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The present study is a three-year longitudinal reassessment of schizotypic young adults and comparison participants identified by the Revised Social Anhedonia Scale (Eckblad, Chapman, Chapman, & Mishlove, 1982). Diaz, Dickerson, and Kwapil (2002) conducted a cross-sectional assessment of 78 Social Anhedonia and 68 comparison participants using a battery of interview, neurocognitive and questionnaire measures. They reported that the Social Anhedonia participants experienced elevated levels of positive and negative symptoms of schizotypy, impaired social functioning, and deficits in sustained attention and executive functioning, relative to comparison group. The present study reassessed 52 Social Anhedonia and 47 comparison participants. As hypothesized, the Social Anhedonia group continued to exhibit higher rates of schizotypic symptoms such as psychotic-like experiences, negative symptoms, and schizotypal, schizoid and paranoid symptoms, and poorer overall functioning at the three-year follow-up. A combination of interview, questionnaire and neurocognitive measures from the initial assessment incremented the prediction of schizotypic symptoms and spectrum disorders at the follow-up assessment. Furthermore, perceived stress, but not the number of significant life events, incremented the prediction of risk over-and-above the effects of social anhedonia. The results provide further support that the Revised Social Anhedonia Scale is a useful predictor of schizotypy and indicates that it is especially effective when used in conjunction with measures of clinical symptoms and neurocognition.

A THREE-YEAR LONGITUDINAL STUDY OF SOCIAL ANEHDONIA AND
COMPARISON GROUPS

by

Martha Ann Diaz

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Approved by

_____
Committee Chair

to my unwavering supporter, Chris

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of

the Graduate School at the University of North Carolina at Greensboro.

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CHAPTER I

INTRODUCTION

The present study is a three-year longitudinal reassessment of schizotypic young adults identified by the Revised Social Anhedonia Scale (Eckblad, Chapman, Chapman, & Mishlove, 1982) and comparison participants. Cross-sectional findings from this sample (Diaz, Dickerson, & Kwapil, 2002) indicate that the Social Anhedonia participants experienced elevated levels of positive and negative symptoms of schizotypy, impaired social functioning, and deficits in sustained attention and executive functioning, relative to the comparison group. It is hypothesized that the Social Anhedonia participants will continue to exhibit schizophrenic-like impairment and that participants who exhibited impairment at the initial assessment will be at elevated risk for developing schizophrenia-spectrum disorders at the follow-up assessment. It should be noted that this is the first study to conduct an exhaustive, multidimensional assessment battery with young adults identified by the Revised Social Anhedonia Scale.

Schizophrenia and Schizotypy

Current models of the etiology of schizophrenia (e.g., Andreasen, 1999; Gottesman, 1991; Meehl, 1990) assume that there are schizophrenia-prone or schizotypic individuals who have a vulnerability for developing schizophrenia and related disorders.

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While the exact mechanisms are not fully understood, this vulnerability is presumed to result from an accumulation or interaction of multiple genetic, neurodevelopmental, and psychosocial factors or hits. These risk factors produce a continuum of schizophrenic-like adjustment that has been referred to as schizotypy. It is hypothesized that the majority of schizotypic individuals will not decompensate into psychosis, although they may experience attenuated or transient symptoms of schizophrenia. These symptoms fall on a continuum from relatively healthy to subclinical deviance to schizophrenia-spectrum personality disorders to full-blown clinical psychosis. Thus, schizotypy is expressed across a dynamic continuum of adjustment with severity contingent on the interaction of biopsychosocial factors (Gooding & Iacono, 1995).

Life events and schizotypy. Psychosocial factors may partially explain the differential outcomes in schizotypy by influencing the trajectory of the disease process (Brown & Birley, 1968; Bebbington, Bowen, & Ramana, 1997). This view is integrative in nature, examining the complex relationship between psychosocial factors and their influence on biological and/or genetic factors. Models of the development of schizophrenia suggest that genetic loadings account for the most variance in the etiology of such conditions (Gottesman, 1991) leaving a relatively smaller (or potentiating) role to other biopsychosocial factors. The premise is that psychosocial factors (life events) can act as "triggers" that potentiate the development of schizophrenia and related conditions in neurodevelopmentally predisposed individuals (Day, 1989). In fact, it is thought that people with schizotypy (and other mental illnesses) may be abnormally sensitive to the impact of stressful life events (Brown & Birley, 1970; Bebbington et al., 1997).

In addition to increased stress sensitivity, the nature of the impairment in schizotypy and schizophrenia may contribute to the experience of an increased number of stressful life events. Simply explained, the environment has an impact on the person, and the person is meanwhile interacting with the environment and changing it as well, and this continues to develop over time, creating a bi-directional relationship. The most extensive research on bi-directionality and mental illness has been done in the area of depression (Hammen, 1992; Nelson et al., 2001). Studies have found that depressed women not only experience more stressful life events, but due in part to their personal characteristics, symptoms, behaviors, and social context, contribute to the recurrence of depression. Following a similar model, schizotypic individuals could possess through genetic loading the potential to experience an increased number of stressful life events. Given the findings on bi-directionality in depressed women, schizotypes may contribute to the worsening of their illness by their personal characteristics, symptoms, behaviors, and social context. This is especially true with schizotypy and schizophrenia, due to the unusual nature of the behaviors often displayed, like magical thinking, unusual perceptual experiences, and erratic behavior. When a person is displaying these unusual behaviors, family, friends and co-workers may initially respond with concern or even guardedness. The schizotypic individual may interpret their reaction in a paranoid and or suspicious manner, and may further withdraw or behave in a way that is perceived as odd. This causes increased concern and or guardedness by those around them (friends, family, and co-workers), which keeps the cycle of experiencing negative life events in motion (Bebbington, Bowen, & Ramana, 1997).

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In addition to considering negative life events, it is also important to consider how the individual experiences events. Research in this area has found that perceived stress, or the subjective interpretation of life events, is a stronger predictor of health outcomes than are life events and should be considered when measuring life stressors (Cohen, Kamarck, & Mermelstein, 1983; Lazarus, 1977). Individuals vary greatly in their appraisal of events, particularly when deciding whether a life event is stressful or not (Lazarus, 1977). This subjective appraisal often dictates whether the person will report feeling stress over a life event, and subsequently influences which coping skills are used.

High-Risk Research Paradigms and Schizotypy

In order to unravel the origins and development of schizophrenia and related conditions, recent research efforts have focused on the identification of individuals at risk for such disorders. The reliable identification of schizotypic individuals should facilitate our understanding of relevant etiological processes and ultimately hasten the development of prophylactic treatment interventions. Lenzenweger (1998) discussed the relative strengths and weaknesses of three broad (and by no means mutually exclusive) methods for identifying individuals at risk: a) familial, b) clinical, and c) psychometric-laboratory index approaches. Of the three methods, the familial is the best-known, due in large part to landmark studies of the offspring of schizophrenic patients including the work by Fish (e.g., 1987), the Copenhagen High-Risk Project (e.g., Cannon & Mednick), and the New York High-Risk Project (e.g., Erlenmeyer-Kimling et al., 1998). The clinical method identifies individuals based upon schizophrenia-spectrum diagnoses, such as schizotypal personality disorder. This method is currently employed by Cornblatt and

colleagues at the Research and Prevention Clinic at Hillside Hospital (e.g., Cornblatt, 2001). The final method involves the use of psychometrically sound research instruments designed to identify symptom, trait, neurocognitive, and biobehavioral markers of vulnerability. While all three methods have their strengths and limitations, the psychometric high-risk method provides several notable advantages. First of all, these measures can be used to screen large numbers of individuals from the general population, rather than selecting participants based upon clinical status or consanguinity. They also tend to be relatively non-invasive and inexpensive to administer and score. Finally, they can be used in conjunction with other measures of risk including family studies, as has been demonstrated by research such as the New York High Risk Project (e.g., Erlenmeyer-Kimling et al., 1993). The present project focuses on the use of symptom and trait-based screening measures in conjunction with neurocognitive measures of vulnerability.

