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Interpretation of Nonverbal Expression of Emotion in Relation to Schizotypal Characteristics

Emily K. Bell
College of William & Mary - Arts & Sciences

INTERPRETATION OF NONVERBAL EXPRESSION OF EMOTION IN RELATION TO SCHIZOTYPAL CHARACTERISTICS

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This thesis is submitted in partial fulfillment of

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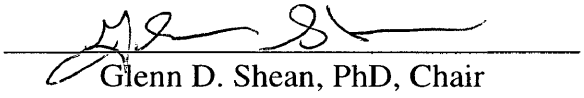

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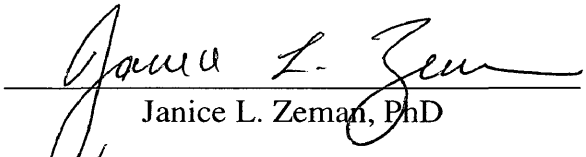

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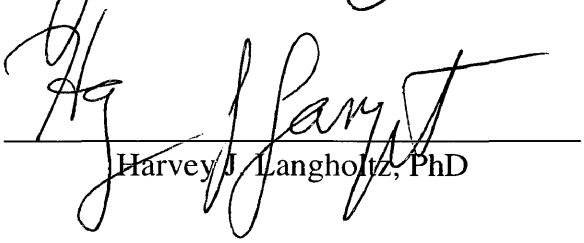

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ABSTRACT

This study explored the hypothesis that those with higher scores on measures of schizotypy would have greater deficits in interpretation of nonverbal emotion than those with lower scores, possibly due to a combination of genetic predisposition and the cumulative effects of social experiences as suggested by previous research. Participants (N = 99) completed the DANVA2 facial, posture, and vocal nonverbal emotion recognition tasks, as well as the Magical Ideation Scale and Schizotypal Personality Questionnaire to assess levels of schizotypal characteristics. Correlations and multiple regressions analyses gave partial support to our main hypothesis. Although the main schizotypy measures were not predictive of main DANVA2 scores, many significant correlations and regressions emerged using SPQ subscales and DANVA2 subtests. This suggests that, rather than a generalized relationship, there may be more specific relationships between emotion recognition and schizotypy, especially involving posture recognition tasks and the interpersonal schizotypy factor.

INTERPRETATION OF NONVERBAL EXPRESSION OF EMOTION IN RELATION TO SCHIZOTYPAL CHARACTERISTICS

INTRODUCTION

It is necessary to use some form of cognition to interpret, predict, and benefit from the behavior of others and the self. Without this ability, the social world would seem chaotic and confusing. This ability, in general, is referred to as social cognition (Abdi & Sharma, 2004). To have properly functioning social cognition, one must be able to use not only general knowledge of common interpersonal situations, but also sensory cues such as the visual interpretation of facial and postural cues and auditory interpretation of vocal qualities (Frith, 1992).

Social cognition is most broadly operationalized in studies of "theory of mind." Theory of mind refers to the knowledge that the self and others have mental states and beliefs that guide their behavior (Abdi & Sharma, 2004; Brüne, 2005b). Normal children seem to develop a theory of mind around age four, and this is usually studied using a task designed to allow the child to detect the consequences of a false belief of a character (Brüne, 2005b; Frith, 2004).

Impairments in theory of mind abilities may characterize certain mental disorders such as autism (Abdi & Sharma, 2004; Brüne, 2005b), Asperger's syndrome, adults with frontal lobe damage (Brüne, 2005b), antisocial personality disorder (Brüne, 2005b), schizotypal personality disorder, schizophrenia (Abdi & Sharma, 2004; Kohler et al., 2003; Kohler & Brennan 2004; Langdon & Coltheart, 1999), and Alzheimer's disease (Brüne, 2005b). People with these disorders tend to display deficits in interpersonal

functions, often most notably in communication, interaction, and behavioral flexibility, as well as imaginative abilities.

Many studies have suggested that such disorders are characterized by generalized theory of mind deficits, most specifically an impairment in the ability to disentangle first-order representations from second-order representations (Abdi & Sharma, 2004). In other words, a person with such a deficit may be unable to differentiate between a fact of the physical world and another person's erroneous belief about this fact, and would respond to such a situation as if the fact were congruent with the other person's belief when it is not (Langdon & Coltheart, 1999; 2001). These second-order representations are not necessarily either true or false, and the ability to ascertain their state is crucial to the delicate task of social functioning; therefore, if an impairment exists in the function necessary to discern these states in others, the social world becomes chaotic and confusing (Brüne, 2005a; Brüne, 2005b; Langdon & Coltheart, 1999). This does become problematic with a disorder such as schizophrenia that tends to emerge in adulthood, as it is usually evident that those with the disorder had a theory of mind before the onset of the illness, and often those with positive symptoms (such as paranoia) also clearly possess an intact theory of mind; however, schizophrenic patients regularly test poorly in theory of mind tasks (Frith, 2004).

To deduce what another person is thinking, it is often useful to be able to understand what that person is feeling. Affective cues, although often neglected in classic theory of mind tasks, are crucial to the interpretation of social situations (Abdi & Sharma, 2004). During social interactions, the parties involved represent their emotions through facial, postural, and vocal cues, which ideally are accurately interpreted to allow an

appropriate social response by other parties. In the past, researchers have studied emotion perception in relation to control tasks such as gender or identity recognition in facial affective tasks, and pitch or tone identification in vocal affective tasks (Abdi & Sharma, 2004).

It is not completely clear yet whether or not these impairments are specific to social cognition or if they result from a more generalized impairment. The ultimate aim of many studies is to discern the areas of the brain that may be implicated in these deficits. There is evidence that theory of mind tasks involve underactivation of the frontal cortex, particularly the medial frontal and medial prefrontal regions, (Abdi & Sharma, 2004; Brüne, 2005a), and prefrontal cortical regions are most often found to be abnormal in schizophrenic patients (Brüne, 2005b). Emotion perception, however, seems to involve underactivation of the amygdala, fusiform gyrus, and/or orbitofrontal cortex (Abdi & Sharma, 2004; Brüne, 2005a; Johnston et al., 2001; Kohler et al., 2003; Kohler & Brennan, 2004). A study of schizophrenic patients indicated that emotion recognition and theory of mind abilities were unrelated, which may support the idea that these abilities are governed by separate neurological pathways (Brüne, 2005a). Separate neurological pathways even seem to govern recognition of different emotional stimuli. For example, the recognition of fearful faces is impaired in those with amygdala damage, and the fusiform gyrus and left dorsolateral frontal cortex are also implicated in fear recognition. Interpretation of positive emotions, however, seems governed by the left ventral prefrontal cortex and right fusiform gyrus in particular (Johnston et al., 2001). The valence hypothesis suggests that negative emotion recognition is governed by the right hemisphere, and positive emotion by the left (Kohler & Brennan, 2004), and therefore

would suggest that schizophrenic patients possibly possess irregularities mainly in the right hemisphere.

Although these areas of the brain could be physically damaged, most schizophrenic individuals are more generally assumed to possess a genetic vulnerability to develop abnormalities of the brain (Broks, 1997; Claridge, 1997). Paul Meehl's diathesis-stress model of mental illness theorizes that certain people possess a genetic vulnerability to develop a particular mental illness (the diathesis) and that a particularly stressful event or series of events can trigger the emergence of the illness (Claridge, 1997; Kerns, 2005; Shean & Wais, 2000). Many researchers seek to discover measurable vulnerability factors so that eventually, people predisposed to develop mental illnesses can be identified early and the illness can be prevented (Abdi & Sharma, 2004). Schizophrenia appears to be on a continuum of schizotypal characteristics developed by several researchers, and these characteristics are seen as probable risk factors for the development of schizophrenic symptoms (Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994; Langdon & Coltheart, 1999; Kerns, 2005; Kwapil et al., 1997; Kwapil, 1998). It is useful to qualify the relationship between risk factors and disorders through shared cognitive and neurological characteristics, such as social cognitive deficits. One of the most generally accepted symptoms of schizophrenia is an impairment in social functioning, and this dysfunction along with related cognitive impairments seem to be present throughout the entire disease course, including premorbid stages (Abdi & Sharma, 2004; Brüne, 2005a). Social cognitive deficits also appear to be related to rates of relapse (Abdi & Sharma, 2004).

Besides theory of mind, social cognition involves discernment of emotion in

others. Throughout numerous studies, schizophrenic patients tend to be impaired in the processing of emotions in facial, vocal (Abdi & Sharma, 2004; Johnston et al., 2001), and postural (Johnston et al., 2001) stimuli.

Some have claimed to find a relationship between these processing deficits and specific types of symptoms, while others have failed to find this relationship. These impairments seem to be associated with actual deficits in social competence in studies looking at questionnaires, behavior in single situations, and behavior in varied situations, as well as controlling for other cognitive abilities (Abdi & Sharma, 2004; Kohler & Brennan, 2004). Other studies, however, suggest that only severely ill patients exhibit reduced social functioning (Brüne, 2005a).

