationship between sound-on and sound-off ratings for the 4-item IM-SS-R Schizoidia Scale and the 3-item IM-SS-R Schizotypy Scale was examined (see results section).

Family Member Report of Schizophrenia-Spectrum Personality Disorders: The Family Interview for Genetic Studies (FIGS, Maxwell, 1992) was administered to probands and their parents as part of the MLSS. The FIGS is a measure designed specifically for use in family genetic studies on schizophrenia and bipolar disorder for the purpose of gathering information on family members who are unable to participate in a given research study. The FIGS contains general screening questions and symptom checklists for Axis I and Axis II disorders. In the MLSS, checklists for depression, mania, psychosis, alcohol and drug abuse, and schizophrenia-spectrum personality disorders (schizoid, schizotypal, and paranoid) were administered to probands (asking about their biological mother and father), to mothers (asking about the proband and the proband’s father), and to fathers (asking about the proband and the proband’s mother). FIGS ratings were made by the same advanced doctoral students in clinical psychology who conducted the SCID-I and IPDE interviews.

A number of studies have used the FIGS (Chen, Hu & Lin, 2004; Edmonds, Mosley & Admiraal, 1998; Gershon & Guroff, 1984; Gershon et al., 1982; Grigoriu-Serbanescu, Nothen & Propping, 1995; Hambrecht & Hafner, 1997; Li et al., 1997; Rende & Weissman, 1999; Slama, Bellivier & Henry, 2004; Somanath, Jain & Reddy, 2002; Somanath, Reddy & Jain, 2002; Stone, Faraone & Seidman, 2001; Tsuang et al.,

2000; Weissman et al., 1986). However, a thorough examination of the validity and reliability of the measure has not yet been conducted. Reliability data is available for the measure on which the FIGS is based, the Diagnostic Interview for Genetic Studies (DIGS; Nurnberger et al., 1994), which was developed specifically for the assessment of major mood and psychotic disorders and their spectrum conditions. The DIGS has been shown to be a reliable and specific diagnostic instrument with test-retest kappas above 0.72 for the majority of disorders (κ less than 0.5 for schizoaffective disorder; Faraone et al., 1996; Nurnberger et al., 1994).

When diagnostic assessments and the FIGS are completed by both probands and their parents, the FIGS allows for the opportunity to compare self-report and familial report of psychopathology and to make best-estimate diagnoses. The present study used FIGS ratings to examine hypothesis 7, the correspondence between behavioral sign ratings and family member report of interpersonal behavior, in an effort to explore the external validity of behavioral sign findings. That is, can results based on a 30-minute sample of behavior be generalized to behavior outside of the research context (as reported by family members)? Four FIGS items represent pure behavioral sign items and could thus be included in this examination: “constricted affect, aloof, cold, rarely reciprocates gestures or expressions” from the schizoid personality disorder section and “odd, eccentric, peculiar behavior or appearance,” “odd speech (without loosened associations or incoherence),” and “inappropriate or constricted affect (e.g., silly or aloof)” from the schizotypal personality disorder section (see results section).

Chapter 6: Results

Overview

The present study sought to replicate findings of elevated levels of schizoid and schizotypal behavioral signs in social anhedonics (Collins et al., 2005) using the IM-SS-R. In addition, schizophrenia-spectrum behaviors were assessed in the biological parents of social anhedonics to determine whether first-degree relatives of social anhedonics display the same pattern of atypical interpersonal behavior. First, the reliability of the IM-SS-R was evaluated. Second, group differences on schizoid and schizotypal behaviors were examined between social anhedonics and controls as well as between their respective biological parents. Third, within-family correspondence on schizophrenia-spectrum behaviors was examined. Fourth, the utility of behavioral signs was evaluated through an assessment of the incremental validity of behavioral sign ratings over clinical symptom ratings for the proband and parent groups. Fifth, the external validity of behavioral sign ratings of schizoidia and schizotypy was examined through the relationship between IM-SS-R ratings and family member report of schizophrenia-spectrum behaviors as well as the relationship between IM-SS-R ratings and global functioning.

Is the IM-SS-R a Reliable Measure?

IM-SS-R Inter-rater Reliability: It was predicted that the IM-SS-R can be used reliably to measure behavioral signs of schizoid and schizotypal personality disorders in social anhedonics and controls as well as their biological mothers and fathers. In an effort to minimize the effect of individual rater error, IM-SS-R ratings for each participant consist of an average rating between two raters. Intra-class correlations (ICC)

type (3, 2) were used as an index of consistency to evaluate the reliability of generalization from a single rating to a mean rating using a fixed number of raters when each rater rated each participant (Shrout & Fleiss, 1979).

One rater was only responsible for rating 6 interactions. With so few cases, ICCs for the inter-rater reliability between this rater and the remaining three raters did not produce meaningful results. Thus, the following analyses represent the remaining three raters, each of whom rated approximately the same number of interactions. For the IM-SS-R Schizoidia Scale, ICCs indicated good inter-rater reliability for probands (ICC=0.86), mothers (ICC=0.73), and fathers (ICC=0.93), with an average IM-SS-R Schizoidia Scale ICC across all participants of 0.84. For the IM-SS-R Schizotypy Scale, ICCs indicated moderate inter-rater reliability for probands (ICC=0.71), mothers (ICC=0.52), and fathers (ICC=0.74), with an average IM-SS-R Schizotypy Scale ICC across all participants of 0.65. Thus, while inter-rater reliability was acceptable across both IM-SS-R scales, ICCs were higher for the IM-SS-R Schizoidia Scale than the IM-SS-R Schizotypy Scale and for probands and fathers compared to mothers.

IM-SS-R Internal Consistency: Cronbach's alpha was used as a measure of internal consistency based on average inter-item correlations to determine how well the IM-SS-R scale items hang together with the scale to which they are assigned (Schizoidia or Schizotypy) for the purpose of measuring a single unidimensional latent construct. Median internal consistencies for the IM-SS-R Schizoidia Scale indicated satisfactory reliability for proband ($\alpha=0.86$), mother ($\alpha=0.74$), and father ($\alpha=0.83$) ratings. For the IM-SS-R Schizotypy Scale, alpha coefficients for proband ($\alpha=0.66$), mother ($\alpha=0.40$), and father ($\alpha=0.35$) ratings were in the moderate range. This finding could be due to low

endorsement of scale items resulting in a truncated range of the IM-SS-R Schizotypy Scale. As evidence of this possible explanation, dimensional ratings using the IM-SS-R Schizoidia Scale resulted in a greater range (0-16) than dimensional ratings using the IM-SS-R Schizotypy Scale (0-7). Additionally, the lower alpha for mothers and fathers may reflect that the parent groups had a narrower range (0-3.5) of IM-SS-R Schizotypy Scale scores than the proband group (0-7). Alternatively, the IM-SS-R Schizoidia Scale may not assess a unitary concept, but rather different dimensions of behaviors characteristic of schizotypal personality disorder.

Relationship between IM-SS-R Sound-on and Sound-off Ratings: Pearson's product-moment correlations (r) were used to examine the relationship between sound-on and sound-off ratings for a random sample of proband interactions ($N=22$, 25%). Two of the four IM-SS-R raters made sound-off ratings, and each participant's sound-off IM-SS-R ratings consist of an average rating between the two raters. Using IM-SS-R items that do not rely on any verbalizations, a strong relationship was observed between sound-on and sound-off ratings for the 4-item IM-SS-R Schizoidia Scale ($r=.90$, $p<.01$) and 3-item IM-SS-R Schizotypy Scale ($r=.99$, $p<.01$). These results suggest that exposure to participants' responses to IPDE questions had little or no effect on IM-SS-R ratings.

Does the IM-SS-R Differentiate Putative Schizotypes From Controls?

The proband social anhedonia group was predicted to have significantly elevated dimensional scores on the IM-SS-R Schizoidia and Schizotypy Scales compared to the proband control group, indicating more severe schizotypal features. Informed by findings from Collins et al. (2005) using the original IM-SS, IM-SS-R Schizoidia Sale

ratings were predicted to be higher for males than for females. A series of univariate analyses of variance (ANOVAs) on the IM-SS-R Schizoidia and IM-SS-R Schizotypy Scales were used to examine hypotheses regarding elevated schizoid and schizotypal behaviors in social anhedonics by proband gender. Significant group findings on proband dimensional scores from the IM-SS-R scales were followed by exploratory multivariate analyses of variance (MANOVAs) in order to determine which IM-SS-R items contributed to the group differentiation.