Social Anhedonia and Schizotypy

Social isolation and disinterest in social contact (otherwise referred to as social anhedonia) are widely described as features of the prodromal, active, and residual phases of schizophrenia, as well as being central features of schizoid and schizotypal personality disorders. DSM-IV (American Psychiatric Association, 1994) indicates that social dysfunction occurs in all phases of schizophrenia. Furthermore, Blanchard et al. (2001) described that trait social anhedonia was characteristic of schizophrenia, but not mood disorders. In their classic texts, Kraepelin (1913/1919) and Bleuler (1911/1950) described asociality as characteristic of the preschizophrenic condition, as well as

characterizing non-psychotic relatives of patients. Social anhedonia played a central role in Rado's (1956) model of the development of schizophrenia, which greatly influenced Meehl's theory of schizotypy. Meehl (1962) stated that anhedonia was one of the four core symptoms of schizotypy and schizophrenia. He indicated that the anhedonia experienced by schizotypes and schizophrenic patients is primarily interpersonal (social anhedonia). According to his original formulation, all schizotypic individuals experience social anhedonia, along with other core symptoms. In a more recent formulation, Meehl (1990) assigned anhedonia a less central role in schizotypy and schizophrenia. He proposed that anhedonia is one of several polygenic traits that serve as potentiators of the risk of developing schizophrenia in schizotypic individuals. According to this revision, social anhedonia might worsen the functioning of a schizotype and even potentiate the development of a psychotic episode, but it is not a necessary feature of the preschizophrenic condition. Nevertheless, social anhedonia appears to be a useful construct for identifying schizotypic individuals.

Although social anhedonia has been identified as a key feature of schizotypy, it should not be considered synonymous with schizotypy. Social anhedonia appears to be a characteristic of schizotypy and as such it provides a point-of-entry to study the condition. Social anhedonia appears to be a promising marker of schizotypy given that it characterizes preschizophrenic functioning, schizophrenia-spectrum disorders, and non-psychotic relatives of schizophrenic patients.

Measurement of social anhedonia. Chapman, Chapman and Raulin (1976) developed the original 48-item, self-administered Social Anhedonia Scale to measure

both social anxiety and a lack of social pleasure. However, the original scale was not an

effective predictor of psychotic-like experiences. Therefore, Eckblad et al. (1982)

revised the scale by removing items that tapped social anxiety and avoidant behavior and

including additional items that tapped schizoid withdrawal. It was hypothesized that the

Revised Social Anhedonia Scale (Please see appendix A), along with the Physical

Anhedonia Scale (Chapman et al., 1976), would identify individuals at risk for negative

or deficit schizophrenia (Andreasen, 1999; Crow, 1980).

Magical ideation and social anhedonia. Chapman et al. (1994) found that

participants identified by the Magical Ideation Scale (Eckblad & Chapman, 1983), a

measure of positive schizotypy, who also scored above the mean on the Revised Social

Anhedonia Scale were at especially heightened risk for psychosis in middle adulthood,

despite the fact that these individuals were not markedly deviant in late adolescence/early

adulthood. They reported that 7 of the 33 individuals in this Magical Ideation-Social

Anhedonia subgroup (21%) developed a psychotic illness during a ten-year follow-up

period compared to 2% of the remaining Magical Ideation participants. In addition, the

remaining 26 non-psychotic participants received significantly higher ratings of

psychotic-like experiences and schizotypal symptoms, and poorer ratings of overall

functioning at the follow-up assessment than did either the remaining Magical Ideation

participants or the control participants. These findings were replicated in an independent

ten-year follow-up sample by Kwapil et al. (1997).

Longitudinal study of social anhedonia and comparison participants. Kwapil

(1998) reported findings from a ten-year longitudinal study of Social Anhedonia

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participants ($n = 34$) and comparison participants ($n = 139$). The participants were part of the Chapmans' longitudinal study of psychosis proneness (e.g., Chapman et al., 1994; Chapman & Chapman, 1987). At the follow-up assessment, 24% of the Social Anhedonia group were diagnosed with schizophrenia-spectrum disorders compared to only 1% of the comparison group, despite the fact that there had been no such difference between the groups at the initial assessment ten years earlier. The Social Anhedonia group also exceeded the comparison group on severity of psychotic-like experiences and had poorer overall adjustment at the follow-up. The groups did not differ on mood symptoms or substance use disorders at the follow-up. The findings indicated that the Revised Social Anhedonia Scale, unlike the Perceptual Aberration (Chapman et al., 1978) and Magical Ideation Scales, identified individuals at specific risk for future development of schizophrenia-spectrum disorders.

However, there were several limitations with this investigation that stemmed largely from the fact that the study was not specifically designed to investigate social anhedonia. First of all, 47% of the Social Anhedonia participants had elevated scores (standard scores of 1.96 or above) on other scales of psychosis proneness and it was not possible to fully disentangle the effects of the different scales (although conservative statistical analyses were conducted to minimize the effects of the other scales). The method of participant selection also restricted the sample sizes. Only one measure of schizotypy (the Revised Social Anhedonia Scale) was used to identify the participants, limiting the predictive quality of the study. The study also only reassessed the participants at the ten-year follow-up—thus, it was not always possible to determine

when, how, and why participants' functioning began to deteriorate during the ten-year window. Therefore, the results of this study should be regarded as preliminary.

Development of a new longitudinal study of social anhedonia. In order to address the limitations of the Kwapil (1998) study, a new prospective study of social anhedonia was initiated. The high-risk and comparison participants in this study were chosen solely by their scores on the Revised Social Anhedonia scale, and the study included multiple predictor measures from multiple domains, with the goal of more frequent reassessments. Diaz, Dickerson, and Kwapil (2002) reported findings from the cross-sectional study comparing Social Anhedonia (*n*=78) and comparison participants (*n*=68). As hypothesized, the Social Anhedonia participants appeared deviant on measures of schizotypy relative to the comparison group. These measures included psychotic-like experiences, negative symptoms, and ratings of schizotypal, schizoid and paranoid symptoms. The Social Anhedonia group also exhibited impaired executive functioning as measured by the Wisconsin Card Sorting Task (WCST; Heaton, 1993) and deficits in sustained attention as measured by the Continuous Performance Test-Identical Pairs version (CPT-IP; Cornblatt, Risch, Faris, Friedman, Erlenmeyer-Kimling, 1988). These neurocognitive deficits are seen in patients with schizophrenia and schizotypal personality disorder and the findings support the idea that the Social Anhedonia Scale identifies individuals that fall on the schizotypic continuum. The Social Anhedonia group had poorer overall social functioning relative to the comparison group. As expected, none of the students were psychotic at the initial assessment. However, two of the anhedonic participants met criteria for schizophrenia-spectrum disorders (paranoid

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and schizoid personality disorders). Finally, as predicted, the groups did not differ on rates of substance/drug use or mood disorders.

In summary, the cross-sectional results supported and extended findings from previous studies employing the Revised Social Anhedonia Scale. As hypothesized, the cross-sectional assessment indicated that the Social Anhedonia group already exhibited higher ratings of psychotic-like experiences, negative symptoms, and schizotypal, schizoid, and paranoid symptoms. Consistent with previous findings, the Social Anhedonia group showed impaired performance on neurocognitive measures of schizotypy. Lastly, the Social Anhedonia group exhibited poorer overall functioning than the comparison group, despite the fact that all of the participants were functioning well enough to be enrolled as college students at the time of the assessment. These patterns of impairment are similar to profiles of schizophrenia patients (Weinberger, Aloia, Goldberg & Berman 1994; Nuechterlein et al., 1998) and schizotypic participants (Barrantes-Vidal et al., 2002; Gooding et al., 2002), providing further support that the Revised Social Anhedonia Scale is useful for identifying schizotypic individuals.

Goals and Hypotheses of the Proposed Study

The specific goal of the present study was to conduct a longitudinal reassessment of the Social Anhedonia and comparison participants examined by Diaz et al. (2002). Of particular importance was the examination of the extent to which the other measures of schizotypy augment the prediction of impairment from the cross-sectional assessment. The effects of life events were also examined.

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Hypothesis 1: **The Social Anhedonia group will continue to demonstrate schizotypic adjustment relative to comparison participants at the follow-up assessment.** Specifically, the Social Anhedonia group will exhibit elevated rates of psychotic-like, negative, schizotypal, schizoid, and paranoid symptoms relative to the comparison group. While some schizotypes are expected to have worsening symptoms from the initial to the follow-up assessment, it is not expected that there will be a main effect for the time of assessment or a group x time interaction, but there is expected to be a main effect for group. While it is ultimately hypothesized that the social anhedonia group will demonstrate worsening symptoms of schizotypy at future assessments (i.e., a group x time interaction), this interaction is not necessarily expected to be significant at such an early reassessment. However, it is expected that significant main effects for group will be observed.