It is also unclear as to whether patients' difficulties with facial stimuli in particular result from a more generalized cognitive deficit (e.g. a deficit of working memory or attentional processes), a specific emotion processing deficit, or difficulties in simply processing facial stimuli. Most studies with control tasks have used facial recognition or age discrimination as a task to control for the effect of a general impairment in facial stimulus processing. Many of these do indeed confirm that schizophrenic patients perform poorly in the control tasks as well, and that when covaried out, the effects of the recognition/age tasks occasionally account for the difference between patients and normal subjects (Johnston et al., 2001).

Several neurocognitive measures, especially measures of attention, have also been tested along with emotion recognition tasks, such as the Span of Apprehension, Continuous Performance Task, and tests of spatial skills. Schizophrenia patients do seem to generally perform poorly on these measures, as well, lending question to the idea that

they are specifically impaired at emotion recognition (Johnston et al., 2001; Kohler & Brennan, 2004). In comparing schizophrenia with other mental disorders, such as depression, schizophrenic patients often displayed the same types of deficits, but with greater severity than other groups (Johnston et al., 2001; Kohler et al., 2003). In some studies, however, patients with other disorders performed similarly to healthy patients, and it is suggested that possibly the allocation of attention rather than the amount of attention given to the task may govern task performance (Kohler & Brennan, 2004).

Some researchers have found interactions involving the specific types of emotional stimuli; schizophrenic patients seem to have more difficulty with negative emotions than positive emotions(Abdi & Sharma, 2004; Johnston et al., 2001; Kohler et al., 2003). In a review of the literature, it was noted that most studies found that controls and patients performed quite similarly for the emotion "happiness" and showed the most disparity with the emotions "fear" and "disgust," with the patients performing more poorly (Johnston et al., 2001). Recognition of the emotion "fear" is frequently the most impaired in studies of schizophrenic populations, and when neutral emotions are included, they are more often misinterpreted as negative than positive (Kohler et al., 2003; Kohler & Brennan, 2004). This is consistent with the fact that, during an acute episode of psychosis, patients are likely to interpret neutral occurrences as personal and negative (Kohler et al., 2003). Negative emotions may be more often misinterpreted and patients may interpret positive emotions similarly to normal populations due to the fact that there are very few universally recognized positive emotions to recognize ("happy" and, depending on the situation, "surprise") (Kohler & Brennan, 2004).

The intensity of the emotion interpreted also negatively effects recognition in

schizophrenic patients relative to controls, with lower-intensity emotions being more difficult to interpret; however, Kohler et al. (2003) found that increased intensity did not significantly benefit schizophrenic patients in emotion recognition (Kohler & Brennan, 2004).

Certain therapeutic interventions exist to improve emotion recognition, both in patients and preemptively as an intervention to help prevent the development of mental illness. Structured cognitive remediation interventions seem to have a positive impact compared to control interventions on emotion perception, specifically recognition skills in acutely ill inpatients (Kohler & Brennan, 2004). As an even earlier intervention, Grinspan, Hemphill, and Nowicki (2003) implemented a program to improve children's facial emotion interpretation skills. Children in the program significantly improved their skills relative to a control group, although the impact of this was more positive for girls than for boys. Social anxiety, however, was decreased in both groups subsequent to the intervention, implying that the program could possibly be implemented in the service of lowering the probability of later symptom exacerbation due to decreased emotion recognition abilities.

The present study is an extension of previous research on the relationship between schizotypal characteristics, schizophrenia, and social cognitive deficits that have been previously studied. This study focuses specifically on measures of schizotypal characteristics. As mentioned earlier, schizotypy has been theorized as a set of personality characteristics found to vastly varying degrees in the normal population and may be exacerbated in personality disordered populations and more severely exacerbated in schizophrenic-spectrum populations. These characteristics seem to serve as

vulnerability factors in the later development of schizophrenic disorders (Chapman et al., 1994; Kwapil et al., 1997; Kwapil, 1998; Langdon & Coltheart, 1999; 2001), effectively creating a valuable proxy population on which to study neurocognitive traits which may be present in clinical populations prior to their initial diagnosis.

It is theorized that a genetic factor may be present in certain individuals which confers on them higher levels of schizotypal characteristics than in others, such as cognitive slippage, suspiciousness, and social anhedonia (Meehl, 1990). These characteristics, among other factors, may contribute to a cyclical pattern of social development and interaction in which interpersonal difficulties are exacerbated when one possessing these characteristics misinterprets the behavior and intentions of others. This misinterpretation could lead to seemingly incongruent reactions by other people, confusing the nature of cause and effect as well as making social interaction difficult and less desirable for the individual with more schizotypal characteristics. It is important to emphasize that such individuals are not necessarily mentally disordered or at risk for development of disorders, although these characteristics could act in conjunction with other risk factors that may be present to lead to the development of schizotypal or paranoid personality disorders, and even affective psychoses or schizophrenia.

Although it seems intuitively superior to study an actual clinical population, there is much utility in the present approach. First, one can use measures of schizotypy to identify those who may be inherently genetically and cognitively predisposed to psychotic experiences and disorders, bolstering research based on a biological essentialist model of disorders. Schizotypal characteristics have reliably distinguished relatives of schizophrenic probands from control subjects (Kendler, McGuire, Gruenberg, & Walsh,

1995), and have distinguished those who would later experience psychosis from those who would not (Chapman et al., 1994; Kwapil et al., 1997; Kwapil, 1998;). Second, research can be conducted on a population that has not yet experienced medication or institutionalization, which may confound results, especially in studies of social cognitive abilities such as the present study (Langdon & Coltheart, 2001). Thirdly, populations of highly-schizotypic individuals are larger and possibly more easily recruited (depending on the setting of the research) than schizophrenic individuals, or even those with diagnosed schizotypal personality disorder. It must, however, be once again emphasized that these groups, such as that which was used for this study, are normal populations that simply possess varying degrees of schizotypal characteristics, and the possibility of the presence of a genetic risk factor or the general risk of the development of a disorder later on cannot be extrapolated from the degree of self-reported schizotypy of these individuals.

Several scales have been frequently used to quantify the level of schizotypic characteristics possessed by an individual. The Social Anhedonia scale taps schizoid asociality, a defining characteristic of schizophrenic-spectrum disorders, and is a good predictor of later psychotic experiences (Kwapil et al., 1997; Kwapil, 1998). Asociality also may have important implications for social cognitive skills as well as emotion recognition abilities, as either a cause or effect of these difficulties. The Magical Ideation scale developed by Eckblad & Chapman (1983) also reliably predicts later psychosis and is often used to identify those with schizotypal characteristics. The two scales seem to map onto Meehl's cognitive slippage and interpersonal aversiveness, which he surmised were central aspects of schizotypy (Kwapil et al., 1997). The Schizotypal Personality

Questionnaire was developed specifically to tap all aspects of schizotypal personality traits, and contains within it nine subscales to address each symptom of schizotypal personality disorder. These subscales can also be grouped to measure the three factors that emerge in schizotypy: cognitive-perceptual, interpersonal, and disorganized (Gruzelier, 1996; Raine et al., 1994).

Relatively few studies have addressed social cognition and, in particular, emotion recognition in individuals with specifically schizotypal characteristics, rather than schizophrenia, but a few researchers have begun to realize the utility of studying this group. A study of adolescents with clinically diagnosed schizotypal personality disorder found that, although this group and the control group did not differ on measures of general cognitive abilities as well as visual and auditory perception, they were less accurate in correctly recognizing emotions in facial and verbal expressions. Interestingly, in a follow-up study, the number of errors in identifying emotional stimuli was negatively predictive of the extent of later social competence and positively predictive of problems in thought processing (Wickline, Bollini, Nowicki, & Walker, unpublished). Likewise, a study on college-aged men identified by scores on the Magical Ideation scale among others, found highly schizotypal students performed more poorly than controls on an affect-recognition task, but that the deficit reflected general attention and vigilance deficits (Poreh, Whitman, & Weber, 1994).

This study attempts to extend such previous research by first identifying potential participants by an abbreviated version of the Magical Ideation Scale, then asking them to complete a variety of emotion recognition tasks (facial, posture, and vocal), each containing four commonly used emotions as stimuli, as well as high and low valence

subscales, and sitting and standing subscales for the postures subtest. Participants also complete the full Magical Ideation Scale as well as the Schizotypal Personality Questionnaire. This allows us to compare these scales, as well as look in more depth at different kinds of nonverbal emotion recognition and various subscales of the emotion and schizotypy tests. In light of previous research, our main hypothesis is that accuracy on the emotion subtests will be negatively related to levels of schizotypy as measured in our study. More precisely, it is hypothesized that high levels of schizotypy will be related to lower accuracy in recognition of low-valence than high-valence stimuli, as well as lower accuracy in negative emotion recognition, especially for "fearful," than in performance on the positive emotion, "happy."