The ANOVA on the IM-SS-R Schizoidia Scale for probands resulted in a significant main effect for group ($F(1, 84) = 9.11, p < .01$), with social anhedonics rated higher than controls, but there was no main effect for gender ($F(1, 84) = 0.00, p > .05$) nor a group by gender interaction ($F(1, 84) = 0.19, p > .05$) (see Table 4). This group difference on IM-SS-R Schizoidia Scale ratings represents a medium effect size ($d = 0.69$) (Cohen, 1988). The effect size for gender on IM-SS-R Schizoidia Scale ratings was non-significant ($d = .09$). The MANOVA with 11 IM-SS-R Schizoidia Scale items revealed an overall significant difference among the proband groups ($F(11, 76) = 6.27, p < .01$). Post-hoc one-way ANOVAs showed significant differences on five IM-SS-R Schizoidia Scale items: “constricted facial affect” ($F(1, 86) = 14.70, p < .01$), “lack of non-verbal expression” ($F(1, 86) = 8.19, p < .01$), “lack of verbal expression” ($F(1, 86) = 6.21, p < .05$), “lack of variability in affect/expression over time” ($F(1, 86) = 8.82, p < .01$), and “physical anergia” ($F(1, 86) = 3.98, p < .05$) (see Table 5).

The ANOVA on the IM-SS-R Schizotypy Scale for probands resulted in a significant main effect for group ($F(1, 84) = 5.26, p < .05$), with social anhedonics rated

Table 4: *Group Differences between Social Anhedonics and Controls on the IM-SS-R by Gender*

	Social Anhedonics (N=48) <u>M (SD)</u>	Controls (N=40) <u>M (SD)</u>
<u>Schizoidia Scale</u>		
Females	3.22 (3.18)	1.11 (1.58)
Males	2.95 (3.95)	1.36 (1.85)
<u>Schizotypy Scale</u>		
Females	0.45 (0.60)	0.32 (0.82)
Males	1.26 (2.21)	0.24 (0.44)

Note. IM-SS-R = Interpersonal Measure of Schizoidia and Schizotypy, Revised.

higher than controls, but there was no main effect for gender ($F(1, 84) = 2.13, p > .05$) nor a group by gender interaction ($F(1, 84) = 3.13, p > .05$) (see Table 4). This group difference on IM-SS-R Schizotypy Scale ratings represents a small effect size ($d = 0.43$). The effect size for gender on IM-SS-R Schizotypy Scale ratings was small ($d = .26$). The MANOVA with 12 IM-SS-R Schizotypy Scale items revealed an overall significant difference among the proband groups ($F(11, 76) = 2.23, p < .05$). Post-hoc one-way ANOVAs showed a significant difference on one IM-SS-R Schizotypy Scale item: “odd speech volume or rate or tone” ($F(1, 86) = 7.11, p < .01$) (see Table 5).^{1, 2}

Table 5: Group Differences between Social Anhedonics and Controls by IM-SS-R Items

	Social Anhedonics (N=48) M (SD)	Controls (N=40) M (SD)	F
<u>Schizoidia Scale</u>			
1. Constricted Facial Affect	0.65 (0.64)	0.20 (0.39)	14.70**
2. Lack of Non-Verbal Expression	0.77 (0.82)	0.35 (0.47)	8.19**
3. Detachment (Lack of Engagement)	0.28 (0.56)	0.23 (0.48)	0.25
4. Lack of Verbal Expression	0.52 (0.68)	0.23 (0.36)	6.21*
5. Indifference (Lack of Interest)	0.08 (0.28)	0.01 (0.08)	2.41
6. Guardedness	0.10 (0.34)	0.06 (0.20)	0.46
7. Lack of Variability in Affect/ Expression Over Time	0.24 (0.41)	0.04 (0.13)	8.82**
8. Poor Rapport	0.17 (0.36)	0.05 (0.15)	3.61
9. Absence of Spontaneity in Speech	0.03 (0.16)	0.00 (0.00)	1.52
10. Lack of Verbal Responsiveness to Interviewer's Remarks	0.05 (0.15)	0.01 (0.08)	2.16
12. Physical Anergia	0.24 (0.48)	0.08 (0.21)	3.98*
<u>Schizotypy Scale</u>			
1. Inappropriate Affect	0.00 (0.00)	0.01 (0.08)	1.20
2. Suspicious/Paranoid Behavior	0.00 (0.00)	0.01 (0.08)	1.20
3. Guarded Posture	0.02 (0.10)	0.04 (0.24)	0.20
4. Speech Disorganized or Difficult to Understand	0.03 (0.12)	0.00 (0.00)	2.61
5. Tends to be Tangential	0.09 (0.29)	0.04 (0.18)	1.18
6. Unusual or Odd Speech (Other Than Disorganized Speech)	0.01 (0.07)	0.01 (0.08)	0.02
7. Odd Speech Volume or Rate or Tone	0.27 (0.47)	0.05 (0.25)	7.11**
8. Excessive Use of Gestures to Accentuate or Qualify Speech	0.00 (0.00)	0.00 (0.00)	0.00
9. Repetitive Behavior	0.06 (0.37)	0.00 (0.00)	1.16
10. Odd Behavior (Other Than Repetitive Behavior)	0.16 (0.40)	0.04 (0.18)	3.02
11. Odd or Disorganized Appearance	0.03 (0.22)	0.04 (0.24)	0.02
12. Negative Reaction of Interviewer to Individual	0.09 (0.34)	0.04 (0.18)	0.91

Note. * $p < .05$, two-tailed, ** $p < .01$, two-tailed; IM-SS-R = Interpersonal Measure of Schizoidia and Schizotypy, Revised.

Does the IM-SS-R Differentiate Parents of Putative Schizotypes from Parents of Controls?

The biological parents of social anhedonics were predicted to display higher rates of schizophrenia-spectrum behaviors than the biological parents of controls, as has been shown for female and male probands using the original IM-SS (Collins et al., 2005), demonstrating a familial pattern of atypical interpersonal behavior. A series of one-way analyses of variance (ANOVAs) on the IM-SS-R Schizoidia Scale and IM-SS-R Schizotypy Scale were used to examine hypotheses regarding elevated schizoid and schizotypal behaviors in the biological parents of social anhedonics. Significant group findings on mother and father dimensional scores from the IM-SS-R scales were followed by exploratory multivariate analyses of variance (MANOVAs) in order to determine which IM-SS-R items best differentiated parents of social anhedonics from parents of controls.

¹ Because proband ratings on both the IM-SS-R Schizoidia Scale and IM-SS-R Schizotypy Scale were positively skewed, proband group comparison analyses were recomputed after applying a square root transformation to the data. ANOVA results remained unchanged, with social anhedonics rated higher than controls on both schizoid and schizotypal behaviors. Thus, proband analyses throughout were conducted using non-transformed data.

² One participant in the social anhedonia group was diagnosed with schizophrenia when he completed the MLSS diagnostic assessment. To examine the potential impact of this diagnosis on group comparison analyses, ANOVAs for both the IM-SS-R Schizoidia Scale and IM-SS-R Schizotypy Scale were recomputed excluding this participant. Group comparison results remained unchanged. Thus, analyses throughout were conducted including all 88 probands.

The ANOVA on the IM-SS-R Schizoidia Scale for mothers found no significant difference between mothers of social anhedonics and mothers of controls ($F(1, 77) = 0.24, p > .05$). Accordingly, an effect size below the “small effect size” cut-off of 0.20 ($d = 0.11$) was observed for group differences on mothers’ IM-SS-R Schizoidia Scale ratings. Due to the non-significant ANOVA for the IM-SS-R Schizoidia Scale, a MANOVA was not conducted for mothers’ IM-SS-R Schizoidia Scale items. The ANOVA on the IM-SS-R Schizotypy Scale for mothers found a significant difference, with mothers of social anhedonics rated higher than mothers of controls ($F(1, 77) = 4.19, p < .05$) (see Table 6). This group difference on mothers’ IM-SS-R Schizotypy Scale ratings represents a small effect size ($d = 0.46$). The MANOVA with 12 IM-SS-R Schizotypy Scale items revealed an overall significant difference among mothers of social anhedonics and mothers of controls ($F(10, 68) = 3.33, p < .01$). Post-hoc one-way ANOVAs showed a significant difference on one IM-SS-R Schizotypy Scale item: “tends to be tangential” ($F(1, 77) = 5.87, p < .05$) (see Table 7).

The ANOVA on the IM-SS-R Schizoidia Scale for fathers found no significant difference between fathers of social anhedonics and fathers of controls ($F(1, 42) = 2.84, p > .05$). However, a medium effect size ($d = 0.53$) was observed for group differences on fathers’ IM-SS-R Schizoidia Scale ratings. The ANOVA on the IM-SS-R Schizotypy Scale for fathers found no significant difference between fathers of social anhedonics and fathers of controls ($F(1, 42) = 1.15, p > .05$) (see Table 6). This group difference on fathers’ IM-SS-R Schizotypy Scale ratings represents a small effect size ($d = 0.33$). Due

to the non-significant ANOVAs for the IM-SS-R Schizoidia Scale and IM-SS-R Schizotypy Scale, MANOVAs were not conducted for fathers' IM-SS-R Schizoidia and IM-SS-R Schizotypy Scale items.³

Table 6: *Group Differences between Parents of Social Anhedonics and Parents of Controls on the IM-SS-R*

	Social Anhedonic Proband <u>M</u> (<u>SD</u>)	Control Proband <u>M</u> (<u>SD</u>)
<u>Mothers (N=79)</u>		
IM-SS-R Schizoidia Scale	1.50 (1.77)	1.30 (1.91)
IM-SS-R Schizotypy Scale	0.61 (0.78)	0.27 (0.67)*
<u>Fathers (N=44)</u>		
IM-SS-R Schizoidia Scale	2.13 (3.04)	0.88 (1.44)
IM-SS-R Schizotypy Scale	0.65 (0.87)	0.38 (0.79)

Note. * $p < .05$, two-tailed; IM-SS-R = Interpersonal Measure of Schizoidia and Schizotypy, Revised.