Hypothesis 2: **The Social Anhedonia group will be at increased risk for developing schizophrenia-spectrum disorders at follow-up assessments.** Conservatively, it is expected that only a few participants will have transitioned into spectrum disorders at the time of the three-year reassessment. Furthermore, it is expected that the majority of these participants will be in the Social Anhedonia group. Chapman and Chapman (1987) reported that three participants out of 150 from their high-risk group had developed psychosis compared to none from the control group in a similar two-year follow-up study of college students. Additionally, nine of the participants were experiencing marked psychotic-like symptoms that had not yet required psychiatric attention. Likewise, in the present study, the proposed reassessment is only partway into

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the age of risk for developing schizophrenia and related disorders and we expect that only a few participants will have developed schizophrenia-spectrum disorders. However, it is expected that participants with spectrum disorders will be members of the Social Anhedonia group.

Hypothesis 3: **Social Anhedonia participants who also appear deviant on interview, psychometric, and neurocognitive measures at the cross-sectional assessment will be at heightened risk for impairment at the follow-up assessment.** It is hypothesized that participants who reported a combination of schizotypic symptoms, neurocognitive impairment, and social dysfunction at the initial assessment will experience elevated rates of schizotypic symptoms and spectrum disorders at the follow-up assessment. A participant who is impaired in many areas (neurocognitive, emotional, and social) will likely experience more impairment in daily life. Additionally, impairment in multiple areas may be indicative of a higher loading for schizophrenia-spectrum disorders and a poorer prognosis. It is specifically hypothesized that neurocognitive deficits will facilitate the identification of negative symptoms as the follow-up. Consistent with the findings of Chapman et al. (1994), it is hypothesized that scores on the Magical Ideation Scale will increment the prediction of psychotic-like and schizotypal symptoms at the reassessment.

Hypothesis 4: **Negative life events will be differentially associated with worsening schizotypic adjustment in the Social Anhedonia participants relative to the comparison participants.** Clearly, negative life events can be deleterious for anyone, but it is hypothesized that these events will differentially push our high-risk

participants towards the development of spectrum disorders and elevated schizotypic symptoms. Past research indicates that individuals with schizophrenia or schizotypy often have family members with schizophrenia-spectrum disorders, or at the very least show schizotypic traits (Cadenhead et al., 2000). Using the same model of bi-directionality and depression, schizotypic children could possess through genetic loading the potential to contribute to the experience of an increased number of stressful life events. In fact, it is thought that people with schizotypy may be abnormally sensitive to the impact of stressful life events. Given the findings on bi-directionality in depressed women, it could be hypothesized that schizotypes contribute to worsening of their illness by their personal characteristics, symptoms, behaviors and social context. A person with burgeoning illness is likely to display outward symptoms that cause those around them to react with concern or avoidance. This is especially true with schizotypy, due to the strange nature of the behaviors often displayed, like magical thinking, unusual perceptual experiences, and erratic behavior. When a person is displaying these odd behaviors, family, friends and co-workers are likely to respond with concern or even guardedness. The pre-schizophrenic may interpret their reaction in a paranoid and or suspicious manner, and may further withdraw or behave in a way that is perceived as odd. This causes increased concern and or guardedness by those around them (friends, family, and co-workers), which keeps the cycle in motion.

Hypothesis 5: **The ratings of schizophrenia-spectrum symptoms will be stable from the cross-sectional assessment to the follow-up assessment.** Negative, schizotypal, schizoid, and paranoid features are expected to be trait-like or enduring

characteristics. Therefore, it is expected that they will demonstrate stability across the two assessments *at the individual level*. The propensity to experience positive, psychotic-like experiences is also expected to be enduring, although the actual experiences tend to be more transient or episodic. Therefore, modest stability is expected for these ratings (albeit less than for the above-listed features).

    Hypothesis 6: **The Social Anhedonia and comparison groups will not differ on rates of major mood disorders and/or substance use/abuse.** This hypothesis is based on findings from Kwapil (1998) where no differences were found when comparing a social anhedonia and a control group.

CHAPTER II

METHOD

Participants

    Original sample. Participants from Diaz, Dickerson and Kwapil's (2002) cross-sectional assessment were invited to take part in the study. These individuals were initially selected on the basis of their scores on the Revised Social Anhedonia Scale from undergraduate students enrolled in General Psychology courses at the University of North Carolina at Greensboro between Fall 1999 and Spring 2001. Students who received standard scores of at least 1.96 on the Revised Social Anhedonia Scale and comparison participants who received standard scores of less and 0.5 on the measure were invited to participate. All of the students who qualified for the Social Anhedonia group were invited to participate, while a subset of comparison participants were selected by a semi-random procedure. When a Social Anhedonia participant was identified, the next comparison participant on the sequential list was selected. This insured that the pairs of Social Anhedonia and comparison participants came from the same mass-screening session and took approximately the same amount of time to complete the measures. Standard scores were computed separately by gender and ethnicity based upon the norms provided in Kwapil, Crump and Pickup (2002).

The cross-sectional sample included 78 Social Anhedonia participants (18 male, 60 female) and 68 comparison participants (14 male, 54 female). While attempts were made to recruit comparable numbers of male and female participants, the preponderance of female participants reflects the characteristics of the student body at UNCG. The sample was limited to Caucasian and African-American students because reliable norms for the Social Anhedonia Scale have not been established for other ethnic groups. The groups did not differ on age, ethnic or gender composition, years of education, or parental social position at the initial assessment.

Participants in Present Study

Every effort was made to relocate and contact the participants from the original sample to be included in the follow-up assessment. The present study reassessed 52 Social Anhedonia participants (67%) and 47 comparison participants (69%) from the original sample. Despite a strict searching protocol, at the present time we have been unable to re-contact 37 participants, and 10 participants have refused to participate. Please refer to Table 1 for the demographic characteristics of the Social Anhedonia and comparison groups at the current assessment. The groups did not differ on any of these characteristics.

Effects of attrition. The Social Anhedonia and comparison groups did not differ in terms of the proportion of participants lost to attrition, Fisher's Exact test = 1.0**.** In order to further assess the effects of attrition, a series of 2 (group) x 2 (attrited/followed) ANOVAs were computed for age, global adjustment, and psychotic-like, schizotypal, and negative symptoms at the initial assessment. Only the attrited x group interaction and the

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main effect for attrition were interpreted for these purposes (the main effect for group simply restated the findings from the cross-sectional assessment). There was not a significant interaction for age at the initial assessment, however, there was a significant main effect for attrition $F(1,144) = 8.52$, $p < .01$, with participants lost to attrition ($M = 21.6$, $SD = 6.3$) being older at the initial assessment than reassessed participants ($M = 19.4$, $SD = 2.8$). This suggests that younger participants were more likely to still be at the University at the time of the reassessment. Neither the interaction nor the main effect for attrition were significant for the analyses of global adjustment or any of the symptom ratings, indicating that the followed-up and attrited participants did not differ on schizotypic psychopathology at the initial assessment. Likewise, the followed-up and attrited participants did not differ on ethnic, chi-square(1) = .90, or gender composition, chi-square(1) = .79.

Materials

Participants were administered a structured diagnostic interview at the follow-up assessment. The interview was comparable to the interview administered at the initial assessment, although the follow-up interview was generally limited to inquiring about events and experiences since the time of the initial assessment. A copy of the interview is provided in Appendix A. The following interview measures were used in the present study:

Wisconsin Manual for Assessing Psychotic-like Experiences. The Wisconsin Manual for Assessing Psychotic-like Experiences is an interview-based rating system designed to quantify the deviance of psychotic symptoms across a broad range of clinical

and subclinical deviance. The manual provides criteria for rating seven classes of experiences on a continuum from relatively normal to grossly psychotic. The seven types of experiences are: 1) transmission of one's own thoughts, 2) passivity experiences, 3) thought withdrawal, 4) voice experiences and other auditory hallucinations, 5) other personally relevant aberrant beliefs, 6) visual hallucinations and other visual experiences, and 7) olfactory experiences. Experiences of mild or transient forms of psychotic symptoms in non-psychotic persons have been long thought of as precursors of clinical psychosis (Kraepelin, 1913/1919; Bleuler 1911/1950; Gillies, 1958; Hoch & Cattell, 1959; Meehl, 1962). Kwapil, Chapman, and Chapman (1999) reviewed the rating system and reported that it was especially useful for identifying psychosis-prone individuals within a previously selected high-risk group. The Wisconsin Manual has good interrater reliability (.78 to .81) and excellent coefficient alpha reliability (.94).