METHOD

Participants

A total of 99 undergraduate students at the College of William & Mary in Williamsburg, VA participated in this study. Although demographic data on age were not collected for these participants, numerous past studies on the William & Mary introductory psychology population have found an average age of 18.76 years. Females made up 56% of our population, and males 44%. All participants were volunteers, and informed consent was obtained prior to data collection. Those who completed the required tasks were granted two hours of credit toward a course requirement.

Materials

Participants were selected based on their scores on the Magical Ideation Scale (MIS; Eckblad & Chapman, 1983), administered through mass testing prior to research participation. This scale was used as a measure of schizotypy and consists of 30 true-false

items which focus on magical cause-and-effect beliefs held by the participant and used in interpreting his or her experiences (e.g., extrasensory perception, ideas of reference, superstitions, paranormal experiences). Participants scoring in the upper and lower 1.5 standard deviations of the distribution of scores on an abbreviated 10-item version of this scale were invited to participate in the study. The full version MIS was taken by participants during data collection to determine the nature of the participating sample as well as the appropriate statistics. The MIS has been found to have high internal validity for males ($\alpha = .82$) and females ($\alpha = .85$) and high external validity with relation to psychotic and psychoticlike symptoms (Eckblad & Chapman, 1983).

The Schizotypal Personality Questionnaire (SPQ; Raine, 1991) is a 74-item yes-no self-report measure of schizotypal personality disorder traits and was developed to measure all nine DSM-III-R traits of the disorder. The SPQ contains subscales to assess levels of ideas of reference, excessive social anxiety, odd beliefs and magical thinking, unusual perceptual experiences, odd or eccentric behavior, no close friends, odd speech, constricted affect, and suspiciousness. In previous studies, the SPQ has been found to have high internal ($\alpha = 0.91$) and test-retest reliability ($\alpha = 0.82$).

To assess levels of affect recognition, we administered the three receptive subtests of the Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2). The subtests are the Adult Faces test (DANVA2-AF; Nowicki & Carton, 1993), Postures test (DANVA2-POS; Pitterman & Nowicki, 2004), and Adult Paralanguage (voices) test (DANVA2-AP; Baum & Nowicki, 1998). The DANVA2 subtests were created to allow researchers to assess ability to identify four basic nonverbal emotions (happy, sad, angry, and fearful) differing in intensity (high and low) in three different nonverbal contexts. All three

subtests include 24 items, each including an equal number of stimuli representing each emotion, an equal number of male and female models/actors, and an equal number of high and low valence items (for the postures, also an equal number of standing and sitting postures). The DANVA2-AF consists of color headshots of the models each portraying one of the four target emotions with his or her facial expression. The DANVA2-POS consists of color full-body shots of models each portraying one of the target emotions through his or her posture. Each is dressed entirely in black, and the face of each model is obscured with a black oval so that judgments must be made based on the posture alone. The DANVA2-AP is an audiocassette recording of actors reading the sentence "I am going out of the room now, and I'll be back later," each expressing one of the four target emotions through vocal tone and inflection. All DANVA2 stimuli were originally selected based on high rater agreement on the specific emotion portrayed.

Procedure

Participants were recruited from the College of William & Mary Introduction to Psychology mass testing pool based on their scores on the Magical Ideation Scale (Eckblad & Chapman, 1983). The students scoring beyond 1.50 and -1.50 standard deviations of the total distribution were contacted with an invitation to participate. Participant scheduling was regulated through the Sona Systems online research participation system, on which the study was posted. The study was password- protected such that students could not sign up without the correct password, and the students invited to participate were sent this password in an e-mail, along with a list of available times. Each time slot was available for up to 10 students.

Once they had completed the sign-up process, the student volunteers arrived in a

classroom at their designated times in groups of around 10 (group sizes ranged from 8-12). This classroom was equipped with a large conference-style table, a computer, a projector, and a projection screen. Prior to the students' arrival, a packet containing the consent form, answer sheets, and questionnaires was placed at each seat at the table. As each participant arrived, he or she was instructed to read and sign the consent form while waiting for the study to begin. When all participants had arrived and indicated consent, they were introduced to the researchers before beginning the first task. Participants were first verbally instructed to write their first initial, middle initial, and first two letters of their last names on the back of each sheet in the packet, and a reminder of these instructions was printed at the bottom of each sheet in the packet. This served to identify participants when matching their mass testing MIS data with the MIS data collected during the study itself. Before completing the DANVA2 receptive subtests, the students participated in collection of data on the Izard facial emotion identification task for another researcher conducting a study similar to this one. Upon completion of that task, the students were read the instructions for the DANVA2-AF (see Appendix A).

The researcher then began the DANVA2-AF Powerpoint presentation. The presentation was created so that each slide would contain a white background with the slide number printed in the upper left corner and the DANVA2-AF stimulus centered. Each stimulus slide was presented for two seconds, followed by a blank white screen presented for 10 seconds, during which the participant could make his or her answer on the answer sheet provided. The answer sheet was titled "Answer Sheet #2" and contained a numbered row for each item containing the words "Happy," "Sad," "Angry," and "Fearful."

After the 24 DANVA2-AF stimuli were presented, the researcher read the instructions before beginning the DANVA2-POS Powerpoint presentation (see Appendix B).

The DANVA2-POS presentation was similar in format to the DANVA2-AF, with each stimulus presented in the center of the numbered slide for two seconds, prior to the 10-second presentation of a blank slide. The answer sheet was titled "Answer Sheet #3" and was otherwise identical to the DANVA2-AF answer sheet.

The DANVA2-AP stimuli were contained on an audiocassette and were presented using a cassette player located at the back of the room. The researcher read aloud the instructions (see Appendix C).

Then, after asking if there were any questions, the researcher began playing the tape recording. Prior to each audio stimulus, a male voice said the number of the item. Again, the answer sheet, aside from being titled "Answer Sheet #4" was otherwise identical to that used for the DANVA2-AF and DANVA2-POS.

After the presentation of the DANVA2 receptive tests, participants were asked to fill out the two questionnaires that were after the four answer sheets in their packets. The MIS was presented first, and the SPQ included second, titled "Questionnaire #1" and "Questionnaire #2." Instructions for each questionnaire were printed under the title of each, and participants were told they were free to ask questions and to take as long as they needed to fill out the questionnaires. For the most part, participants were able to fill out both questionnaires in 15-30 minutes.

Upon completion of the questionnaires, participants were instructed to place their packets in a box provided and their consent forms in a nearby folder. They were then

given a printed debriefing form explaining the purpose of the study, along with the researchers' contact information. Participants were granted two hours of research participation credit through Sona Systems.

RESULTS

Analytic Strategy

All analyses were based on a significance level of $\alpha = .05$. Analyses which were deemed to approach significance were based on a significance level of $\alpha = .10$.

Descriptive Statistics and Comparison

The article from which the MIS was developed (Eckblad & Chapman, 1983) described data for a sample of 1,512 college students, as well as 28 who scored above 1.91 *SD* above the mean, and 27 controls. The mean score for all participants was lower for males ($M = 8.56$, $SD = 5.24$) than for females ($M = 9.69$, $SD = 5.93$). When our participants were not differentiated by sex, our mean was within this range ($M = 9.29$, $SD = 6.74$), although when males and females were separated, the mean for females ($M = 8.73$, $SD = 6.78$) was lower than the mean for males ($M = 9.95$, $SD = 6.77$). In our sample, the MIS had a high reliability, Cronbach's $\alpha = .70$.

As noted previously, participants were selected based on a shortened version of the MIS administered to all students in introductory psychology classes. This MIS included 10 questions, which were rated on a 1 through 5 Likert scale rather than endorsed as true or false, with a score of 1 indicating greater agreement with the item. Participants' 10-item MIS scores correlated significantly with the 30-item MIS scores collected during the study, $r = -.77$, $p = .000$.

The original article introducing the SPQ (Raine, 1991) contained descriptive data

for two large samples of normal subjects. The samples' total SPQ descriptive statistics (M = 26.9, SD = 11.0, range = 0-58 and M = 26.3, SD = 11.4, range = 1-57) were similar to those in our sample (M = 25.89, SD = 13.1, range = 0-57). Internal reliability of the SPQ in our sample was very high, Cronbach's α = .926.

The DANVA2 manual reports mean number of errors for normal college-aged students (ages 19-21). These values in comparison with our own means and standard deviations can be found in Table 5.

DANVA2 group differences. Participants were separated into two groups based on a median split of their scores on the 30-item MIS. Scores on this measure ranged from 0 to 26, and the median was set at 13. Independent-samples t-tests were run to ascertain whether there were differences in DANVA2 subtest scores between the high- and low-scoring MIS groups. Differences between the high- and low-scoring groups were not significant on any of the three DANVA2 subtests.

Independent-samples t-tests were also run to check for sex differences in performance on the three DANVA2 subtests. There were no significant sex differences in performance on any of the DANVA2 subtests.