³ Because mother and father ratings on both the IM-SS-R Schizoidia Scale and IM-SS-R Schizotypy Scale were positively skewed, mother and father group comparison analyses were recomputed after applying a square root transformation to the data. ANOVA results remained unchanged, with mothers of social anhedonics rated higher than mothers of controls on schizotypal behaviors but no group differences between the mother groups on schizoid behaviors or between the father groups on schizoid or schizotypal behaviors. Thus, parent analyses throughout were conducted using non-transformed data.

Table 7: *Group Differences between Mothers of Social Anhedonics and Mothers of Controls by IM-SS-R Schizotypy Scale Items*

	Mothers of Social Anhedonics	Mothers of Controls	F
	(N=42) <u>M (SD)</u>	(N=37) <u>M (SD)</u>	
1. Inappropriate Affect	0.05 (0.15)	0.01 (0.08)	1.54
2. Suspicious/Paranoid Behavior	0.02 (0.11)	0.00 (0.00)	1.80
3. Guarded Posture	0.01 (0.08)	0.01 (0.08)	0.01
4. Speech Disorganized or Difficult to Understand	0.01 (0.08)	0.01 (0.08)	0.01
5. Tends to be Tangential	0.25 (0.50)	0.04 (0.18)	5.87*
6. Unusual or Odd Speech (Other Than Disorganized Speech)	0.01 (0.08)	0.00 (0.00)	0.88
7. Odd Speech Volume or Rate or Tone	0.13 (0.27)	0.10 (0.28)	0.34
8. Excessive Use of Gestures to Accentuate or Qualify Speech	0.00 (0.00)	0.00 (0.00)	0.00
9. Repetitive Behavior	0.02 (0.11)	0.00 (0.00)	1.80
10. Odd Behavior (Other Than Repetitive Behavior)	0.05 (0.15)	0.04 (0.25)	0.03
11. Odd or Disorganized Appearance	0.00 (0.00)	0.00 (0.00)	0.00
12. Negative Reaction of Interviewer to Individual	0.05 (0.19)	0.05 (0.20)	0.02

Note. * $p < .05$, two-tailed; IM-SS-R = Interpersonal Measure of Schizoidia and Schizotypy, Revised.

Do Behavioral Sign Ratings for Probands and Parents Correspond?

Pearson's product-moment correlations were used to examine within-family correspondence on dimensional ratings of schizoid and schizotypal behavioral characteristics, as measured by the IM-SS-R. It was predicted that behavioral sign ratings for social anhedonics and their biological mothers and fathers would be

significantly related, demonstrating within-family correspondence on atypical interpersonal behaviors. Exploratory analyses examined whether correspondence between probands and their mothers and fathers varied by proband gender. All correlational analyses were conducted collapsing across the social anhedonia and control groups.

For all proband-mother dyads ($N=79$), the relationship between proband IM-SS-R Schizoidia Scale dimensional ratings and mother IM-SS-R Schizoidia Scale dimensional ratings was non-significant ($r=.18, p>.05$). This same pattern was observed for the relationship between proband IM-SS-R Schizotypy Scale dimensional ratings and mother IM-SS-R Schizotypy Scale dimensional ratings ($r=.04, p>.05$). When female probands and their mothers ($N=46$) were examined, the relationship for the IM-SS-R Schizoidia Scale ($r=.20, p>.05$) and IM-SS-R Schizotypy Scale ($r=-.01, p>.05$) remained non-significant. Similarly, when male probands and their mothers ($N=33$) were examined, the relationship for the IM-SS-R Schizoidia Scale ($r=.11, p>.05$) and IM-SS-R Schizotypy Scale ($r=.04, p>.05$) was non-significant (see Table 8). Thus, dimensional ratings for both the IM-SS-R Schizoidia Scale and IM-SS-R Schizotypy Scale were not significantly related for either female or male probands and their mothers.

For all proband-father dyads ($N=44$), a significant relationship was observed between proband IM-SS-R Schizoidia Scale dimensional ratings and father IM-SS-R Schizoidia Scale dimensional ratings ($r=.36, p<.05$). The relationship between proband IM-SS-R Schizotypy Scale dimensional ratings and father IM-SS-R Schizotypy Scale dimensional ratings was non-significant ($r=-.10, p>.05$). A significant relationship was

Table 8: Relationship between Proband and Parent IM-SS-R Ratings

	Mother Schizoidia Scale (N=79) (r)	Mother Schizotypy Scale (N=79) (r)	Father Schizoidia Scale (N=44) (r)	Father Schizotypy Scale (N=44) (r)
<u>Proband Schizoidia Scale</u>				
Female ^a	.196	.270	.075	-.119
Male ^b	.110	.069	.527*	.018
<u>Proband Schizotypy Scale</u>				
Female ^a	.161	-.006	.018	.282
Male ^b	-.134	.042	.340	-.226

Note. * $p < .05$, two-tailed; ^a $N = 46$ for female proband-mother analyses, $N = 21$ for female proband-father analyses; ^b $N = 33$ for male proband-mother analyses, $N = 23$ for male proband-father analyses; IM-SS-R = Interpersonal Measure of Schizoidia and Schizotypy, Revised.

observed between proband IM-SS-R Schizotypy Scale dimensional ratings and father IM-SS-R Schizoidia Scale dimensional ratings ($r = .31$, $p < .05$). When female probands and their fathers ($N = 21$) were examined, the relationship for the IM-SS-R Schizoidia Scale ($r = .08$, $p > .05$) and IM-SS-R Schizotypy Scale ($r = .28$, $p > .05$) was non-significant. However, when male probands and their fathers ($N = 23$) were examined, a significant relationship was observed for the IM-SS-R Schizoidia Scale ($r = .53$, $p < .05$). The relationship between male proband IM-SS-R Schizotypy Scale dimensional scores and father IM-SS-R Schizotypy Scale dimensional scores was non-significant ($r = -.23$, $p > .05$) (see Table 8). Thus, proband dimensional ratings for the IM-SS-R Schizoidia Scale and

father dimensional ratings for the IM-SS-R Schizoidia Scale were related, and this relationship appears to be accounted for mainly by male probands' IM-SS-R Schizoidia Scale ratings.

Does the IM-SS-R Contribute Uniquely to the Assessment of Schizotypy in Social Anhedonics?

Hierarchical regression analyses were performed to examine the incremental validity of behavioral sign ratings in the identification of proband social anhedonics. That is, do behavioral sign ratings contribute unique information beyond that already accounted for by clinical symptom ratings? It was predicted that IM-SS-R ratings of schizoid and schizotypal behavior would explain a significant amount of variance in proband group status (social anhedonia vs. control) after controlling for IPDE ratings of schizophrenia-spectrum symptomatology (as has been previously shown for the original IM-SS Schizoidia Scale, Collins et al., 2005). As discussed earlier, although the IPDE does include a limited amount of behavioral sign items, it was conceptualized in the present study as a measure of schizophrenia-spectrum symptoms. Thus, most analyses herein (except where otherwise noted) utilize the IPDE scales in their entirety (symptoms and signs). Consistent with previous studies (Blanchard et al., 2005; Kwapil, 1998), the present study found that IPDE clinical symptom ratings of schizoid ($F(1, 85) = 11.54$, $R^2 = .12$, $p < .01$) and schizotypal ($F(1, 85) = 10.35$, $R^2 = .11$, $p < .01$) personality disorders accounted for a significant amount of variance in group status, with social anhedonics reporting significantly higher dimensional scores compared to controls. However, contrary to previous findings, paranoid ($F(1, 85) = 1.02$, $R^2 = .01$, $p > .05$) personality

disorder ratings did not account for a significant amount of variance in group status. One social anhedonic participant was not included in the above analyses due to a current Axis I psychotic disorder diagnosis (see Blanchard et al., 2005 for IPDE results from the complete MLSS sample).