Negative Symptom Manual. The Negative Symptom Manual, which provides a companion rating system to the Wisconsin Manual, quantifies negative symptoms of schizophrenia across a range of clinical and subclinical deviance. The Negative Symptom Manual consists of a structured interview and rating manual that assess six classes of symptoms across a range of clinical and subclinical deviance: alogia, flattened affect, anhedonia, social indifference, avolition/anergia, and impairment in attention. Preliminary findings (Kwapil, 1999) suggest that the manual is especially useful for quantifying the deviance of schizotypic college students. Interrater reliability for the manual was .94, test-retest reliability was .78 (across a six-week period), and the internal consistency for the six classes of symptoms was .72 (Kwapil & Dickerson, 2001).

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International Personality Disorder Examination. The sections of the International Personality Disorder Examination that assess schizophrenia-spectrum personality disorders (schizoid, schizotypal, and paranoid personality disorders) were included in the interview. These personality disorders were assessed because they have been reported to be genetically related to schizophrenia (e.g., Kety et al., 1968; Kendler, 1988; Gottesman, 1991). The International Personality Disorder Examination provides diagnoses of personality disorders, as well as dimensional ratings of the disorders. Loranger et al. (1994) reported that it has adequate interrater reliability and temporal stability based upon international field trials.

Structured Clinical Interview for DSM-IV. The interview also contained the overview, mood episode, and substance use disorders section of the Structured Clinical Interview for DSM-IV (SCID-IV; First, Spitzer, Gibbon, & Williams, 1995). The SCID-IV is widely used and has adequate reliability and validity for assessing psychopathology in nonpatient and patient samples. The Global Assessment Scale (GAS; Endicott, Spitzer, Fleiss, & Cohen, 1976) was used to assess overall functioning for each participant. The GAS is a rating of overall adjustment ranging from marked psychopathology at the low end to superior functioning at the high end. Parental socioeconomic status was computed using the Hollingshead Two-Factor Index of Social Position. The Index of Social Position is a weighted composite measure of occupation and education (with higher scores indicating lower social position). Parental socioeconomic status was used to provide an index of the participants' backgrounds.

The following questionnaires were used in the study:

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Perceived Stress Scale. The Perceived Stress Scale (PSS; Cohen, Kamarck & Mermelstein, 1983) is a two-part, 14-item self-report questionnaire that measures 1) the degree to which a person perceives situations in their life to be stressful and 2) coping strategies that are used to deal with stressors in their life. Respondents are requested to recall a period of one month when answering the questions. There are five choices on the likert scale from 0 (never) to 4 (very often), yielding a possible range of scores from 0-56, with higher scores indicating more perceived stress. The scale has good internal consistency (.80) and test-retest reliability (.85).

Recent Life Changes Questionnaire (RLCQ). The Recent Life Changes Questionnaire (Holmes & Rahe, 1967) is an 87-item self-report questionnaire that measures recent life changes in the areas of family, marriage, occupation, economics, residence, group and peer relationships, education, religion, recreation and health. The scale has been used in a variety of health domains and has excellent reliability (Miller & Rahe, 1997). Items are weighted depending on the severity of the events, and the weighted scores are summed to produce a total score. The PSS and RLCQ are provided in Appendix C.

Procedure

Method of relocation We attempted to relocate all of the original Social Anhedonia and comparison group participants to invite them to participate in the follow-up assessment. The following procedures were undertaken to relocate the participants:

1) Participants provided their name, social security number, current phone number and their parents' names, address and telephone number at the initial screening. The first step was

to contact the number given by the student. If that number was unsuccessful, the parents would be contacted to provide a current contact number and/or address.

2) The following directories were employed to search for the participants and their parents:

a) University of North Carolina at Greensboro student/faculty/staff online directory.

b) Local telephone directories.

c) Internet directories (Yahoo people search, 411 white pages).

d) The University of North Carolina at Greensboro Alumni Association provides contact information for individuals that have graduated and who maintain their alumni records.

e) The Social Security Locator Service forwards letters to individuals on behalf of the University.

Participants were invited to take part in a two-part assessment: questionnaires and a structured diagnostic interview. These administrations usually took place in the University of North Carolina at Greensboro Department of Psychology. Some participants were unable or unwilling to return to Greensboro to take part in the experiment and arrangements were made to travel to their location.

A licensed clinical psychologist and clinical psychology graduate students conducted the interviews, which typically lasted one to two hours. The questionnaires took about 20 minutes to complete. The schedulers, testers, interviewers, and raters were unaware of the participants' group membership. Students received payment ($25.00) for their participation. The participants were asked to provide their informed consent at all steps of the study.

CHAPTER III

RESULTS

Comparison of Social Anhedonia and Comparison Groups on Measures of Schizotypy

Hypothesis 1 stated that the Social Anhedonia group would demonstrate schizotypic adjustment relative to comparison participants. In order to minimize the likelihood of making Type I errors, a 2 (group) x 2 (time of assessment) multivariate analysis of variance (MANOVA) was computed for the five-interview measures of schizotypy (psychotic-like, negative, schizotypal, schizoid, and paranoid symptom ratings). Table 2 presents the means and standard deviations for the groups on these measures at each assessment. Neither the assessment x group interaction, Wilks' Lambda = .96, $F(5,93) = .78$, nor the main effect for assessment, Wilks' Lambda = .90, $F(5,93) = 2.16$, were significant. However, as hypothesized the main effect for group was significant, Wilks' Lambda = .60, $F(5,93) = 12.52$, $p < .001$. Given the significant main effect for group in the MANOVA, group comparisons were examined separately for each of the five dependent measures. The Social Anhedonia group exceeded the comparison group on ratings of psychotic-like experiences, $F(1,97) = 25.56$, $p < .001$, negative symptoms, $F(1,97) = 39.87$, $p < .001$, and IPDE schizotypal, $F(1,97) = 34.87$, $p < .001$, schizoid, $F(1,97) = 28.81$, $p < .001$, and paranoid, $F(1,97) = 20.50$, $p < .001$, dimensional scores.

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A separate group x time of assessment ANOVA was calculated for the GAS score. As hypothesized, the group x assessment interaction was not significant. However, both the main effects for assessment, $F(1,97) = 5.78, p < .05$, and group, $F(1,97) = 54.76, p < .001$, were significant, with poorer functioning overall reported at the initial assessment and with the Social Anhedonia group exhibiting poorer functioning than the comparison group.

Fisher's Exact test was used to evaluate the second hypothesis that the Social Anhedonia group would be at increased risk for developing schizophrenia-spectrum disorders at the follow-up assessment. Four of the Social Anhedonia participants (8%) and none of the comparison participants reported spectrum disorders at the follow-up. These included one participant each with schizophreniform disorder, delusional disorder, paranoid personality disorder, and schizoid personality disorder. However, the statistical comparison of the groups on rates of schizophrenia-spectrum disorders was not significant, Fisher's exact test = .13.

In order to rule out that the findings of elevated schizotypic symptoms in the Social Anhedonia group were not simply due to the inclusion of four participants with schizophrenia-spectrum disorders, the calculations listed above were recomputed with these four participants omitted. The results were substantively unchanged.

Prediction of Psychopathology at the Follow-up Assessment

Multiple regression analyses were computed to examine the extent to which a combination of measures potentiated the identification of negative, schizotypal and psychotic-like symptoms, and the diagnosis of spectrum disorders at the follow-up in the

Social Anhedonia group (as described in the third hypothesis). In order to minimize excessive *post hoc* exploratory analyses and the likelihood of committing a Type I error, the regressions were limited to these four analyses based on *a priori* hypotheses. Table 3 outlines the increments in variance accounted for at each step of the analyses. In the case of the three symptom criterion measures, the symptom level at the initial assessment was entered at the first step of the regression, in order to examine the extent to which additional predictors accounted for symptoms at the follow-up, over-and-above the level of the symptoms at the initial assessment. Moreover, entering the symptom level of the initial assessment at the first step allowed examination of worsening symptoms over time, which was apparent in each of the regressions. In each of the four regressions, specific predictors were used based on research supporting differential responding patterns found in negative and positive schizotypy. Additionally, on all the regressions computed, the predictors are defined as cross-sectional and the criteria are defined as longitudinal.