Pearson Correlation Analyses

MIS and SPQ. For hypothesis testing, all Pearson correlation statistics were two-tailed. Total scores on the Magical Ideation Scale (MIS) correlated significantly with total scores on the Schizotypal Personality Questionnaire (SPQ). Scores on the MIS also correlated significantly with all SPQ subscales. As expected, the three SPQ subscales underlying the "cognitive-perceptual" factor of schizotypy correlated especially strongly with MIS scores. See Table 4 for statistical information.

MIS and SPQ total scores with DANVA2. There were no significant correlations between the MIS totals and scores on any of the three Diagnostic Analysis of Nonverbal Accuracy 2 (DANVA2) subtests. Likewise, there were no significant correlations between the DANVA2 subscale scores and the SPQ total score.

SPQ subscales with DANVA2. The "No Close Friends" subscale of the SPQ was significantly correlated with the DANVA2 adult postures test (DANVA2-POS), $r = -.27$, $p = .01$. The "Unusual Perceptual Experiences" SPQ subscale approached significance with the DANVA2 adult paralanguage test (DANVA2-AP; $r = -.19$, $p = .06$). None of the SPQ subscales were significantly correlated with DANVA2 facial expression test total (DANVA2-AF).

DANVA2 emotion subscales. As described in the method section, subscales were derived from each of the DANVA2 subtests to generate accuracy scores for each of the four emotion response choices. The DANVA2-AF "Happy" subscale scores did not significantly correlate with the MIS or SPQ total scores, but did correlate with the "Odd or Eccentric Behavior" SPQ subscale. The "Fearful" subscale scores correlated with total scores on the MIS, as well as the "Suspiciousness" subscale of the SPQ, though not with SPQ total scores. There were no significant correlations for the "Sad" or "Angry" subscales with any of the MIS, SPQ, or SPQ subscales.

The DANVA2-POS "Fearful" subscale scores significantly correlated with the "No Close Friends" SPQ subscale scores, as well as with "Constricted Affect" and "Suspiciousness" subscale scores. "Angry" subscale scores correlated with the "No Close Friends" SPQ subscale scores. None of the DANVA2-POS emotion subscales correlated with the MIS or SPQ total scores.

The DANVA2-AP "Fearful" subscale scores correlated with the "Odd Speech" SPQ subscale scores. None of the DANVA2-AP emotion subscale scores correlated with MIS or SPQ total scores, and neither "Happy," "Sad," or "Angry" subscales correlated with SPQ subscale scores. See Table 1 for statistical information.

DANVA2 valence subscales. Subscales were derived from each of the DANVA2 subtests to generate accuracy scores for the high and low valence items separately (and, in the case of the DANVA2-POS, also "sitting" and "standing" items). Scores on the DANVA2-POS "Standing" subscale correlated significantly with four subscales of the SPQ, and the "Sitting" subscale correlated significantly with the "No Close Friends" subscale. DANVA2-POS "Low" scores were significantly correlated with the SPQ subscales "Odd/Eccentric Behavior," "No Close Friends," and "Constricted Affect," while "High" subscale scores correlated with "Ideas of Reference" and "Odd Speech." DANVA2-AP "Low" scores correlated significantly with the "Unusual Perceptual Experiences" and "Odd/Eccentric Behavior" SPQ subscales. No valence subscales correlated with MIS or SPQ total scores, and neither valence subscale of the DANVA2-AF correlated with any of the SPQ subscales. See Table 3 for statistical information.

Multiple Regression Analyses

SPQ Factors. In previous studies, the SPQ has been shown to load on three factors of schizotypy: cognitive-perceptual, interpersonal, and disorganized factors. Subscales were created by summing the scores on the subscales that make up each factor. Multiple regressions predicting DANVA2 faces and voices subtest scores from these three factors were not significant. The regression predicting the DANVA2 postures subtest scores was significant, $R^2 = .09$, adjusted $R^2 = .06$, $F(3 , 90) = 2.96$, $p = .04$, with

the cognitive-perceptual and interpersonal factors contributing significant variance.

SPQ Subscales. Regressions analyses using the nine SPQ subscales as independent variables were conducted to predict variance on each of the three DANVA2 subtest scores. The SPQ subscales were significantly related to scores on the DANVA2-POS subtest, $R^2 = .19$, adjusted $R^2 = .10$, $F(9, 85) = 2.17$, $p = .03$. A significant negative relationship was found between the "No Close Friends" SPQ subscale and scores on the DANVA2-POS subtest, $t = -2.66$, $p = .01$ ($\beta = -.40$).

A regression was also run in which the DANVA2 subtests were entered to predict variance on the "Unusual Perceptual Experiences" SPQ subscale, which approached a significant correlation with the DANVA2-AP. This model was non-significant, although DANVA2-AP scores predicted significant variance on the "Unusual Perceptual Experiences" SPQ subscale, $t = -2.31$, $p = .02$ ($\beta = -.25$).

DANVA2 emotion subscales. In order to explore the relationship between ability to recognize specific emotions and scores on the "No Close Friends" SPQ subscale, the four emotion variables for each DANVA2 subtest were entered into regression equations to predict variance on the "No Close Friends" subscale. None of the models reached significance, although the relationship between the DANVA2-POS subtest and the "No Close Friends" subscale approached significance, $R^2 = .092$, adjusted $R^2 = .05$, $F(4, 91) = 2.307$, $p = .06$. In this equation, the "Fearful" emotion subscale predicted significant variance. In the equation using the DANVA2-AF emotion subtests as independent variables, the "Sad" and "Angry" emotion subscales approached significance, and for the DANVA2-AP emotion subtests, the "Angry" subscale approached significance. It is curious to note that, in both of these equations, the "Angry" subtest had a positive beta

coefficient, suggesting a positive relationship between "No Close Friends" SPQ scores and accuracy of recognition for the "Angry" faces and voices.

Regressions were also run by entering the congruent emotion subscales from all three DANVA2 subtests as independent variables to predict the "No Close Friends" SPQ subscale. Specifically, for each regression, the independent variables would be the DANVA2-AF, DANVA2-POS, and DANVA2-AP subscales for one of the emotions (e.g. "Happy"). The regression model predicting "No Close Friends" scores from scores on the DANVA2 "Angry" emotion subscales was significant, $R^2 = .11$, adjusted $R^2 = .08$, $F(3, 93) = 3.92$, $p = .01$. As expected, given the seemingly strong relationship between posture recognition and the "No Close Friends" subscale, scores on the DANVA2-POS "Angry" subscale predicted significant variance, and these scores on the DANVA2-AP approached significance, once again, in a positive direction. The model using the "Fearful" subscales to predict variance on the "No Close Friends" subscale approached significance, $R^2 = .07$, adjusted $R^2 = .04$, $F(3, 92) = 2.35$, $p = .08$, with the DANVA2-POS scores contributing significant variance.

Since there seemed to be a trend toward the "Angry" and "Fearful" subscales predicting variance in the "No Close Friends" SPQ subscale, these two subscales from all three DANVA2 subtests were entered into an equation to predict variance on the "No Close Friends" subscale. This model was significant, $R^2 = .17$, adjusted $R^2 = .11$, $F(6, 87) = 2.96$, $p = .01$, with the DANVA2-POS "Fearful" and "Angry" and DANVA2-AP "Angry" contributing significant variance. A significant regression also emerged using only these three significant subscales as independent variables to predict "No Close Friends" SPQ subscale variance, $R^2 = .14$, adjusted $R^2 = .11$, $F(3, 92) = 4.81$, $p = .01$. The

DANVA2-POS "Fearful" subscale was significant, along with the DANVA2-AP "Angry" subscale, again in the opposite expected direction. In this regression, the DANVA2-POS "Angry" subscale now only approached significance. See Table 2 for statistical information.

DISCUSSION

Although the main hypothesis was not supported that scores on the schizotypy-related scales would be negatively correlated with scores on facial, postural, and vocal emotion recognition tasks, several subordinate hypotheses were supported or partially supported. Three subscales seemed to be the most often predictive in the analyses: the DANVA2 postures subscale, DANVA2 "fearful" subscales, and the SPQ "No Close Friends" subscale.

Expressions of basic emotions can be readily recognized from postural representations in the absence of facial cues, but recognition of postural emotion has rarely been studied in relation to schizotypal characteristics. A Russian study has found that low accuracy of gestural and postural nonverbally expressed emotion is characteristic of schizophrenic patients (Kurek, 1986), and other studies have attempted to identify which brain structures are implicated in recognition of postural emotion and whether these differ from those used to identify facial emotion (Atkinson & Adolphs, 2005). This study was unique in that it was able to explore the relation of schizotypal characteristics with performance on a relatively comprehensive posture recognition task.