A summary of proband hierarchical regression analyses can be found in Table 9. When considered independently, the IM-SS-R Schizoidia Scale accounted for 10.2% of the variance in group status ($F(1, 86) = 9.74, p < .01$). Step one of the hierarchical regression analysis included the IPDE schizoid personality disorder scale, which accounted for 12.0% of the variance in group status ($F(1, 85) = 11.54, p < .01$). Adding the IM-SS-R Schizoidia Scale to the regression equation in step two accounted for an additional 2.6% of the variance in group status ($F \text{ Change}(1, 84) = 2.59, p > .05$), which was non-significant. A second hierarchical regression analysis was conducted with only the behavioral sign item from the IPDE schizoid personality disorder scale entered in the first step, which accounted for 1.9% of the variance in group status ($F(1, 85) = 1.63, p > .05$), which was non-significant. Adding the IM-SS-R Schizoidia Scale to the regression equation in step two accounted for an additional 8.5% of the variance in group status ($F \text{ Change}(1, 84) = 7.97, p < .01$), which was significant. Thus, although the IM-SS-R Schizoidia Scale did not contribute to the differentiation of social anhedonics from controls beyond clinical symptom ratings, schizoid behavioral ratings, as measured by the IM-SS-R Schizoidia Scale, contributed more to group differentiation than schizoid behavioral sign ratings, as measured by the IPDE schizoid personality disorder scale.

Table 9: *Incremental Validity of Proband Behavioral Ratings in Predicting Group Membership (Social Anhedonic vs. Control)*

<u>N=87^a</u>	<u>R</u>	<u>F</u>	<u>R² Change</u>	<u>F Change</u>
<u>Proband IM-SS-R Schizoidia Scale</u>				
Step 1: IPDE Schizoid Total	.346	11.54**	.120	-----
Step 2: IM-SS-R Schizoidia Scale	.319	9.74**	.026	2.59
<u>Proband IM-SS-R Schizoidia Scale</u>				
Step 1: IPDE Schizoid Signs	.137	1.63	.019	-----
Step 2: IM-SS-R Schizoidia Scale	.319	9.74**	.085	7.97**
<u>Proband IM-SS-R Schizotypy Scale</u>				
Step 1: IPDE Schizotypal Total	.329	10.35**	.109	-----
Step 2: IM-SS-R Schizotypy Scale	.205	3.78	.006	0.54
<u>Proband IM-SS-R Schizotypy Scale</u>				
Step 1: IPDE Schizotypal Signs	.163	2.32	.027	-----
Step 2: IM-SS-R Schizotypy Scale	.205	3.78	.012	1.06

Note. ** $p < .01$, two-tailed; ^a One social anhedonic proband was not included in these incremental validity analyses because he was missing IPDE ratings due to a current Axis I psychotic disorder diagnosis; IM-SS-R = Interpersonal Measure of Schizoidia and Schizotypy, Revised; IPDE = International Personality Disorders Examination.

When considered independently, the IM-SS-R Schizotypy Scale accounted for 4.2% of the variance in group status ($F(1, 86) = 3.78, p > .05$). Step one of the hierarchical regression analysis included the IPDE schizotypal personality disorder scale, which accounted for 10.9% of the variance in group status ($F(1, 85) = 10.35, p < .01$). Adding the IM-SS-R Schizotypy Scale to the regression equation in step two accounted for only an additional 0.6% of the variance in group status ($F\text{ Change}(1, 84) = 0.54$,

$p > .05$), which was non-significant. A second hierarchical regression analysis was conducted with only the behavioral sign items from the IPDE schizotypal personality disorder scale entered in the first step, which accounted for 2.7% of the variance in group status ($F(1, 85) = 2.32, p > .05$), which was non-significant. Adding the IM-SS-R Schizotypy Scale to the regression equation in step two accounted for an additional 1.2% of the variance in group status ($F \text{ Change}(1, 84) = 1.06, p > .05$), which was non-significant (see Table 9). Thus, the IM-SS-R Schizotypy Scale did not contribute to the differentiation between social anhedonics and controls beyond clinical symptom ratings. In addition, while IPDE schizotypal personality disorder behavioral signs did not contribute significantly to the differentiation of social anhedonics from controls, the IM-SS-R Schizotypy Scale did not contribute to group differentiation beyond IPDE schizotypal behavioral sign ratings.

Does the IM-SS-R Contribute Uniquely to the Assessment of Schizotypy in Parents of Social Anhedonics?

It was predicted that IM-SS-R ratings of schizoid and schizotypal behaviors would explain a significant amount of variance in parent group status (parents of social anhedonics vs. parents of controls) after controlling for IPDE ratings of schizophrenia-spectrum symptomatology. Hierarchical regression analyses were planned to conduct this examination of the incremental validity of behavioral sign ratings in the biological parents of social anhedonics. However, upon examination of the IPDE using regression analyses, it was observed that for mothers' schizoid ($F(1, 77) = 0.14, R^2 = .00, p > .05$), schizotypal ($F(1, 77) = 0.64, R^2 = .01, p > .05$), and paranoid ($F(1, 77) = 0.15, R^2 = .00,$

$p > .05$) personality disorder ratings as well as for fathers' schizoid ($F(1, 42) = 3.02$, $R^2 = .07$, $p > .05$), schizotypal ($F(1, 42) = 2.70$, $R^2 = .06$, $p > .05$), and paranoid ($F(1, 42) = 1.46$, $R^2 = .03$, $p > .05$) personality disorder ratings, traditional clinical symptom ratings failed to account for a significant amount of variance in parent group status. Thus, incremental validity analyses were not warranted. Rather, to further examine the utility of behavioral sign ratings against traditional clinical symptom ratings, a comparison of effect sizes for group differentiation across the IM-SS-R and IPDE (including symptoms and signs) scales was performed.

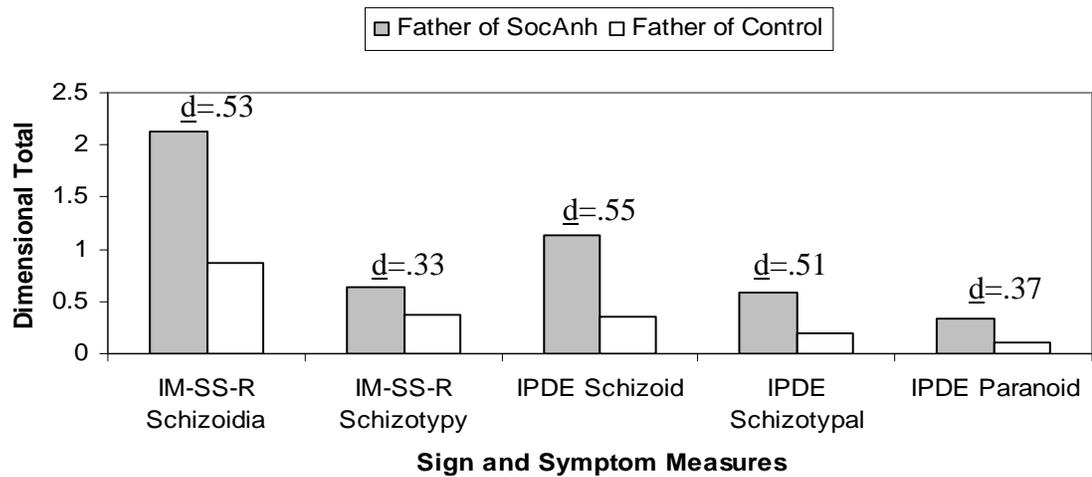
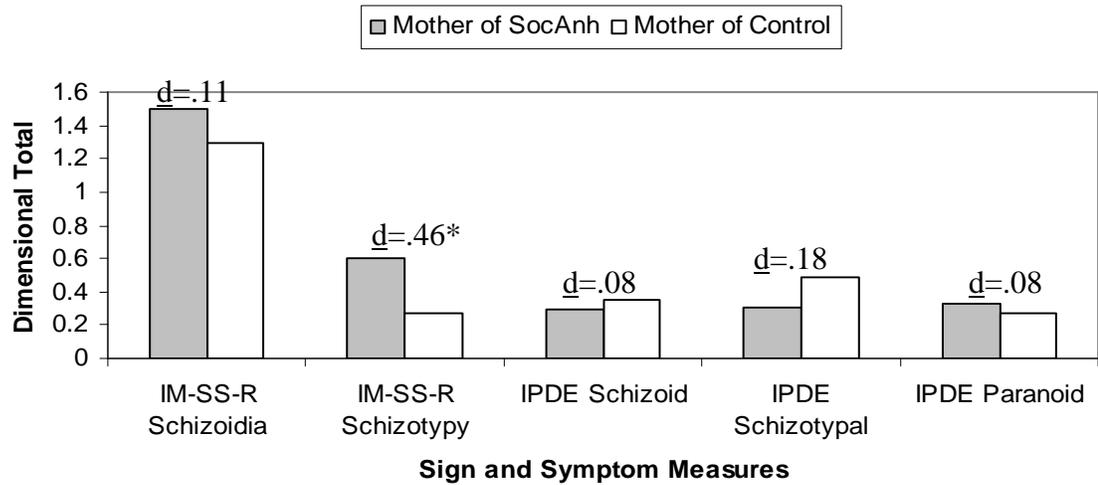
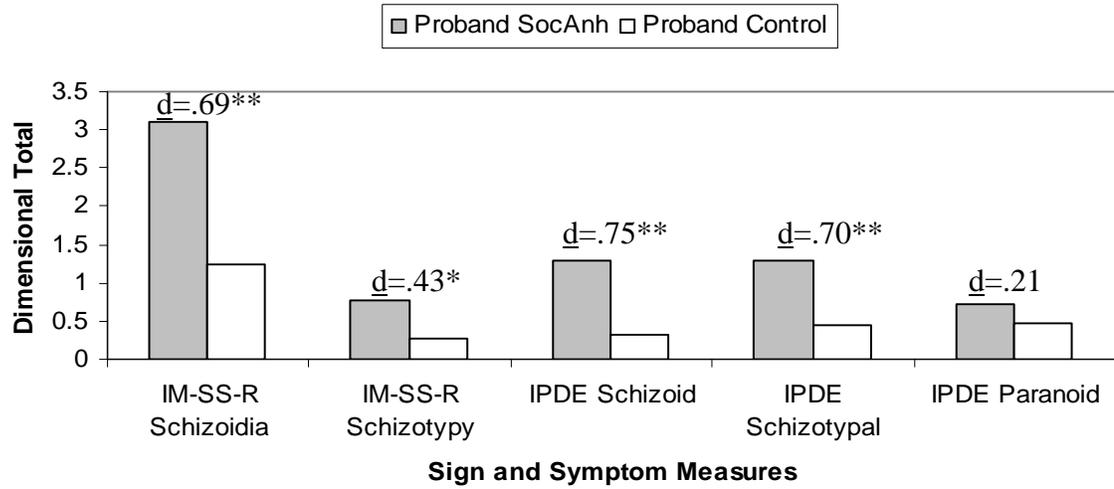
Effect sizes for the differentiation of mothers of social anhedonics from mothers of controls were non-significant for the IM-SS-R Schizoidia Scale ($d = .11$), IPDE schizoid personality disorder scale ($d = .08$), IPDE schizotypal personality disorder scale ($d = .18$), and IPDE paranoid personality disorder scale ($d = .08$). However, a small effect size was observed for the IM-SS-R Schizotypy Scale ($d = .46$). Thus, the IM-SS-R Schizotypy Scale successfully differentiated mothers of social anhedonics from mothers of controls (as presented earlier) with a small effect size while none of the IPDE clinical symptom ratings contributed to group differentiation among mothers. In fact, post-hoc regression analyses demonstrated that the IM-SS-R Schizotypy Scale ($F(1, 77) = 4.19$, $R^2 = .05$, $p < .05$) accounted for more of the variance in mother group status (mother of social anhedonic vs. mother of control) than all three IPDE scales (schizoid, schizotypal, and paranoid personality disorders) combined ($F(3, 75) = 0.45$, $R^2 = .02$, $p < .05$).