As seen in Table 3, initial Negative Symptom Manual total score, continuous performance test (CPT) score, and the interaction of the two variables accounted for significant variance in Negative Symptom Manual total score at the follow-up assessment. The full 7-variable model accounted for 55% of the variance in Negative Symptoms. The WCST was only used in the first regression (Negative Symptom Manual total score) as a predictor. Research has suggested that the WCST is a trait marker of schizophrenia-spectrum disorders, specifically manifestations characterized by increased negative symptoms.

The second regression used the follow-up schizotypal dimensional score as the dependent measures. The initial schizotypal dimensional score, Magical Ideation scale score and the CPT performance, along with the interaction terms, were the predictors. The full 7-variable model accounted for 41% of the variance in schizotypal dimensional score. Both initial schizotypal dimensional score and the interaction of schizotypal dimensional and Magical Ideation accounted for significant variance in the prediction of the follow-up schizotypal dimensional score. Ratings of psychotic-like experiences at the follow-up assessment was the criterion in the third analysis. Initial ratings of psychotic-like experiences and the CPT x Magical Ideation interaction accounted for significant increments in variance. The full model accounted for 42% of the variance in psychotic-like experiences at the follow-up.

The final regression used the diagnosis of any spectrum disorder as the dependent measure, while the initial schizotypal dimensional score, Magical Ideation score, CPT and the interaction terms were used as the predictors. The full 7-variable model accounted for 69% for the variance. Initial schizotypal score, CPT, and all of the two-way interactions accounted for significant variance in predicting the diagnosis of any spectrum disorder at the follow-up. Note that the regression weights for each of the significant interactions in all four analyses indicated that in every case it was the combination of poorer performance/higher symptoms at the cross-sectional assessment that was associated with poorer outcome at the follow-up assessment.

Schizotypy, Life Events, and Perceived Stress

The Social Anhedonia and comparison groups were compared on the RLCQ and

PSS total scores and subscales. Table 4 presents the means and standard deviations for

the groups. The groups did not differ on any of the RLCQ indices. However, the Social

Anhedonia group exceeded the comparison group on the PSS total score, $t(90) = 3.00, p$

$< .01$; subscale 1, $t(90) = 3.01, p < .01$, and subscale 2, $t(90) = 1.91, p < .10$.

In order to test the fourth hypothesis, four multiple regression analyses were

computed to examine the extent to which life events and perceived stress potentiated the

identification of psychotic-like, negative, and schizotypal symptoms, and the diagnosis of

any spectrum disorders in the entire sample. The group codes were used as predictors in

all four of the regressions in order to determine whether group membership influenced.

In each case, the group code, PSS total, RLCQ total, along with the interaction terms,

were the predictors (the PSS x RLCQ interaction was not included because it did not

directly assess the hypothesis). The first regression used the follow-up negative symptom

score as the dependent measure. Table 5 outlines the increments in variance accounted

for at each step of the analyses. The full 6-variable model accounted for 27% of the

variance in 3-year follow-up negative symptom score. Only the group code accounted

for significant variance. The second regression used the follow-up Schizotypal

dimensional score as the dependent measure. The full 6-variable model accounted for

39% of the variance in 3-year follow-up Schizotypal dimensional score. Group code,

PSS total, Group x PSS interaction and the Group x RLCQ x PSS interaction term all

accounted for significant variance in the prediction of 3-year follow-up schizotypal

dimensional score. The three-way interaction indicated that within the Social Anhedonia group, symptoms were associated with high levels of perceived stress, but low levels of major life events.

The third regression used 3-year follow-up psychotic-like experiences as the dependent measure. The full 6-variable model accounted for 21% of the variance in 3-year follow-up psychotic-like experiences. Both group code and PSS total accounted for significant variance in the prediction.

The final regression used diagnosis of any spectrum disorder as the dependent measure. The full 6-variable model accounted for 37% of the variance in the diagnosis of any spectrum disorder at the reassessment. PSS total and the interaction of Group x PSS x RLCQ both accounted for significant variance in the prediction of 3-year follow-up Any Spectrum disorder. Again the three-way interaction indicated that it was the combination of Social Anhedonia group membership with high perceived stress and low levels of life events that predicted spectrum disorders.

Stability of Schizotypic Symptoms Across the Three-Year Interval

Pearsonian correlations were used to test hypothesis five, that the ratings of schizophrenia-spectrum symptoms would be stable from the cross-sectional assessment to the follow-up assessment. As hypothesized, the scores at the follow-up were significantly correlated with the initial assessment on psychotic-like experiences, $r(97) = .52, p < .001$; negative symptom manual, $r(97) = .66, p < .001$; schizotypal dimensional score $r(97) = .59, p < .001$; and schizoid dimensional score $r(97) = .60, p < .001$. The

paranoid dimensional scores demonstrated a trend towards significance, $r(97) = .18$, $p <$ .10.

Assessment of Mood Disorders and Substance Use

Hypothesis 6 stated that the Social Anhedonia and comparison groups would not differ on rates of major mood disorders or ratings of substance use/abuse. Fisher's Exact test was used to test group differences on rates of mood disorders. Depressive episodes were found in 26% of the Social Anhedonia group compared to 15% of the comparison group, Fisher's Exact test = .23. One participant in each group reported experiencing a manic episode, Fisher's Exact test = 1.00.

A 2 (group) x 2 (time of assessment) MANOVA was computed for the four ratings of alcohol and drugs use and impairment. Table 6 presents the means and standard deviations for the groups on these measures at each assessment. In support of the hypothesis, there was neither a significant interaction, Wilks' Lambda = .93, $F(4,93)$ = 1.67, nor main effect for group, Wilks' Lambda = .96, $F(4,93) = 0.93$. There was a main effect for assessment, Wilks' Lambda = .77, $F(4,93)$, $p < .001$, with the comparison group reporting higher rates at the follow-up assessment. However, given that the main effect for time of assessment was not relevant to the hypothesis of the study, this effect was not examined in the individual ANOVAs for the four variables.

CHAPTER IV

DISCUSSION

The present study examined the relationship between Social Anhedonia and schizotypy and offers the following observations. Three years ago a sample of purported high-risk and comparison participants were identified by their scores on the Revised Social Anhedonia Scale for inclusion in a longitudinal study of schizotypy. At the initial assessment, the Social Anhedonia group already exhibited impairment on measures of schizotypic psychopathology. In fact, the Social Anhedonia subjects exhibited mild forms of impairment that are commonly seen in full-blown Schizophrenia, further supporting the construct of schizotypy as an underlying vulnerability that expresses itself over a continuum of adjustment. At the follow-up assessment the Social Anhedonia group continued to exhibit this pattern of schizotypic impairment, suggesting that the deficits are stable over time. Moreover, reports of increased perceived stress augmented the prediction of schizotypic impairment, indicating a bi-directional relationship between stress and adjustment in the Social Anhedonia group.

These findings lend support to the utility of the psychometric high-risk method and indicates that it is possible to identify young adults at risk for schizophrenia-spectrum disorders using the psychometric high-risk method, in this case the Revised Social Anhedonia Scale. The Revised Social Anhedonia Scale appears to be useful in

identifying a high-risk group experiencing both positive and negative symptoms, which seem to indicate a higher risk for developing schizophrenia-spectrum disorders than positive symptoms alone do.

The early identification of individuals at risk for schizophrenia and related disorders holds the promise of facilitating the identification of relevant etiological factors and may ultimately hasten the development of prophylactic treatment interventions. Furthermore, this strategy allows us to examine potential etiological factors relatively untainted by the consequences of such disorders, like social stigma, hospitalization and effects from medications. Studying Social Anhedonia participants, who are purported to be at high-risk for schizophrenia-spectrum disorders, but not yet psychotic, allows us to study the disorder before the secondary effects occur (e.g., hospitalization, side effects from medications). The results of the present study support and extend previous findings that the Revised Social Anhedonia Scale is a useful marker of schizotypy.