The postures scale was also divided into four different valence subscales, which each correlated with a relatively large amount of SPQ subscales. The "standing" subscale correlated positively with "Ideas of Reference," "Odd Beliefs/Magical Thinking," and

negatively with "No Close Friends" and "Constricted Affect" SPQ subscales. The high valence posture subtest likewise had a positive correlation with the "Ideas of Reference" and "Odd Speech" SPQ subscales. In factorial analyses of schizotypy, "Ideas of Reference" and "Odd Beliefs/Magical Thinking" load on a cognitive-perceptual or unreality factor, while "No Close Friends" and Constricted Affect" load on an interpersonal or withdrawn factor (Raine et al., 1994; Gruzelier, 1996). The negative relationship between performance on recognizing standing postural emotions and withdrawn interpersonal characteristics makes intuitive sense, as do the negative correlations between performance on the "sitting" subtest and the "No Close Friends" SPQ subscale and between the low valence subtest and the "No Close Friends" and "Constricted Affect" SPQ subscales, in that those who are less comfortable with social interaction and likely less accustomed to it may show greater deficits in understanding the more demanding category of postural emotions.

Why cognitive-perceptual characteristics would be positively related to recognition of standing emotions is difficult to understand. Looking at the items on the SPQ, many of those on the "Ideas of Reference" and "Odd Beliefs/Magical Thinking" subscales seem to emphasize a heightened sensitivity to outside forces, such as the subtle actions and thoughts of strangers, unique aspects of objects, and the supernatural, and their meaning in regard to the target individual. The endorsement of these items may indicate that the participant truly is "in tune" with his or her surroundings and others to an extreme, and that rather than being impaired in a way that would indicate a difficulty in recognizing subtle emotions, they are impaired such that they *over*-recognize subtle emotions (and other subtleties of the environment). This may, in turn, lead to some of their signs of

schizotypy in which they see meaning and experience communication where none is actually intended.

It should also be noted that the specific SPQ subscales that most often tended to be correlated with posture recognition scores were components of the Cognitive-Perceptual (ideas of reference, odd beliefs/magical thinking, unusual perceptual experiences, and suspiciousness) and Interpersonal factors (excessive social anxiety, no close friends, constricted affect, and suspiciousness) of schizotypal personality, although the low and high valence subtests did each correlate with Disorganization factor subscales (Odd Speech and Odd/Eccentric Behavior). Theory suggests that defective mentalising is a major cause of psychotic symptoms in schizophrenia, from which the Cognitive-Perceptual (or Unreality) factor of schizotypy in the SPQ was originally developed. Measurements of theory of mind skills suggest that those with deficits tended to score high on Cognitive-Perceptual and Interpersonal factors, but not on the third factor, Disorganization, which is consistent with our findings in postural emotion recognition skills, although the tendency to score higher on Cognitive-Perceptual factors did not reach significance (Langdon & Coltheart, 1999).

The interpersonal factor was especially represented. Total scores on the postures subscale, along with its "fearful" and "angry" subscales individually, correlated with the "No Close Friends" SPQ subscale. The "fearful" subscale also correlated with the "Constricted Affect" and "Suspiciousness" SPQ subscales. The interpersonal factor's comparatively large number of significant correlations with emotion recognition tests is intuitively logical. In a cyclical process, one with a predisposition toward emotion recognition deficits may respond inappropriately to others' social cues, causing others to

react in a seemingly confusing manner and spurring an outwardly strange reaction from the person with the deficit. This, in turn, leads to what seems to be an unsolicited and often unpleasant reaction from the interaction partner. This could lead to exacerbation of social anxiety and suspiciousness of others; social anxiety could lead to a dearth of close friends, and suspiciousness may lead one to constrict the display and experience of emotions. The "No Close Friends" subscale was also quite frequently related to emotion recognition measures, which may be explained by this specific and probably cyclical nature of emotion recognition impairment effects.

When the DANVA2 subscales were separated into emotion subscales, fear was the emotion with the greatest number of significant correlations and rivaled "angry" for the most often predictive independent variable in the emotion subscale regressions. This corresponds with research suggesting that negative emotions, and "fear" and "anger" in particular, are most often misperceived in those with schizophrenia (Abdi & Sharma, 2004; Johnston, Katsikitis, & Carr, 2001; Kohler et al., 2003; Kohler & Brennan, 2004). Although the population in our study was a non-disordered convenience sample and the high scoring participants were not even necessarily at risk for developing psychosis, the schizotypal characteristics measured are to a great extent modeled from attenuated versions of characteristics generally possessed by schizophrenic patients; therefore, it is reasonable to extrapolate that, if schizophrenic patients have deficits in a certain area, individuals with higher scores on the SPQ and MIS might have milder versions of these deficits.

It should be noted that, in two instances when the "angry" subscale approached significance in predicting the "No Close Friends" SPQ subscale, the relationship between

schizotypal characteristics and performance on the emotion subscale was positive, suggesting that individuals with high levels of schizotypal characteristics were better at recognizing angry faces and voices than those with fewer characteristics. Rather than indicating impairments in recognition, this pattern of perception may signify a hypervigilant style of interpretation for this particular emotion. This pattern may support the overvigilance previously described as an explanation of the positive correlation between postural emotion recognition and cognitive-perceptual scores. It has been suggested that theory of mind abilities can confer a risk of inferring too much about others' mental states. Abu-Akel's continuity model of theory of mind assumes that attributional abilities can be hyperactive rather than impaired in many individuals with disorders, especially those with persecutory delusions (Brüne, 2005b). This may be reflected to a lesser extent in the segment of our sample with more schizotypal characteristics by more accuracy in identifying the emotion "anger," which would theoretically be fairly specific to suspicious thinking. Our present study's stimuli did not contain neutral emotional images or voices, and if these particular participants were displaying an overvigilance in attribution, we might predict that they would frequently attribute angry emotions to neutral stimuli.

Future researchers may wish to study in greater depth or differing capacity the topics of posture recognition and interpretation of the emotions "fear" and "anger" as they relate to schizotypal personality characteristics. Of particular interest may be the relationships between lack of close friends, interpersonal skills, and emotion recognition in conditions of the schizotypy spectrum. There were several limitations to our research, however, that may possibly account for our findings, as well as the findings we expected

but were not explicitly supported in this study. Although the sample of participants was selected in the same manner as other studies of schizotypy (Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994) in an attempt to represent the highest and lowest scores available, the final range of scores on the MIS and SPQ found during the data collection was not bimodal as would have been expected, and the mean differences between the highest and lowest schizotypal groups, when separated, were non-significant, which could have affected the statistical findings. This may be due to self-selection of those who chose to participate, or there simply may not be as much variation in a college sample as in the general population. Some studies of schizotypy, particularly those which are attempting to study levels of schizotypy as risk factors for the development of mental disorders such as psychosis and schizophrenia, suggest that college populations are not ideal due to the high level of functioning and middle-class socioeconomic status generally required to attend a university (Chapman et al., 1994). Other studies, however, suggest that high-achieving, healthy college students may reasonably provide an acceptable population on which to study schizotypy as a dimensional construct (Gruzelier, 1996). In future research, it may be useful to explore whether or not samples from the public will yield greater variability, although since the present study was not specifically looking at schizotypy as a risk factor for other mental disorders, the educational status of the sample may well have been reasonable.

The tasks used to measure recognition may have simply been less challenging than they needed to be to detect an effect, as well. The DANVA2 is a relatively simple multiple-choice task including four commonly distinguishable emotion choices and no neutral stimuli, although it was certainly a comprehensive measure in that it contained

equal numbers of high and low valenced stimuli, as well as standing and sitting stimuli for the postures measure. The relative simplicity of the DANVA2 faces and voices measures may be an alternative explanation for the greater number of significant results found for the postures measure. Practically speaking, people may not normally have as much opportunity to use postures *alone* as criteria for judging emotional stimuli. When people are using postures to identify emotion, it is a rare situation that they would not also be able to use facial or vocal information in conjunction with postural information. The DANVA2 postures subtest, however, consists of still photographs with no movement or vocal information, the models' faces are obscured by a black oval, and the models are wearing all black, making it relatively difficult to distinguish more subtle posture information. Also, the subtest contained a mixture of standing and sitting models, whereas the facial and vocal subtests only differentiated stimuli on intensity. In short, the postures subtest may be the most difficult of the three tests, which is supported in previous samples of this age group by high mean errors on the posture test. However, it must be noted that, in our sample, mean errors on the posture test were relatively similar to those on the facial and vocal tests (see Table 5).

The current study could not account for attention effects or non-emotional facial, vocal, and postural processing deficits due to the lack of comparable tasks. In the future, it may be useful to add these to the battery of tasks and questionnaires to ascertain whether these effects are present and accounting for variance in emotion recognition tasks. Fatigue was unlikely to be an issue on the three DANVA2 tasks, which in their totality lasted approximately 15 minutes; however, participants were allowed as much time as needed to complete the MIS and SPQ scales, and may have possibly rushed

through the SPQ, which is lengthy and was presented last in the packet of tasks and questionnaires. Further studies could randomize the probability of the MIS and SPQ being presented first. There is a brief version of the SPQ available (the SPQ-B), but the entire study, which included an emotion task used by another researcher, almost invariably took only around 40 to 45 minutes to complete, and the information from the longer scale could tap effects of the nine subscales more precisely.