Effect sizes for the differentiation of fathers of social anhedonics from fathers of controls were small for the IM-SS-R Schizotypy Scale ($d = .33$) and the IPDE paranoid

personality disorder scale ($d=.37$) and in the medium range for the IM-SS-R Schizoidia Scale ($d=.53$), IPDE schizoid personality disorder scale ($d=.55$), and IPDE schizotypal personality disorder scale ($d=.51$). Thus, despite having a small sample, fathers of social anhedonics were differentiated from fathers of controls on all measures of schizophrenia-spectrum behavioral signs and clinical symptoms, with the strongest effects observed for behavioral signs of schizoid personality disorder, clinical symptoms of schizoid personality disorder, and clinical symptoms of schizotypal personality disorder.

Effect sizes for the IM-SS-R and IPDE for mothers and fathers are displayed in Figure 1. Effect sizes for probands are also displayed in Figure 1 to provide comparison across measures for the three participant groups. As presented earlier, a medium effect size was observed for proband group differentiation using the IM-SS-R Schizoidia Scale ($d=.69$) and a small effect size was observed for the IM-SS-R Schizotypy Scale ($d=.43$). Medium effect sizes were observed for proband group differentiation using the IPDE schizoid personality disorder scale ($d=.75$) and IPDE schizotypal personality disorder scale ($d=.70$), while a small effect size was observed for the IPDE paranoid personality disorder scale ($d=.21$).

Figure 1: *Proband and Parent Group Differences on the Interpersonal Measure of Schizoidia and Schizotypy, Revised (IM-SS-R) and the International Personality Disorders Examination (IPDE)*; * $p<.05$, two-tailed and ** $p<.01$, two-tailed for ANOVAs; one social anhedonic proband was not included in the IPDE analyses because he was missing IPDE ratings due to a current Axis I psychotic disorder diagnosis.



External Validity of Behavioral Sign Ratings

Relationship between IM-SS-R Ratings and Family Member Report of

Interpersonal Behavior: To address the external validity of IM-SS-R ratings based on a 30-minute sample of behavior within the research context, the correspondence between behavioral sign ratings and family member report of schizophrenia-spectrum behavior was examined. Because these analyses were constrained by having information from both behavioral assessment (IM-SS-R ratings) and report by family members (FIGS ratings), *N*s vary by family member dyad. The analyses below represent 78 proband IM-SS-R-mother FIGS dyads, 43 proband IM-SS-R-father FIGS dyads, 78 mother IM-SS-R-proband FIGS dyads, 35 mother IM-SS-R-father FIGS dyads, 44 father IM-SS-R-proband FIGS dyads, and 34 father IM-SS-R-mother FIGS dyads (see Table 10). All correlational analyses were conducted collapsing across the social anhedonia and control groups.

For proband IM-SS-R Schizoidia Scale ratings, neither mother ($r=.09$, $p>.05$) nor father ($r=.05$, $p>.05$) report of proband schizoid behavior (based on 1 “pure” behavioral sign rating from the FIGS) were significantly related. For proband IM-SS-R Schizotypy Scale ratings, both mother ($r=.45$, $p<.01$) and father ($r=.37$, $p<.05$) report of proband schizotypal behavior (based on 3 “pure” behavioral sign ratings from the FIGS) were significantly related (see Table 10).

For mother IM-SS-R Schizoidia Scale ratings, neither proband ($r=.01$, $p>.05$) nor father ($r=.04$, $p>.05$) report of mother schizoid behavior (based on 1 “pure” behavioral sign rating from the FIGS) were significantly related. For mother IM-SS-R Schizotypy

Table 10: Relationship between IM-SS-R Ratings and Family Member Report of Interpersonal Behavior

	Mother FIGS Schizoid (N=78) (r)	Mother FIGS Schizotypal (N=78) (r)	Father FIGS Schizoid (N=43) (r)	Father FIGS Schizotypal (N=43) (r)
<u>Proband IM-SS-R</u>				
Schizoidia Scale	.087	-.113	.047	-.013
Schizotypy Scale	.007	.445**	.247	.372*
	Proband FIGS Schizoid (N=78) (r)	Proband FIGS Schizotypal (N=78) (r)	Father FIGS Schizoid (N=35) (r)	Father FIGS Schizotypal (N=35) (r)
<u>Mother IM-SS-R</u>				
Schizoidia Scale	.006	-.068	.040	.088
Schizotypy Scale	.055	.346**	.114	.332
	Proband FIGS Schizoid (N=44) (r)	Proband FIGS Schizotypal (N=44) (r)	Mother FIGS Schizoid (N=34) (r)	Mother FIGS Schizotypal (N=34) (r)
<u>Father IM-SS-R</u>				
Schizoidia Scale	.040	.049	.082	.349*
Schizotypy Scale	.026	-.049	-.101	.056

Note. * $p < .05$, two-tailed, ** $p < .01$, two-tailed; IM-SS-R = Interpersonal Measure of Schizoidia and Schizotypy, Revised.

Scale ratings, proband ($r=.35, p<.01$) but not father ($r=.33, p>.05$) report of mother schizotypal behavior (based on 3 “pure” behavioral sign ratings from the FIGS) was significantly related. Of note, the relationship between mother IM-SS-R Schizotypy Scale ratings and father report of mother schizotypal behavior was in the medium range with $p=.051$ (see Table 10).

For father IM-SS-R Schizoidia Scale ratings, neither proband ($r=.04, p>.05$) nor mother ($r=.08, p>.05$) report of father schizoid behavior (based on 1 “pure” behavioral sign rating from the FIGS) were significantly related. For father IM-SS-R Schizotypy Scale ratings, neither proband ($r=-.05, p>.05$) nor mother ($r=.06, p>.05$) report of father schizotypal behavior (based on 3 “pure” behavioral sign ratings from the FIGS) were significantly related. The relationship between father IM-SS-R Schizoidia Scale ratings and mother report of father schizotypal signs was significant ($r=.35, p<.05$) (see Table 10).