The goals of the present study were to: 1) replicate and expand upon the findings from Kwapil (1998) that young adults identified by the Revised Social Anhedonia Scale exhibit psychotic-like symptoms and deficits, 2) to conduct a longitudinal reassessment of the Social Anhedonia and comparison participants examined by Diaz et al. (2002), and 3) to examine the effects of negative life events. It should be noted that this is the first study to conduct an exhaustive, multidimensional longitudinal assessment battery with young adults identified by the Revised Social Anhedonia scale.

Social Anhedonia and Schizotypy

Three years ago at the initial assessment, the Social Anhedonia participants exceeded the comparison participants on the five ratings of schizotypy: psychotic-like symptoms, negative symptoms, schizotypal, schizoid and paranoid symptoms (Diaz, Dickerson & Kwapil, 2002). The first hypothesis predicted that the Social Anhedonia group would continue to demonstrate schizotypic adjustment relative to the comparison participants at the follow-up assessment. As hypothesized, at the follow-up assessment, the Social Anhedonia group continues to exceed the comparison group in schizotypic experiences and adjustment, including negative symptoms, psychotic-like experiences and symptoms related to schizophrenia-spectrum disorders. At further assessments, we expect that the Social Anhedonia group will continue to exceed the comparison group on rates of schizotypic symptoms, with a greater divergence between the groups as they pass through the window of risk for developing schizophrenia

This pattern was observed with GAS scores as well; where the Social Anhedonia group continued to exhibit more impairment in daily functioning than the comparison group. At the follow-up assessment the comparison group had a GAS score indicating a high level of functioning, with little or no difficulties. However, the Social Anhedonia group had a GAS score indicating a lower level of functioning, with moderate difficulties, leading to impairment in one or more areas of functioning. This suggests that the higher levels of schizotypic symptoms experienced by the Social Anhedonia group is causing impairment in their daily functioning.

In summary, our Social Anhedonia participants exhibited a wide array of symptoms associated with schizotypy. This particular pattern of impairment and symptomology is consistent with profiles of schizophrenia patients (Weinberger, Aloia, Goldberg & Berman, 1994; Nuechterlein et al., 1998) and schizotypic participants (Barrantes-Vidal et al., 2002; Gooding et al., 2002) and suggests schizotypic adjustment in our purported high-risk participants. Moreover, these findings are consistent with Meehl's theory of a continuum of schizotypic adjustment (Meehl, 1990).

The Revised Social Anhedonia Scale only assesses asociality and disinterest in social contact—experiences that are consistent with negative symptoms. However, at both assessments, participants identified by high scores on the scale exhibited both positive and negative symptoms of schizotypy relative to the comparison group. Furthermore, the scale consistently correlates with questionnaire measures of both positive and negative schizotypy. This may explain why the measure is a more potent predictor of schizophrenia-spectrum disorders than other measures that only tap one dimension of schizotypy. The fact that the content of the items only appears to tap negative schizotypy may suggest, consistent with Faraone, Green, Seidman, and Tsuang, (2001) that negative symptoms are the core deficit in schizotypy. This also has the advantage that the content of the scale is less deviant than measures that assess positive symptoms such as unusual perceptual experiences and strange beliefs. As a result, it is less likely to be influenced by defensive response styles.

In addition to increased symptoms of schizotypy and impairment in daily functioning, the Social Anhedonia group (8%) exceeded the comparison group (0%) on

rates of schizophrenia-spectrum disorders. At the follow-up, four diagnoses were made from the Social Anhedonia group, including schizophreniform disorder, delusional disorder, paranoid personality disorder, and schizoid personality disorder. This finding is especially striking given that three years earlier all the study participants were functioning well enough to attend a major university. This follow-up assessment is still early in the window-of-risk for the participants and higher rates of schizophrenia-spectrum disorders are predicted at future assessments, as was found in Kwapil (1998). This is especially so due to the demographic makeup of the sample, being predominantly female, and not yet fully into the window of risk, which is typically thought to be in the late twenties to early thirties (Gottesman, 1991). Additionally, as all the participants in the study have gained entry into a major university, it suggests that the present sample is particularly high functioning, which indicates a later onset of illness.

Numerous studies have advocated for the need to assess the "stress" in "diathesis-stress" models of schizophrenia. However, psychosocial stress has generally been overlooked in this era of molecular studies. Corcoran et al., (2003) discussed the importance of a study that examines the role of life events in the development of schizophrenia. This is the first psychometric high-risk study to examine the experience of life events and their effect on functioning in schizotypic young adults. The finding in the present study indicates that schizotypic young adults report more stress than their nonschizotypic peers, despite that they did not report experiencing more significant life events and stressors. Furthermore, this perceived stress augmented the prediction of schizotypic psychopathology.

There is a strong literature that supports a diathesis-stress model in the development of schizophrenia and spectrum disorders, in which environmental factors play a necessary role (Corcoran et al., 2003; Gooding and Iacono, 1995). Yet, the present study and others do not find that persons at risk for schizophrenia report higher rates of life events. The question remains - are events perceived as more stressful to schizotypic individuals? And does this perceived stress contribute to the development of schizotypic symptoms? In the present study a measure of perceived stress was utilized in order to examine these questions. The Social Anhedonia group exceeded the comparison group on the measure, indicating greater levels of perceived (and possibly actual) difficulties in dealing with stress that they encounter in their lives. Additionally, their health habits (working out, getting enough rest, using social support available and eating well) were lacking when compared to the comparison group. This suggests that schizotypic young adults might feel less capable of dealing with stress that they experience and use less coping-focused activities and resources.

Interestingly, the results indicated that a combination of higher perceived stress and fewer life events are associated with higher rates of schizotypic symptoms in the Social Anhedonia group. The decreased level of life events may suggest a pattern of disengagement from world that may be influenced both by schizotypic tendencies and perceiving the world as stressful and unsafe. Individuals who are anhedonic by definition seek to avoid social contact and are not stimulation seeking. Thus schizotypic individuals may disengage from the world because social contact is not reinforcing and because the world seems hostile and intrusive. This stress may worsen their schizotypic symptoms,

which in turn leads to further disengagement, and further deterioration of their functioning. This conjecture is consistent with the findings of Kwapil (1998), who reported that Social Anhedonia participants experienced worsening schizotypic symptoms and higher rates of spectrum disorders after they left the structure provided by their home of origin and their university.

It was reported throughout the interview process that the Social Anhedonia group had fewer friends and family members that they were willing to approach as a source of support. The participants reported feeling suspicious of sharing their private feelings, fearing harm and or punishment. Additionally, they reported not feeling pleasure or joy from contacts with friends and family and subsequently avoided social contact. This lack of social support, whether due to paranoia or anhedonia, equips them with less coping mechanisms to deal with the stressors they encounter (Kwapil, 1998). Furthermore, the Social Anhedonia group reported feeling more stress and less ability to cope with the experiences in their life. This subjective report of increased perceived stress coupled with low amounts of social support could very likely put the Social Anhedonia participants at much higher risk for schizophrenia-spectrum disorders in the future.

The Social Anhedonia group did not report higher rates of alcohol and drug use than the comparison group. This finding is not surprising given the low sensation-seeking behavior of Social Anhedonics in general. However, the literature in this area suggests that persons with mental illness do tend to use/abuse substances as a form of self-medication (Bowers et al., 2001; Allebeck, 1999; & Tanda, Pontieri and DiChiara, 1997). It may be that the Social Anhedonia group, due to their low-sensation seeking

behavior, engages less in substance use as a form of self-medicating. This may prove to serve as a protective factor, as substance abuse in high-risk groups can be a potentiating factor for future psychotic break (MacCabe et al., 2002; Miller et. al., 2001; Tsuang, Simpson, and Kronfol, 1982).