Emotion recognition is a crucial skill for interpersonal interaction. Our study, among others, suggests that those scoring high on measures of schizotypal personality characteristics seem to have specific, though mild, impairments in the identification of nonverbal emotions. Hopefully, studies will continue to clarify the precise relation between these skills and schizotypal characteristics, possibly through use, as in the present study, of posture identification measures and more specific and comprehensive schizotypy measures.

TABLE 1

SIGNIFICANT PEARSON CORRELATIONS BETWEEN THE DANVA2 AND SPQ SUBSCALES

Subscales	*r*	*p*
DANVA2 Faces		
Happy		
SPQ Odd/Eccentric Behavior	-.20	.05
Fearful		
MIS Total	-.21	.04
SPQ Suspiciousness	-.22	.03
DANVA2 Postures		
SPQ No Close Friends	-.27	.03
Angry		
SPQ No Close Friends	-.23	.02
Fearful		
SPQ No Close Friends	-.26	.01
SPQ Constricted Affect	-.20	.05
SPQ Suspiciousness	-.20	.05
DANVA2 Voices		

TABLE 1 CONTINUED

Fearful		
SPQ Odd Speech	-.26	.01

TABLE 2

MULTIPLE REGRESSIONS ANALYSES USING THE DANVA2 EMOTIONS SUBSCALES TO PREDICT THE "NO CLOSE FRIENDS" SPQ SUBSCALE

Independent Variables	*t*	*p*	β	*r*
Regression 1				
Faces, Angry	1.48	.14	.15	.11
Postures, Angry	-2.77	.01	-.27	-.23*
Voices, Angry	1.78	.08	.18	.17
Regression 2				
Faces, Fearful	-.25	.80	-.03	-.09
Postures, Fearful	-2.50	.01	-.26	-.26**
Voices, Fearful	-.18	.86	-.02	-.04
Regression 3				
Faces, Angry	1.81	.07	.19	.11
Postures, Angry	-2.01	.05	-.20	-.23*
Voices, Angry	2.00	.05	.20	.17
Faces, Fearful	-.54	.59	-.06	-.09
Postures, Fearful	-2.77	.01	-.28	-.26**
Voices, Fearful	-.486	.63	-.05	-.04
Regression 4				
Postures, Angry	-1.74	.08	-.17	-.23**

TABLE 2 CONTINUED

Voices, Angry	2.17	.03	.22	.17
Postures, Fearful	-2.85	.01	-.28	-.26**

TABLE 3

SIGNIFICANT PEARSON CORRELATIONS BETWEEN DANVA2 VALENCE SUBSCALES AND SPQ SUBSCALES

Subscales	*r*	*p*
DANVA2 Postures		
Standing		
Ideas of Reference	.26	.01
Odd Beliefs/Magical Thinking	.21	.04
No Close Friends	-.24	.02
Constricted Affect	-.22	.03
Sitting		
No Close Friends	-.22	.03
High		
Ideas of Reference	.21	.04
Odd Speech	.22	.03
Low		
Odd/Eccentric Behavior	-.26	.01
No Close Friends	-.29	.00
Constricted Affect	-.22	.03
DANVA2 Voices		
Low Valence		
Unusual Perceptual Experiences	-.27	.01

TABLE 3 CONTINUED

Odd/Eccentric Behavior	-.27	.02

TABLE 4

CORRELATIONS BETWEEN MIS TOTAL SCORES AND SPQ TOTAL, SPQ SUBSCALE, AND SPQ FACTOR SCORES

Scale	*r*	*p*
SPQ Total	.75	.00
Factors		
Cognitive-Perceptual	.85	.00
Ideas of Reference	.70	.00
Odd Beliefs/Magical Thinking	.72	.00
Unusual Perceptual Experiences	.78	.00
Suspiciousness	.48	.00
Interpersonal	.39	.00
Excessive Social Anxiety	.23	.02
No Close Friends	.25	.01
Constricted Affect	.25	.01
Suspiciousness	.48	.00
Disorganized	.49	.00
Odd/Eccentric Behavior	.40	.00
Odd Speech	.47	.00

TABLE 5

DANVA2 SUBTESTS MANUAL DESCRIPTIVE STATISTICS COMPARED WITH DESCRIPTIVES OF THIS STUDY'S SAMPLE

	DANVA2 Manual		Study Sample	
	M	*SD*	*M*	*SD*
Faces Subtest	4.2	2.4	5.1	2.2
Postures Subtest	7.9	2.4	5.3	2.1
Voices Subtest	5.5	2.2	5.6	2.2