Relationship between IM-SS-R Ratings and Global Functioning: To further examine the external validity of IM-SS-R ratings, the relationship between schizophrenia-spectrum behavioral signs and global functioning, as measured by the Global Assessment of Functioning (GAF, First et al., 1996), was examined. For probands, both the IM-SS-R Schizoidia Scale ($r=-.30, p<.01$) and IM-SS-R Schizotypy Scale ($r=-.41, p<.01$) were negatively related to the GAF. For mothers, both the IM-SS-R Schizoidia Scale ($r=-.39, p<.01$) and IM-SS-R Schizotypy Scale ($r=-.47, p<.01$) were

negatively related to the GAF. For fathers, the IM-SS-R Schizoidia Scale ($r=-.46$, $p<.01$) but not the IM-SS-R Schizotypy Scale ($r=-.08$, $p>.05$) was significantly negatively related to the GAF.

Chapter 7: Discussion

The present study examined schizophrenia-spectrum behavioral characteristics in social anhedonics and controls as well as their biological parents as an initial investigation into the familiarity of these behaviors in a psychometrically-identified putative schizotypal group. Reliability analyses of the revised version of the IM-SS (IM-SS-R, Kosson et al., 2004) add to the growing literature showing the IM-SS to be a reliable assessment measure (e.g., Collins et al., 2005; Kosson et al., 2005) and suggest that ratings are not influenced by exposure to patient report of schizophrenia-spectrum symptomatology. Further research is needed to examine whether the IM-SS-R Schizotypy Scale measures a single unidimensional latent construct or multiple dimensions of behavior characteristic of schizotypal personality disorder.

Consistent with the Collins et al. (2005) study using the original IM-SS, proband social anhedonics were found to exhibit atypical interpersonal behaviors characteristic of schizoid and schizotypal personality disorders. These results support previous work (Kendler et al., 1995; Miller et al., 2002; Tyrka et al., 1995) showing that the assessment of behavioral signs is an important component of the measurement of schizotypy. Using the original IM-SS in the Collins et al. study, in addition to finding that social anhedonics exhibited more schizoid behaviors than controls, males in both the social anhedonia and control groups were found to have higher IM-SS Schizoidia Scale ratings than females. Using the IM-SS-R in the present study, no effect for proband gender was observed on schizoid behavioral ratings. The IM-SS-R Schizoidia Scale may include items that are more representative of atypical interpersonal behaviors exhibited by both males and females. Alternatively, statistical power limitations in the present study ($N=88$ compared

to $N=170$ in Collins et al.) may have impacted the examination of gender differences in proband behavioral ratings. Future research with a larger sample should examine possible gender differences in IM-SS-R schizophrenia-spectrum behavioral ratings.

Exploratory analyses examined which IM-SS-R items best differentiated between the proband groups. On the IM-SS-R Schizoidia Scale, constricted facial affect, lack of non-verbal expression, lack of verbal expression, lack of variability in affect or expression over time, and physical anergia were found to best differentiate between social anhedonics and controls. As noted in Collins et al., these schizoid items reflect a lack of expressive interpersonal behavior similar to the negative symptoms of flat or blunted affect and poverty of speech (alogia) observed in schizophrenia (Andreasen, 1985; Kay, Fiszbein & Opler, 1987). Longitudinal research is needed to examine whether the deficit in interpersonal behavior exhibited by social anhedonics in the present study reflects a risk for developing negative symptomatology. On the IM-SS-R Schizotypy Scale, odd speech volume, rate, or tone best differentiated between the social anhedonia and control groups. It is interesting to note that only one of the “positive schizotypy” items included in the IM-SS-R Schizotypy Scale independently differentiated between the social anhedonia and control groups compared to five of the “negative schizotypy” items included in the IM-SS-R Schizoidia Scale. Elevated frequency of behavioral expression for the negative schizotypy factor compared to the positive schizotypy factor has also been observed in first-degree relatives of individuals with schizophrenia (Kendler et al., 1995).

As in Collins et al. (2005) using the original IM-SS, the unique contribution of proband IM-SS-R behavioral sign ratings over traditional clinical symptom ratings was examined. Contrary to findings from Collins et al., the IM-SS-R Schizoidia Scale did not contribute to the differentiation between social anhedonics and controls beyond clinical symptom ratings. These analyses may have been limited by the smaller sample size in the present study. Schizoid behavioral sign ratings, as measured by the IM-SS-R, did contribute significantly more to group differentiation than schizoid behavior sign ratings, as measured by the IPDE. Despite recent revisions to the IM-SS-R that focused on the Schizotypy Scale, the present study found that the IM-SS-R Schizotypy Scale did not contribute to the differentiation between social anhedonics and controls beyond clinical symptom ratings. This finding is consistent with Collins et al. using the original IM-SS Schizotypy Scale. However, these analyses again may have been limited by low statistical power due to small sample size. It is notable that IPDE schizotypal behavioral sign items did not contribute significantly to the differentiation of social anhedonics from controls. It may be that the disjunction between signs and symptoms observed for schizoid personality characteristics is not observed in schizotypal personality disorder. Despite not observing a significant incremental effect upon clinical symptom ratings, the IM-SS-R scales did successfully differentiate social anhedonics from controls and further research, both cross-sectionally in different populations and longitudinally, should continue to explore the utility of behavioral sign ratings in the assessment of schizotypy. Additionally, findings from both IM-SS-R scales further suggest that commonly used measures of schizophrenia-spectrum personality disorders may not adequately assess behavioral signs of schizoidia and schizotypy.

This was the first study to examine interpersonal behavior in the biological parents of a social anhedonics. Mothers of social anhedonics were found to display higher rates of atypical interpersonal behaviors characteristic of schizotypal personality disorder than mothers of controls. This finding is particularly noteworthy given that none of the clinical symptom ratings (i.e., IPDE ratings of schizoid, schizotypal, or paranoid personality disorder) contributed to group differentiation among mothers. Thus, behavioral signs of schizotypy were the only outcome measure to successfully identify mothers of social anhedonics in the present study. These findings support those of Kendler et al. (1995) showing that clinical symptoms and behavioral signs of schizotypy represent fundamentally distinct domains of psychopathology and extend Kendler et al.'s finding that behavioral signs are more powerful than symptom ratings for detecting schizophrenia-spectrum characteristics in first-degree relatives of individuals with schizophrenia to the biological mothers of social anhedonics. Results from the present study and Kendler et al. suggest that measures focusing on the assessment of schizotypal symptoms alone may fail to detect familial characteristics of schizotypes.

Mothers of social anhedonics were best differentiated from mothers of controls by the IM-SS-R Schizotypy Scale item assessing tangentiality, which included difficulty staying with the topic of conversation as well as rambling or very lengthy responses, whereas proband social anhedonics were best differentiated from proband controls by the IM-SS-R Schizotypy Scale item assessing odd speech volume, rate, or tone. While the specific behaviors that best differentiated the proband and mother groups varied, the schizotypal behaviors exhibited by both proband social anhedonics and their mothers were broadly related to speech and language. Because statistically significant differences

between mothers of social anhedonics and mothers of controls were not observed for any of the schizophrenia-spectrum symptom measures, it was not possible to evaluate the incremental validity of behavioral sign ratings beyond clinical symptom ratings in the identification of mothers of social anhedonics. Dimensional ratings for both IM-SS-R scales were not significantly related for either female or male probands and their mothers. Thus, while the IM-SS-R appears to capture some of the atypical interpersonal behaviors exhibited by both probands and their mothers, further research is needed to examine similarities and differences in interpersonal behavior expressed by social anhedonics and their biological mothers.

Although no significant differences in displays of schizophrenia-spectrum behavior were observed between fathers of social anhedonics and fathers of controls, a medium effect size for group differentiation was observed for the IM-SS-R Schizoidia Scale and a small effect size was observed for the IM-SS-R Schizotypy Scale, with fathers of social anhedonics rated higher than fathers of controls. Low statistical power may have affected these analyses, such that the father group had only 44 participants (20 fathers of controls and 24 fathers of social anhedonics) while the mother group had 79 participants (37 mothers of controls and 42 mothers of social anhedonics). The effect of fathers' schizoid signs on group differentiation was comparable to that observed for clinical symptom ratings of schizoid and schizotypal personality disorders. Because statistically significant differences between fathers of social anhedonics and fathers of controls were not observed for any of the schizophrenia-spectrum symptom measures, it was not possible to evaluate the incremental validity of behavioral sign ratings beyond clinical symptom ratings in the identification of fathers of schizotypes. Proband

dimensional ratings on both the IM-SS-R Schizoidia Scale and the IM-SS-R Schizotypy Scale were related to father dimensional ratings on the IM-SS-R Schizoidia Scale. For the IM-SS-R Schizoidia Scale, the relationship between proband and father behavioral ratings appears to be accounted for mainly by ratings of male probands' schizoid behaviors. Thus, gender may differentially affect the familiarity of schizophrenia-spectrum behaviors. Future studies should examine the utility of schizophrenia-spectrum behavioral ratings in the identification of fathers of social anhedonics as well as gender differences in the familiarity of schizophrenia-spectrum behaviors using a larger sample.