Integration of Measures from Multiple Domains

While the Revised Social Anhedonia scale has been a useful predictor of group differences in schizotypy, it is not an adequate predictor of individual differences. It is hypothesized that the combination of predictor measures from multiple domains will improve the prediction of psychosis-prone individuals. These analyses were limited in number to avoid excessive *post hoc* comparisons. The first regression examined the extent to which neurocognitive measures, the CPT and WCST, would increment the prediction of follow-up NSM scores. The CPT and WCST were added to this study because of their strength in previous literature as indicators of deficits in frontal lobe and attention that is commonly seen in those who are psychosis-prone (Diaz, Dickerson & Kwapil, 2002; Vollema & Postma, 2002; Gooding, Tallant, & Hegyi, 2001). This study found that the CPT did augment the prediction of follow-up negative symptom manual score. Additionally, the CPT accounted for significant variance in the prediction of any spectrum disorder, and psychotic-like experiences at the follow-up assessment. Surprisingly, the WCST did not significantly augment the prediction of negative symptom score. However, consistent with Cornblatt (1988), the WCST may be a better episodic marker of schizophrenia rather than a vulnerability marker. These findings

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provide support for the idea that the CPT, paired with interview measures of schizotypy is a powerful predictor of psychosis-proneness.

Interaction terms including the Magical Ideation score accounted for significant variance in the prediction of any spectrum disorder, psychotic-like experiences and schizotypal dimensional score at follow-up. This finding is not surprising as the Magical Ideation scale taps symptomology found in those diagnosed with spectrum disorders and reporting psychotic-like experiences.

Based on the findings from this study, it appears that CPT performance and PSS scores might be potential predictors of schizotypic adjustment, particularly schizotypal dimensional score, any spectrum disorder diagnosis and psychotic-like experiences. The CPT also contributed to the prediction of negative symptom scores. Specifically, membership in the Social Anhedonia group, deviant performance on the CPT, and higher perceived stress scores seem to suggest higher rates of schizotypic adjustment and to be a particularly strong combination of predictors. Use of these measures in a screening battery will provide additional power in identifying those purported to be at high-risk for developing schizophrenia-spectrum disorders.

Stability of Schizotypy Symptoms

Hypothesis five predicted that the ratings of Schizophrenia-spectrum symptoms and disorders would be stable from the cross-sectional to the follow-up. The correlational results indicated that psychotic-like experiences, negative symptoms, schizotypal and schizoid dimensional scores all remained stable from the cross-sectional to the three-year follow-up assessment, indicating that schizotypy symptoms are trait-like

or enduring characteristics. Contrary to the hypothesis, the paranoid dimensional scores only neared significance. These findings support the idea that schizotypic adjustment is a stable phenomenon, not state-like, as is found in depression (Blanchard, Horan & Brown, 2001). At further assessments, we expect that the rate of schizotypic symptoms experienced by the Social Anhedonia's group will continue to exceed the comparison group (Chapman et al., 1994). In fact, at further assessments it is predicted that there will be not only a main effect for group, but also a group x time interaction as well, with the Social Anhedonia group experiencing more symptoms.

In conclusion, at the three-year follow-up, the Social Anhedonia group continued to exhibit higher rates of schizotypy symptoms such as psychotic-like experiences, negative symptoms, and schizotypal, schizoid and paranoid dimensional scores. These symptoms appear to contribute to impaired daily functioning in the Social Anhedonic group as indicated by the significantly lower GAS. The scores on the PSS suggest that the Social Anhedonia group does not feel capable of handling the stress that they encounter. However, the Social Anhedonia group tended not to use substances at a higher rate that the comparison group, which might put them at a higher risk for developing spectrum disorders at a future date. The present study identified the CPT and PSS as potential predictors of psychosis-proneness.

Limitations to the Study

There has been criticism of using college freshmen as a subject pool, as they are purported to be higher functioning than others in their cohort that do not attend university (Cadenhead, Kumar & Braff, 1996). The results of the study demonstrated that despite

admission to a university, a high-risk group was clearly identified. This high-risk group exhibited schizotypic adjustment at not only the initial assessment, but at the follow-up assessment as well. Furthermore, using a college student sample is a more conservative test of the stated hypothesis, as the measures will need to be that much more sensitive to measure schizotypic adjustment in a better functioning sample.

To address the effects of attrition analyses were run in order to compare the followed-up vs. attrited groups. There were no differences between the attrited groups (Social Anhedonia and comparison) and the followed-up groups on age, gender, or measures of schizotypy. However, we do not have information on the participants that have not been reassessed. Although every attempt was made to contact all the participants from the initial assessment, 47 participants have not been reassessed.

One potential consequence of not assessing the full sample is that the Social Anhedonia participants who are not assessed are possibly more impaired. Social withdrawal and paranoia are symptoms typically experienced by these group members, thereby influencing their participation in our study. It is likely that the participants from the social anhedonia group that we do not reassess are more likely to be the experiencing psychopathology. Therefore, re-assessing fewer members from the social anhedonia group could understate meaningful differences in the analysis.

Future Directions

The results of the present study support and extend previous findings that the Revised Social Anhedonia scale is a useful marker of psychosis-proneness, by identifying a sample purported to be at high-risk for Schizophrenia-spectrum disorders. The scale

was able to identify a group of participants said to be at high risk for psychotic disorders. This group exhibited schizotypic adjustment at the cross-sectional assessment, along with impaired neurocognitive functioning. Furthermore, at a three-year longitudinal assessment the Social Anhedonia group continued to report higher levels of schizotypic symptoms and experiences impaired rates of social functioning, indicating that these symptoms are enduring. The results from this prospective, longitudinal provide strong support for the use of the Revised Social Anhedonia Scale as a screening measure to identify at-risk young adults.

The present study made a unique contribution to the literature by looking at the incidence of life events in Social Anhedonia and comparison participants. One important use of these findings is that the Social Anhedonia group reports feeling less competent when dealing with life stress. A practical application might be to administer Cognitive-Behavioral therapy to purported high-risk samples in order to change maladaptive thought patterns, and possibly lowering stress levels.

Longitudinal reassessments of this sample at pre-determined intervals will enable us to continue to assess schizotypal symptoms and functioning of the Social Anhedonia and comparison groups. An assessment scheduled in three to five years will allow us to examine the groups as they pass through the known window of risk for schizophrenia-spectrum disorders. Additionally, exiting college and experiencing life with less structure may pose more stress for our groups. This increase in stress may push the at-risk participants to experience more schizotypal symptoms.

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APPENDIX A: RAW DATA

TABLE 1

Demographic Characteristics of the Social Anhedonia and Comparison Groups at the

Follow-up Assessment

	Social Anhedonia ($n = 52$)	Comparison ($n = 47$)
Age (years)	19.8 (3.8)	19.0 (0.8)
%Female/Male	75/25	68/32
%Caucasian/African American	72/28	72/28
Parents' highest social position	26.7 (11.6)	24.2 (9.1)
Education (years)	14.7 (0.7)	14.4 (0.8)
Interval between Assessments (years)	2.6 (0.7)	2.6 (0.8)

Note: Group means are presented with standard deviations in parentheses (unless otherwise noted).

TABLE 2

Schizotypic Symptoms and Global Adjustment for the Social Anhedonia (n=52) and Comparison Groups (n=47) at the Initial and Follow-up Assessment

	Initial Assessment		Follow-up	
	Social Anhedonia	Comparison	Social Anhedonia	Comparison
Psychotic-like Experiences	2.0***(2.4)	0.3 (1.0)	1.9*** (2.8)	.15 (.67)
Negative Symptoms	6.5***(5.9)	1.2 (1.5)	5.4***(5.8)	.89 (1.6)
IPDE - Paranoid	1.3** (1.7)	0.4 (1.1)	1.0***(1.5)	.13 (.40)
IPDE - Schizotypal	1.8***(1.7)	0.3 (0.7)	1.9***(2.6)	.15 (.42)
IPDE - Schizoid	1.8***(2.2)	0.2 (0.6)	1.8***(2.2)	.24 (.73)
Global Adjustment	69.6***(8.6)	81.2 (5.8)	72.8***(9.6)	81.8 (7.5)

***$p < .001$ **$p < .01$

Note: Group means are presented with standard deviations in parentheses. IPDE = International Personality Disorder Examination.