FIGURE 1

SAMPLE DISTRIBUTION FOR THE DANVA2-AF SUBTEST SCORES

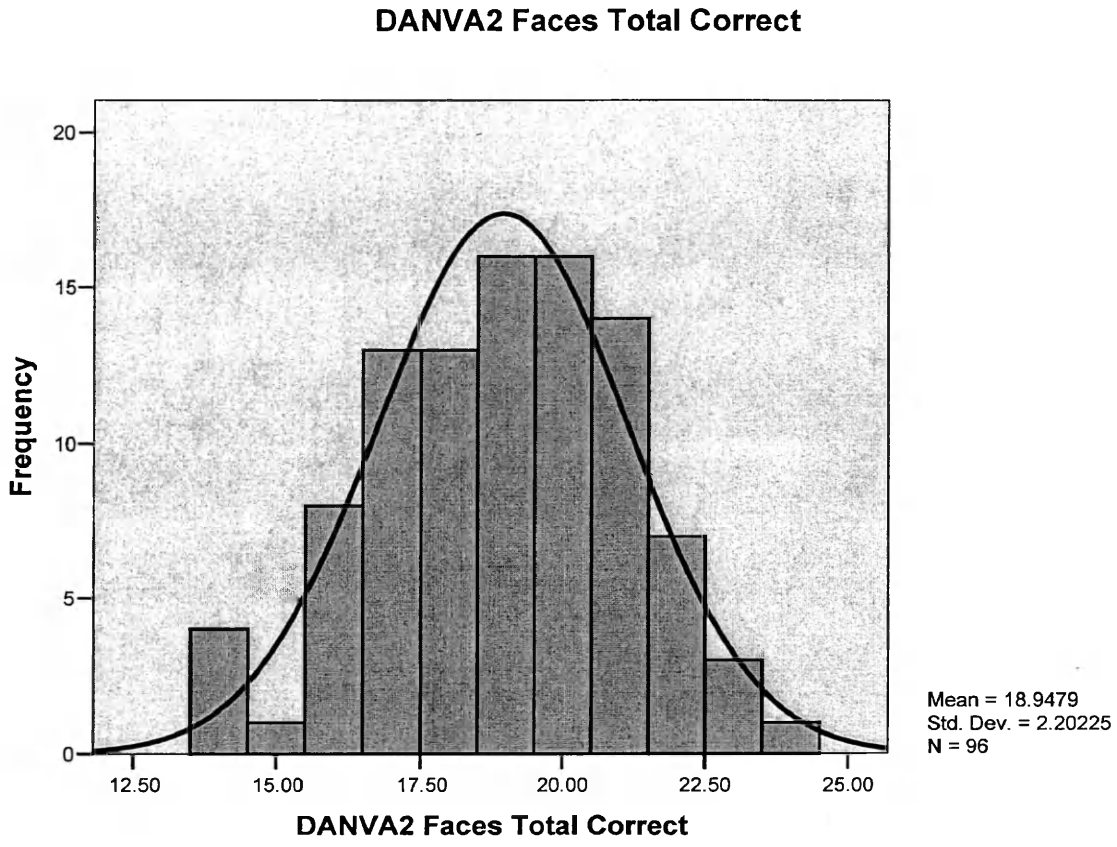


FIGURE 2

SAMPLE DISTRIBUTION FOR THE DANVA2-POS SUBTEST TOTAL SCORES

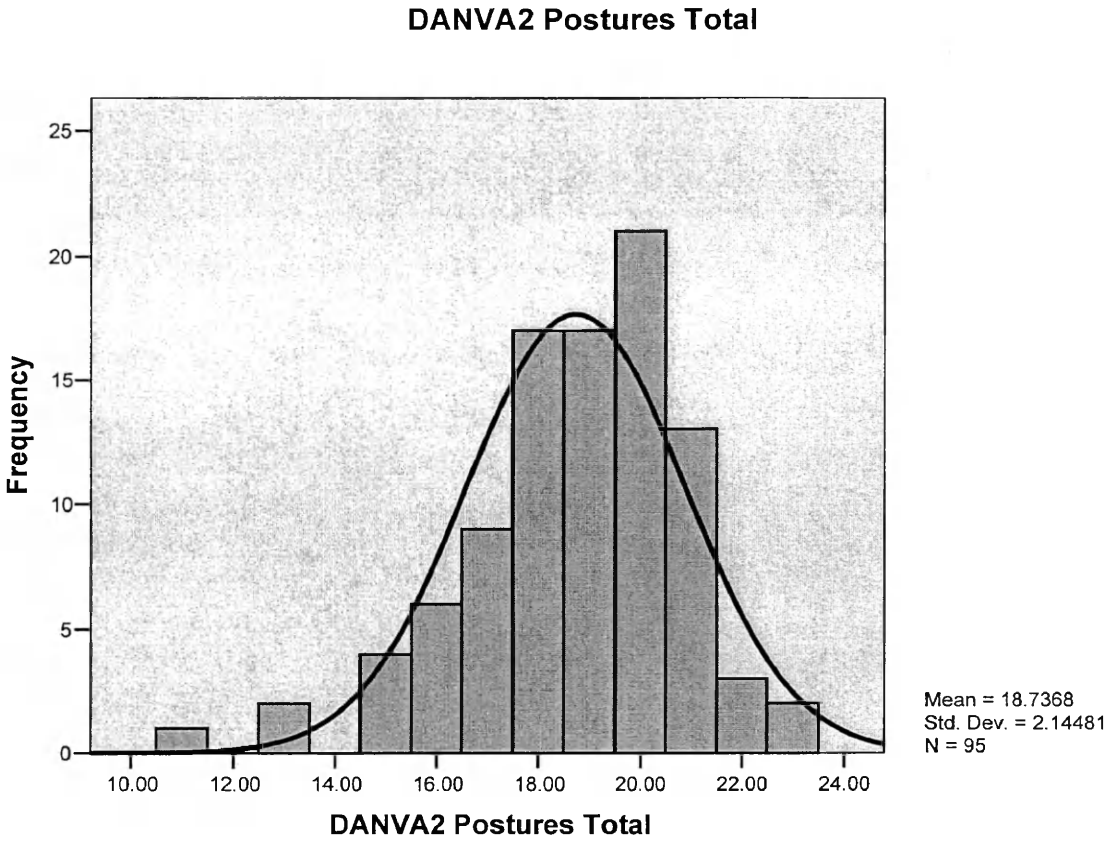


FIGURE 3

SAMPLE DISTRIBUTION FOR THE DANVA2-AF SUBTEST TOTAL SCORES

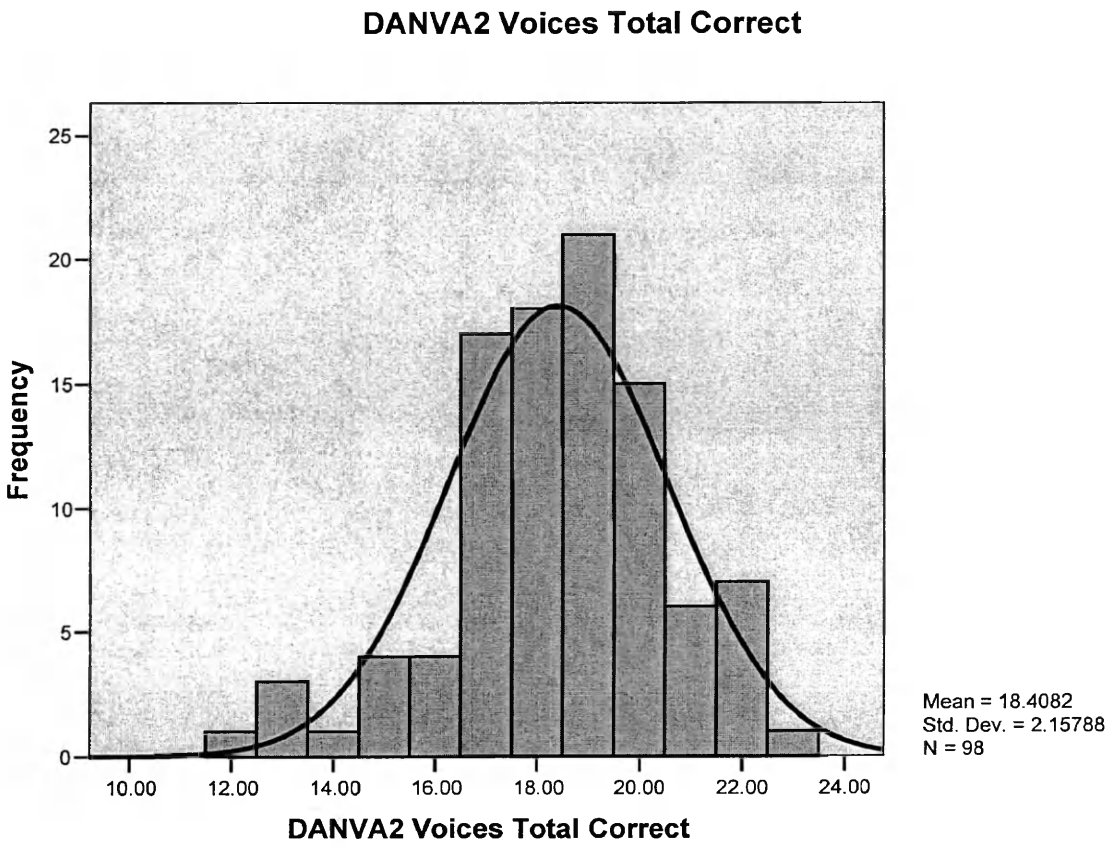


FIGURE 4

SAMPLE DISTRIBUTION FOR THE MAGICAL IDEATION SCALE TOTAL SCORES

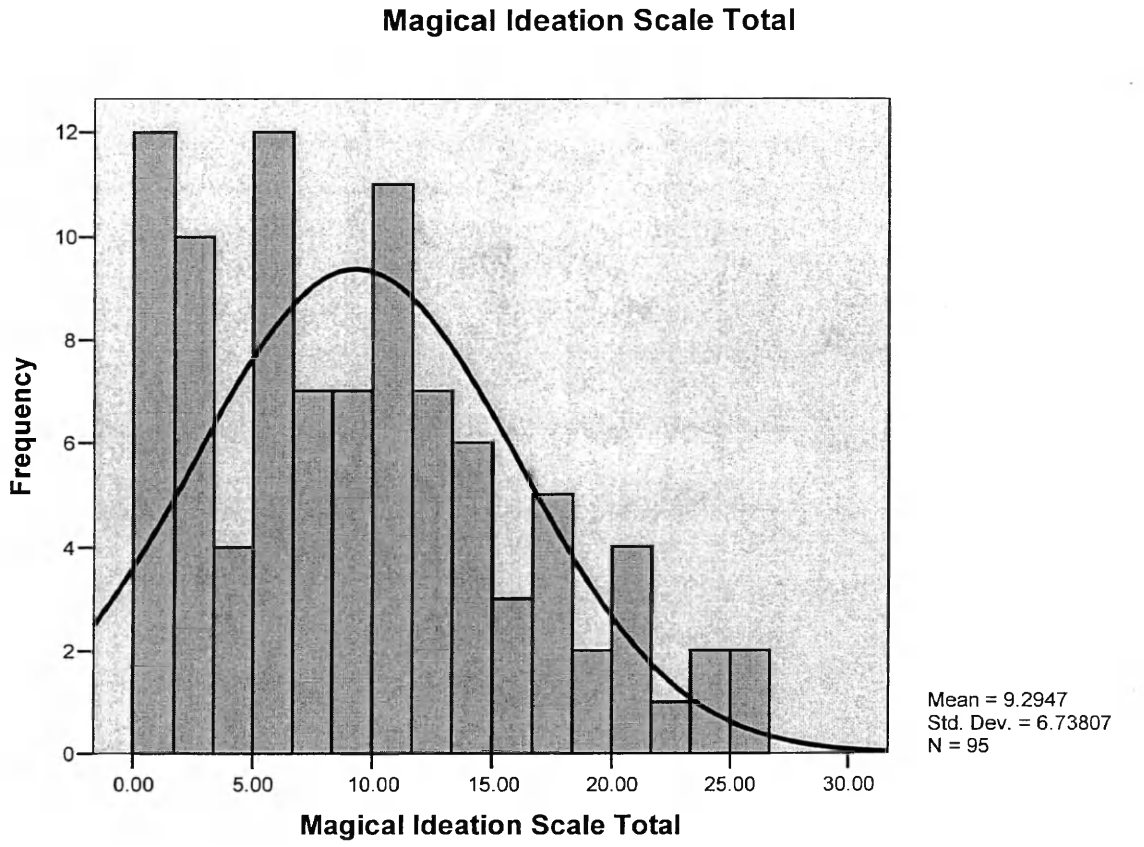
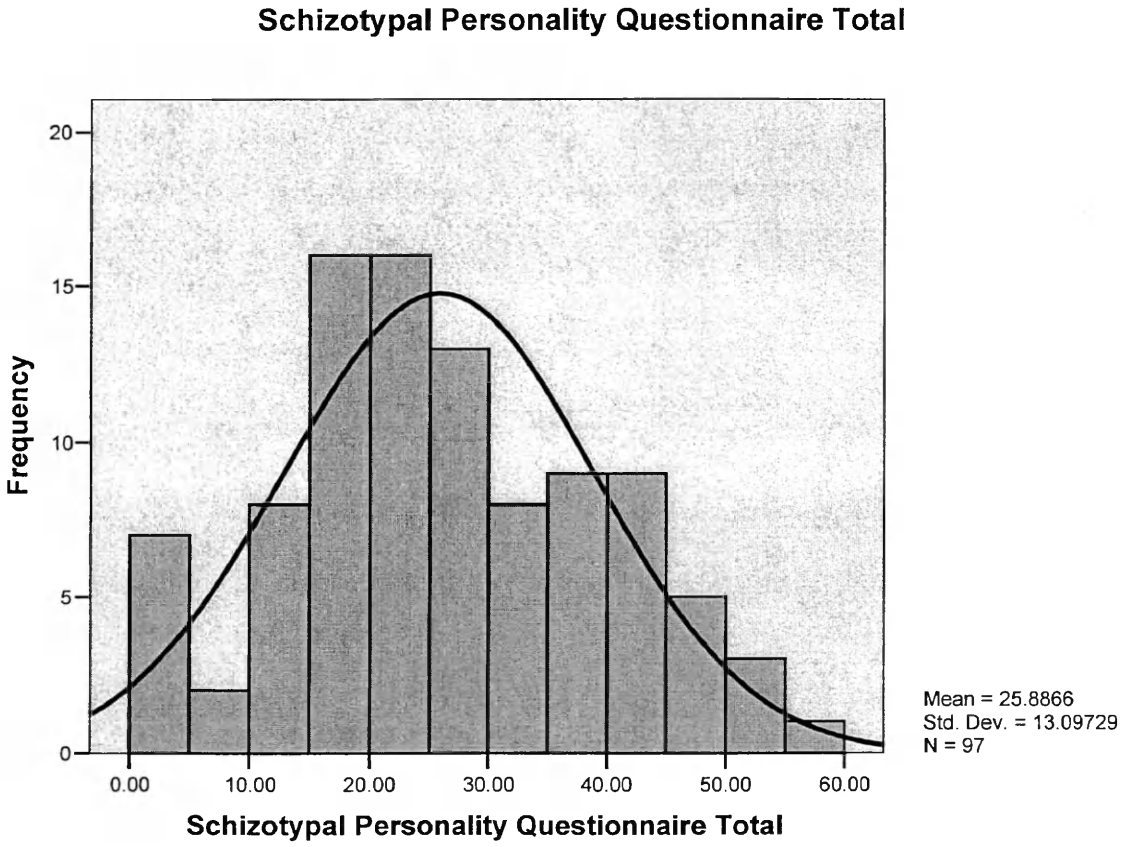