In an effort to explore the external validity of IM-SS-R behavioral sign ratings based on a 30-minute sample of behavior during a professional interaction, the correspondence between participant IM-SS-R ratings and family member report of interpersonal behavior was examined. For probands, mothers, and fathers, non-significant relationships were observed between IM-SS-R Schizoidia Scale ratings and family member report of schizoid behavior. However, only one item from the FIGS (the measure used to obtain family member report of behavior) represented a "pure" behavioral sign item and was used in this analysis, which may be related to the poor reliability observed between schizoid behavioral ratings and family member report of schizoid behavior. Low endorsement rates for the item, "constricted affect, aloof, cold, rarely reciprocates gestures or expressions," as well as a truncated range of scores (01 due to the inclusion of only one item) may have affected these analyses. Positive reports by family members on this item ranged from 1.1% of respondents (proband report of mother schizoid signs) to 17.0% (proband report of father schizoid signs). In contrast, for the three items comprising the schizotypal behavioral items from the FIGS, the range of

scores was 0-3 and positive reports by family members on these items ranged from 4.5% of respondents (father report of mother schizotypal signs) to 19.3% of respondents (proband report of father schizotypal signs). Importantly, prior research has shown that agreement between self- and informant-reports of personality disorders is modest, with poorer convergence for younger participants and for Cluster A and C personality disorders compared to Cluster B (for a review, see Klonsky, Oltmanns & Turkheimer, 2002). The present findings suggest that observer ratings and family member report of schizoid behaviors are subject to the same lack of correspondence. Thus, it is not clear whether IM-SS-R Schizoidia Scale ratings are representative of proband, mother, and father behavior outside of the research context. Future studies should examine schizophrenia-spectrum behavioral characteristics in a more naturalistic setting.

The correspondence between participant IM-SS-R ratings and family member report of interpersonal behavior was more evident for the IM-SS-R Schizotypy Scale than for to the IM-SS-R Schizoidia Scale. For probands, IM-SS-R Schizotypy Scale ratings were related to both mother and father report of proband schizotypal behavior. For mothers, IM-SS-R Schizotypy Scale ratings were related to proband report of mother schizotypal behavior and a moderate, though not statistically significant, relationship was observed for father report of mother schizotypal behavior. For fathers, IM-SS-R Schizotypy Scale ratings were not related to proband or mother report of father schizotypal behavior, which may be an artifact of low statistical power due to the smaller number of father participants. Interestingly, father IM-SS-R Schizoidia Scale ratings were related to mother report of father schizotypal behavior. It may be that mothers misidentified behaviors characteristic of schizoid personality disorder as those

characteristic of schizotypal personality disorder in fathers. Overall, these findings support the external validity of IM-SS-R ratings of schizophrenia-spectrum behavior beyond the brief professional interaction examined in the present study. Importantly, the above analyses examined behaviors observed by trained raters compared to those of family members without formal training in the identification of schizophrenia-spectrum behaviors. Thus, these findings should be interpreted with caution and serve as a preliminary examination of the external validity of IM-SS-R behavioral ratings.

As an additional examination of the external validity of the IM-SS-R, schizoid and schizotypal behavioral sign ratings were examined in relation to global functioning ratings. For probands and mothers, ratings for both the IM-SS-R Schizoidia Scale and IM-SS-R Schizotypy Scale were related to lower global functioning scores, indicating a relationship between schizophrenia-spectrum behaviors and poorer psychological, social, and occupational functioning. The same pattern of findings was observed for fathers with the IM-SS-R Schizoidia Scale. However, fathers' ratings on the IM-SS-R Schizotypy Scale were not significantly related to global functioning. These findings generally support the external validity of IM-SS-R ratings of schizophrenia-spectrum behaviors. It is noteworthy that schizophrenia-spectrum behavioral ratings for a group of putative schizotypes and their biological parents based on a brief sample of behavior were related to such a broad assessment of functional difficulties. Future research should examine the functional impact of treatments targeting atypical interpersonal behavior, as in social skills training for schizophrenia patients, in individuals at risk for the disorder.

The present study design allowed for an examination of the familiarity of atypical interpersonal behavior. That is, whether the atypical interpersonal behaviors observed in social anhedonics are also observed in their biological parents. This study did not directly address heritability, as in use of a behavior genetics design such as a twin or adoption study, where the relative contribution of genetics and environment may be examined. Therefore, results must be interpreted cautiously with an understanding that findings may represent genetic influences, modeling, reciprocal parent-child influences, or shared environment influences. Despite this limitation, the present study provides an initial examination of the familiarity of schizophrenia-spectrum behavioral signs in social anhedonics and serves as a basis for further exploration of this construct. Other study limitations should be considered when interpreting findings from the present study. The IM-SS-R Schizotypy Scale was observed to have low internal consistency reliability, indicating that further revisions to the scale may be necessary. Proband participants in the present study were recruited from the community in an effort to increase the generalizability of the findings. However, it is possible that parent participants were higher functioning than community members in general (i.e., they had found romantic partners and raised at least one child to the age of 18).

This study provided an initial investigation into the familiarity of schizoid and schizotypal behaviors in a group of psychometrically-identified social anhedonics, as putative schizotypes. Results generally support the familiarity of atypical interpersonal behavior in social anhedonics. These findings add to the growing literature on social anhedonia and support the construct as an indicator of Meehl's (1962, 1989) schizotypy. Further research is needed to examine the differential effects of genetics and environment

on familial patterns of schizophrenia-spectrum behavior. Findings from the present study have implications for the development of assessment measures of schizotypy such that both proband and family member assessments should include behavioral ratings of schizophrenia-spectrum characteristics. The proband group examined in the present study was a relatively young (18- to 19- years old), non-clinical group of putative schizotypes whose ultimate outcome has not yet been determined. Findings from the present study may be used in conjunction with the Maryland Longitudinal Study of Schizotypy to conduct a longitudinal analysis of the utility of behavioral sign ratings in the identification of schizotypes and the identification of first-degree relatives of schizotypes.

Appendix 1

Revised Social Anhedonia Scale (SocAnh Scale) Item Content

1. Having close friends is not as important as many people say.
2. I attach very little importance to having close friends.
3. I prefer watching television to going out with other people.
4. A car ride is much more enjoyable if someone is with me. (-)
5. I like to make long distance phone calls to friends and relatives. (-)
6. Playing with children is a real chore.
7. I have always enjoyed looking at photographs of friends. (-)
8. Although there are things that I enjoy doing by myself, I usually seem to have more fun when I do things with other people. (-)
9. I sometimes become deeply attached to people I spend a lot of time with. (-)
10. People sometimes think I am shy when I really just want to be left alone.
11. When things are going really good for my close friends, it makes me feel good too. (-)
12. When someone close to me is depressed, it brings me down also. (-)
13. My emotional responses seem very different from those of other people.
14. When I am alone, I often resent people telephoning me or knocking on my door.
15. Just being with friends can make me feel really good. (-)
16. When things are bothering me, I like to talk to other people about it. (-)
17. I prefer hobbies and leisure activities that do not involve other people.
18. It's fun to sing with other people. (-)
19. Knowing that I have friends who care about me gives me a sense of security. (-)
20. When I move to a new city, I feel a strong need to make new friends. (-)
21. People are usually better off if they stay aloof from emotional involvements with most others.
22. Although I know I should have affection for certain people, I don't really feel it.
23. People often expect me to spend more time talking with them than I would like.
24. I feel pleased and gratified as I learn more about the emotional life of my friends. (-)
25. When others try to tell me about their problems and hang-ups, I usually listen with interest and attention. (-)
26. I never had really close friends in high school.
27. I am usually content to just sit alone, thinking and daydreaming.
28. I'm much too independent to really get involved with other people.
29. There are few things more tiring than to have a long, personal discussion with someone.
30. It made me sad to see all my high school friends go their separate ways when high school was over. (-)
31. I have often found it hard to resist talking to a good friend, even when I have other things to do. (-)
32. Making new friends isn't worth the energy it takes.
33. There are things that are more important to me than privacy. (-)
34. People who try to get to know me better usually give up after awhile.

35. I could be happy living all alone in a cabin in the woods or mountains.
 36. If given the choice, I would much rather be with others than be alone. (-)
 37. I find that people too often assume that their daily activities and opinions will be interesting to me.
 38. I don't really feel very close to my friends.
 39. My relationships with other people never get very intense.
 40. In many ways, I prefer the company of pets to the company of people.
-

Note. (-) indicates items that are reverse scored and keyed false; all other items are keyed true.