TABLE 3

Prediction of Psychopathology at the Three-Year Follow-up Assessment

Criterion: Follow-up Negative Symptom Manual total Score

Predictors	change in r^2
Step 1: Initial Negative Symptom Manual (NSM) total score	.444***
Step 2: Continuous Performance Test d' (CPT)	.033**
Step 3: WCST Perseverative Errors (WCST)	.007
Step 4: NSM x CPT	.041***
Step 5: NSM x WCST	.003
Step 6: CPT x WCST	.008
Step 7: NSM x WCST x CPT	.011
Total Variance	.548***

Criterion: Follow-up Schizotypal Dimensional Score

Predictors	change in r^2
Step 1: Initial Schizotypal Dimensional score	.265***
Step 2: Magical Ideation	.018
Step 3: CPT	.011
Step 4: Schizotypal x Magical	.069*
Step 5: Schizotypal x CPT	.031
Step 6: CPT x Magical Ideation	.000
Step 7: CPT x Magical x Schizotypal	.012
Total Variance	.406***

TABLE 3 (continued)

Prediction of Psychopathology at the Three-Year Follow-up Assessment

Criterion: Follow-up Psychotic-like Experiences	
Predictors	change in r^2
Step 1: Initial Psychotic-like Experiences (PSX)	.227***
Step 2: Magical Ideation	.042
Step 3: CPT	.007
Step 4: PSX x Magical	.005
Step 5: PSX x CPT	.024
Step 6: CPT x Magical Ideation	.082*
Step 7: CPT x Magical x PSX	.037
Total Variance	.424***

Criterion: Diagnosis of any spectrum disorder	
Predictors	change in r^2
Step 1: Initial Schizotypal Dimensional score	.330***
Step 2: Magical Ideation	.001
Step 3: CPT `	.102**
Step 4: Schizotypal x Magical Ideation	.092**
Step 5: Schizotypal x CPT	.086**
Step 6: CPT x Magical Ideation	.080***
Step 7: Schizotypal x CPT x Magical Ideation	.001
Total Variance	.690***

***$p < .001$ **$p < .01$ *$p < .05$

TABLE 4

Measures of Life Events and Perceived Stress by Group at the Follow-up Assessment

	Social Anhedonia ($n = 52$)	Comparison ($n = 47$)
RLCQ		
Total	588.1 (493.6)	614.9 (595.0)
Health	80.2 (64.0)	78.6 (59.2)
Work	99.0 (103.6)	100.4 (113.6)
Home & Family	137.2 (211.3)	173.6 (284.7)
Personal & Social	183.2 (129.0)	182.2 (133.0)
Finance	52.6 (58.6)	42.3 (61.8)
Student	36.0 (62.3)	37.8 (55.7)
PSS		
Total	22.5 (10.4)**	16.9 (6.5)
PSS 1	15.2 (7.7)**	11.1 (5.0)
PSS 2	7.3 (4.1)*	5.9 (2.9)

**$p < .01$ *$p < .05$

Note: Group means are presented with standard deviations in parentheses

TABLE 5

Prediction of Psychopathology at the Three-Year Follow-up Assessment

Criterion: Follow-up Negative Symptom Manual total Score

Predictors	change in r^2
Step 1: Group code	.209***
Step 2: PSS total	.023
Step 3: RLCQ total	.014
Step 4: Group code x PSS	.001
Step 5: Group x RLCQ	.011
Step 6: Group x RLCQ x PSS	.015
Total Variance	.273***

Criterion: 3-year Follow-up Schizotypal dimensional

Predictors	change in r^2
Step 1: Group code	.180***
Step 2: PSS total	.131***
Step 3: RLCQ total	.012
Step 4: Group code x PSS	.032*
Step 5: Group code x RLCQ	.008
Step 6: Group code x RLCQ x PSS	.030*
Total Variance	.392***

TABLE 5 (continued)
Prediction of Psychopathology at the Three-Year Follow-up Assessment

Criterion: 3-year follow-up Psychotic-like experience

Predictors	change in r^2
Step 1: Group code	.140***
Step 2: PSS	.087***
Step 3: RLCQ	.006
Step 4: Group code x PSS	.020
Step 5: Group code x RLCQ	.005
Step 6: Group code x RLCQ x PSS	.015
Total Variance	.273***

Criterion: Diagnosis of any spectrum disorder

Predictors	change in r^2
Step 1: Group code	.027
Step 2: PSS	.064**
Step 3: RLCQ	.000
Step 4: Group x PSS	.020
Step 5: Group x RLCQ	.000
Step 6: Group x RLCQ x PSS	.101***
Total Variance	.212***

***$p < .001$ **$p < .01$ *$p < .05$

TABLE 6

Rates of Mood Disorders and Drug/Alcohol use/abuse at the Initial and Follow-up Assessments

	Initial Assessment		Follow-up	
	Social		Social	
	Anhedonia	Comparison	Anhedonia	Comparison
Alcohol Use	1.1 (1.6)	1.5 (1.8)	2.2 (3.4)	3.2 (3.8)
Alcohol Impairment	.55 (.50)	.58 (.50)	.68 (.47)	.98 (.54)
Drug Use	.47 (1.9)	.16 (.52)	.32 (.84)	.60 (1.4)
Drug Impairment	.26 (.76)	.11 (.32)	.21 (.51)	.31 (.70)

Note: Group means are presented with standard deviations in parentheses.

TABLE 7

Intercorrelations Between Schizotypal Measures - Hypothesis 3

Measure	1	2	3	4	5	6	7	8	9	10
1. Magic	--	.595**	-.095	.411**	-.100	.234	-.128	.453**	-.089	.309*
2. PSX	.595**	--	-.009	.610**	-.190	.235	-.089	.477**	.115	.336*
3. NSM	-.095	- .009	--	.251**	-.138	.160	.120	.207	.572**	.281*
4. Schizotypal	.411**	.610**	.251*	--	-.122	.575**	-.011	.358**	.251	.516**
5. WCST	-.100	-.190	-.138	-.122	--	-.017	-.151	-.144	-.041	.007
6. 3YF Spectru	.234	.235	.160	.575**	-.017	--	-.325*	.359**	.456**	.603**
7. CPT	-.128	-.089	.120	-.011	-.151	.325*	--	.009	-.080	-.106
8. 3YF PSX	.453**	.477**	.207	.358**	-.144	.359**	.009	--	.380**	.687**
9. 3YF NSM	-.089	.115	.572**	.251	-.041	.456**	-.080	.380**	--	.430**
10. 3YF Schi	.309*	.336*	.281*	.516**	.007	.603**	-.106	.687**	.430**	--

$^{**}p < .01$ $^{*}p < .05$

TABLE 8

Intercorrelations Between PSS, Life Events & Schizotypal Symptoms - Hypothesis 4

Measure	1	2	3	4	5	6	7
1. SocAnh Code	--	-.302**	.025	-.412**	-.357**	-.445**	-.182
2. PSS - total	-.302**	--	.129	.473**	.395**	.284**	.290**
3. RLCQ - total	.025	.129	--	.151	.107	.127	.046
4. 3YF Schizotypal	-.412**	.473**	.151	--	.727**	.523**	.601**
5. 3YF PSX	-.357**	.395**	.107	.727**	--	.457**	.380**
6. 3YF NSM	-.445**	.284**	.127	.523**	.457**	--	.461**
7. 3YF Any Spectrum	-.182	.290**	.046	.601**	.380**	.461**	--

$^{**}p < .01$

TABLE 9

Intercorrelations Between Five Psychopathology Measures at Initial and Follow-up Assessments

Measure	1	2	3	4	5	6	7	8	9	10
1. PSX	--	.200*	.605**	.257**	.319**	.520**	.293**	.438**	.298**	.026
2. NSM	.200*	--	.432**	.672**	.158	.351**	.664**	.439**	.556**	.255*
3. Schizotypal	.605**	.432**	--	.648**	.584**	.453**	.397**	.592**	.481**	.189
4. Schizoid	.257**	.672**	.648**	--	.334**	.242**	.538**	.472**	.579**	.211**
5. Paranoid	.319**	.158	.584**	.334**	--	.309**	.106**	.249*	.204*	.178
6. 3YF PSX	.520**	.351**	.453**	.242*	.308**	--	.457**	.727**	.461**	.295**
7. 3YF NSM	.293**	.664**	.397**	538**	.106	.457**	--	.523**	.871**	.365**
8. 3YF Schizot	.438**	.439**	.592**	.472**	.249*	.727**	.523**	--	.627**	.509**
9. 3YF Schizo	.298**	.556**	.481**	.579**	.204*	.461**	.871**	.627**	--	.327**
10. 3YF Paran	.026	.255*	.189	.211*	.178	.295**	.365**	.509**	.327**	--

$^{**}p < .01$ $^{*}p < .05$