Appendix 2

Infrequency Scale Item Content

1. On some mornings, I didn't get out of bed immediately when I first woke up. (-)
 2. There have been a number of occasions when people I know have said hello to me. (-)
 3. There have been times when I have dialed a telephone number only to find that the line was busy. (-)
 4. At times when I was ill or tired, I have felt like going to bed early. (-)
 5. On some occasions I have noticed that some other people are better dressed than myself. (-)
 6. Driving from New York to San Francisco is generally faster than flying between these cities.
 7. I believe that most light bulbs are powered by electricity. (-)
 8. I go at least once every two years to visit either northern Scotland or some part of Scandinavia.
 9. I cannot remember a time when I talked with someone who wore glasses.
 10. Sometimes when walking down the sidewalk, I have seen children playing. (-)
 11. I have never combed my hair before going out in the morning.
 12. I find that I often walk with a limp, which is the result of a skydiving accident.
 13. I cannot remember a single occasion when I have ridden on a bus.
-

Note. (-) indicates items that are reverse scored and keyed false; all other items are keyed true.

Appendix 3

Perceptual Aberrations Scale (PerAb Scale) Item Content

1. I sometimes have had the feeling that some parts of my body are not attached to the same person.
2. Occasionally I have felt as though my body did not exist.
3. Sometimes people whom I know well begin to look like strangers.
4. My hearing is sometimes so sensitive that ordinary sounds become uncomfortable.
5. Often I have a day when indoor lights seem so bright that they bother my eyes.
6. My hands or feet have never seemed far away. (-)
7. I have sometimes felt confused as to whether my body was really my own.
8. Sometimes I have felt that I could not distinguish my body from other objects around me.
9. I have felt that my body and another person's body were one and the same.
10. I have felt that something outside my body was a part of my body.
11. I sometimes have had the feeling that my body is abnormal.
12. Now and then, when I look in the mirror, my face seems quite different than usual.
13. I have never had the passing feeling that my arms or legs have become longer than usual. (-)
14. I have sometimes felt that some part of my body no longer belongs to me.
15. Sometimes when I look at things like tables and chairs, they seem strange.
16. I have felt as though my head or limbs were somehow not my own.
17. Sometimes part of my body has seemed smaller than it usually is.
18. I have sometimes had the feeling that my body is decaying inside.
19. Occasionally it has seemed as if my body had taken on the appearance of another person's body.
20. Ordinary colors sometimes seem much too bright for me.
21. Sometimes I have had a passing thought that some part of my body was rotting away.
22. I have sometimes had the feeling that one of my arms or legs is disconnected from the rest of my body.
23. It has seemed at times as if my body was melting into my surroundings.
24. I have never felt that my arms or legs have momentarily grown in size. (-)
25. The boundaries of my body always seem clear. (-)
26. Sometimes I have had feelings that I am united with an object near me.
27. Sometimes I have had the feeling that a part of my body is larger than it usually is.
28. I can remember when it seemed as though one of my limbs took on an unusual shape.
29. I have had the momentary feeling that my body has become misshapen.
30. I have had the momentary feeling that the things I touch remain attached to my body.
31. Sometimes I feel like everything around me is tilting.
32. I sometimes have to touch myself to make sure I'm still there.
33. Parts of my body occasionally seem dead or unreal.

34. At times I have wondered if my body was really my own.
 35. For several days at a time I have had such a heightened awareness of sights and sounds that I cannot shut them out.
-

Note. (-) indicates items that are reverse scored and keyed false; all other items are keyed true.

Appendix 4

Magical Ideations Scale (MagicID Scale) Item Content

1. I have occasionally had the silly feeling that a TV or radio broadcaster knew I was listening to him.
2. I have felt that there were messages for me in the way things were arranged, like in a store window.
3. Things sometimes seem to be in different places when I get home, even though no one has been there.
4. I have never doubted that my dreams are the products of my own mind. (-)
5. I have noticed sounds on my records that are not there at other times.
6. I have had the momentary feeling that someone's place has been taken by a look alike.
7. I have never had the feeling that certain thoughts of mine really belonged to someone else. (-)
8. I have wondered whether the spirits of the dead can influence the living.
9. At times I perform certain little rituals to ward off negative influences.
10. I have felt that I might cause something to happen just by thinking too much about it.
11. At times, I have felt that a professor's lecture was meant especially for me.
12. I have sometimes felt that strangers were reading my mind.
13. If reincarnation were true, it would explain some unusual experiences I have had.
14. I sometimes have a feeling of gaining or losing energy when certain people look at me or touch me.
15. It is not possible to harm others merely by thinking bad thoughts about them. (-)
16. I have sometimes sensed an evil presence around me, although I could not see it.
17. People often behave so strangely that one wonders if they are part of an experiment.
18. The government refuses to tell us the truth about flying saucers.
19. I almost never dream about things before they happen. (-)
20. I have sometimes had the passing thought that strangers are in love with me.
21. The hand motions that strangers make seem to influence me at times.
22. Good luck charms don't work. (-)
23. I have sometimes been fearful of stepping on sidewalk cracks.
24. Numbers like 13 and 7 have no special powers. (-)
25. I have had the momentary feeling that I might not be human.
26. I think I could learn to read others' minds if I wanted to.
27. Horoscopes are right too often for it to be a coincidence.
28. Some people can make me aware of them just by thinking about me.
29. I have worried that people on other planets may be influencing what happens on earth.
30. When introduced to strangers, I rarely wonder whether I have known them before. (-)

Note. (-) indicates items that are reverse scored and keyed false; all other items are keyed true.

Appendix 5

Global Assessment of Functioning (GAF) Scale Item Content

- 91-100 Superior functioning in a wide range of activities, life's problems never seem to get out of hand, is sought out by others because of his or her many positive qualities. No symptoms.
- 81-90 Absent or minimal symptoms (e.g., mild anxiety before an exam), good functioning in all areas, interested and involved in a wide range of activities, socially effective, generally satisfied with life, no more than everyday problems or concerns (e.g., an occasional argument with family members).
- 71-80 If symptoms are present, they are transient and expectable reactions to psychosocial stressors (e.g., difficulty concentrating after family argument), no more than slight impairment in social, occupational, or school functioning (e.g., temporarily falling behind in school work).
- 61-70 Some mild symptoms (e.g., depressed mood and mild insomnia) OR some difficulty in social, occupational, or school functioning (e.g., occasional truancy, or absences from work), but generally functioning pretty well, has some meaningful interpersonal relationships.
- 51-60 Moderate symptoms (e.g., flat affect and circumstantial speech, occasional panic attacks) OR moderate difficulty in social, occupational, or school functioning (e.g., few friends, conflicts with co-workers).
- 41-50 Serious symptoms (e.g., suicidal ideation, severe obsessional rituals, frequent shoplifting) OR any serious impairment in social, occupational, or school functioning (e.g., no friends, unable to keep a job).
- 31-40 Some impairment in reality testing or communication (e.g., speech is at times illogical, obscure, or irrelevant) OR major impairment in several areas, such as work or school, family relations, judgment, thinking, or mood (e.g., depressed man avoids friends, neglects family, and is unable to work; child frequently beats up younger children, is defiant at home, and is failing at school).
- 21-30 Behavior is considerably influenced by delusions or hallucinations OR serious impairment in communication or judgment (e.g., sometimes incoherent, acts grossly inappropriately, suicidal preoccupation) OR inability to function in almost all areas (e.g., stays in bed all day; no job, home, or friends).
- 11-20 Some danger of hurting self or others (e.g., suicide attempts without clear expectation of death, frequently violent, manic excitement), OR occasionally fails to maintain minimal personal hygiene (e.g., smears feces) OR gross impairment in communication (e.g., largely incoherent or mute).
- 1-10 Persistent danger of severely hurting self or others (e.g., recurrent violence) OR persistent inability to maintain minimal personal hygiene OR serious suicide act with clear expectation of death.
-

Appendix 6

Interpersonal Measure of Schizoidia and Schizotypy, Revised (IM-SS-R) Item Content

Schizoidia Scale

1. Constricted Facial Affect
2. Lack of Non-Verbal Expression
3. Detachment (Lack of Engagement)
4. Lack of Verbal Expression
5. Indifference (Lack of Interest)
6. Guardedness
7. Lack of Variability in Affect/Expression Over Time
8. Poor Rapport
9. Absence of Spontaneity in Speech
10. Lack of Verbal Responsiveness to Interviewer's Remarks
12. Physical Anergia

Schizotypy Scale

1. Inappropriate Affect
 2. Suspicious/Paranoid Behavior
 3. Guarded Posture
 4. Speech Disorganized or Difficult to Understand
 5. Tangential Speech
 6. Unusual or Odd Speech (Other Than Disorganized or Repetitive Speech)
 7. Odd Speech Volume or Rate or Tone
 8. Excessive Use of Gestures to Accentuate or Qualify Speech
 9. Repetitive Behavior
 10. Odd Behavior (Other Than Repetitive Behavior)
 11. Odd or Disorganized Appearance
 12. Negative Reaction of Interviewer to Individual
-

Note. Item 11 from the Schizoidia Scale and items 13 through 18 from the Schizotypy Scale were omitted from the IM-SS-R for use in the present study.

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