FIGURE 5

SAMPLE DISTRIBUTION FOR THE SCHIZOTYPAL PERSONALITY QUESTIONNAIRE TOTAL SCORES



APPENDIX A

DANVA2-AF INSTRUCTIONS TO PARTICIPANTS

You are going to see some photographs of people's faces. Please pay attention to whether you believe the person in the photograph is happy, sad, angry, or fearful. Each photograph will be shown for two seconds before it disappears from the screen. After the photograph is no longer visible, a blank slide will be shown for 10 seconds. During this time, please circle on your answer sheet the answer choice indicating the emotion you believe the person in the photograph is feeling -- happy, sad, angry, or fearful. Do you have any questions?

APPENDIX B

DANVA2-POS INSTRUCTIONS TO PARTICIPANTS

You are going to see some photographs of people in various postures. Please pay attention to whether you believe the person in the photograph is happy, sad, angry, or fearful. There will be a black oval covering the person's face in each photograph, so you must decide how he or she feels based on posture. Each photograph will be shown for two seconds before it disappears from the screen. After the photograph is no longer visible, a blank slide will be shown for 10 seconds. During this time, please circle on your answer sheet the answer choice indicating you believe the person in the photograph is feeling. Do you have any questions?

APPENDIX C

DANVA2-AP INSTRUCTIONS TO PARTICIPANTS

I'm going to play a tape for you. On this tape, you will hear the phrase 'I am going out of the room now, and I'll be back later' read by different actors. Immediately after you hear the phrase, decide whether the actor sounded happy, sad, angry, or fearful, and circle this answer on the answer sheet. There will be a few seconds of pause after each time the phrase is read. Please mark your answer during this time. Do you have any questions?

REFERENCES

Abdi, Z. & Sharma, T. (2004). Social cognition and its neural correlates in schizophrenia and autism. *CNS Spectrums, 9,* 335-343.

Atkinson, A.P., & Adolphs, R. (2005). Visual emotion perception: Mechanisms and processes. In L. Feldman-Barrett, P.M. Niedenthal, & P. Winkielman (Eds.), pp. 150-182. *Emotion and Consciousness,* Guilford Press.

Broks, P. (1997). Brain, self, and others: The neuropsychology of social cognition. In *Schizotypy: implications for illness and health*, G. Claridge (Ed.), pp. 98-123. Oxford University Press: Oxford.

Brüne, M. (2005). Emotion recognition, 'theory of mind,' and social behavior in schizophrenia. *Psychiatry Research, 133,* 135-147.

Brüne, M. (2005). Theory of mind in schizophrenia: A review of the literature. *Schizophrenia Bulletin, 31,* 21-42.

Claridge, G. (1997). Theoretical background and issues. In *Schizotypy: implications for illness and health*, G. Claridge (ed.), pp. 7-18. Oxford University Press: Oxford.

Eckblad, M., & Chapman, L.J. (1983). Magical ideation as an indicator of schizotypy. *Journal of Counseling and Clinical Psychology, 31,* 215-225.

Frith, C.D. (1992). *The cognitive neuropsychology of schizophrenia.* Hove, U.K.: Lawrence Erlbaum Associates.

Frith, C.D. (2004). Schizophrenia and theory of mind. *Psychological Medicine, 34,* 385-389.

Grinspan, D., Hemphill, A., & Nowicki, S. Jr. (2003). Improving the ability of elementary school-age children to identify emotion in facial expression. *Journal*

of Genetic Psychology, 164, 88-100.

Gruzelier, J.H. (1996). The factorial structure of schizotypy: Part 1. Affinities with syndromes of schizophrenia. *Schizophrenia Bulletin, 22,* 611-620.

Johnston, P.J., Katsikitis, M., & Carr, V.J. (2001). A generalised deficit can account for problems in facial emotion recognition in schizophrenia. *Biological Psychology, 58,* 203-227.

Kendler, K.S., McGuire, M., Gruenberg, A.M., & Walsh, D. (1995). Schizotypal symptoms and signs in the Roscommon Family Study. *Archives of General Psychiatry, 52,* 296-303.

Kerns, J.G. (2005). Positive schizotypy and emotion processing. *Journal of Abnormal Psychology, 114,* 392-401.

Kohler, C.G., Turner, T.H., Bilker, W. B., Brensinger, C.M., Siegel, S.J., Kanes, S.J., Gur, R.E., & Gur, R.C. (2003). Facial emotion recognition in schizophrenia: intensity effects and error pattern. *American Journal of Psychiatry, 160,* 1768-1774.

Kohler, C.G. & Brennan, A.R. (2004). Recognition of facial emotions in schizophrenia. *Current Opinion in Psychiatry, 17,* 81-86.

Kurek, N.S. (1986). Study of the emotional range of schizophrenic patients in a model of emotion recognition through nonverbal expression. *Zhurnal Nevrologii I Psikhiatrii imeni S.S. Korsakova, 86,* 1831-1837.

Kwapil, T.R. (1998). Social anhedonia as a predictor of the development of schizophrenia-spectrum disorders. *Journal of Abnormal Psychology, 108,* 558-565.

Kwapil, T.R., Miller, M.B., Zinser, M.C., Chapman, J., & Chapman, L.J. (1997). Magical ideation and social anhedonia as predictors of psychosis proneness: a partial replication. *Journal of Abnormal Psychology, 106,* 491-495.

Langdon, R. & Coltheart, M. (1999). Mentalising, schizotypy, and schizophrenia. *Cognition, 71,* 43-71.

Meehl, P.E. (1990). Toward an integrated theory of schizotaxia, schizotypy, and schizophrenia. *Journal of Personality Disorders, 4,* 1-99.

Pitterman, H. & Nowicki, S. Jr. (2004). A test of the ability to identify emotion in human standing and sitting postures: the diagnostic analysis of nonverbal accuracy-2 posture test (DANVA2-POS). *Genetic, Social, and General Psychology Monographs, 130,* 146-162.

Poreh, A.M., Whitman, R.D., & Weber, M. (1994). Facial recognition in hypothetically schizotypic college students. *Journal of Nervous and Mental Disease, 182,* 503-507.

Raine, A. (1991). The SPQ: a scale for the assessment of schizotypal personality based on DSM-III-R criteria. *Schizophrenia Bulletin, 17,* 555-564.

Raine, A., Reynolds, C., Lencz, T., Scerbo, A., Triphon, N., & Kim, D. (1994). Cognitive-perceptual, interpersonal, and disorganized features of schizotypal personality. *Schizophrenia Bulletin, 20,* 191-201.

Wickline, V.B., Bollini, A.M., Nowicki, S. Jr., & Walker, E.F. (unpublished). Emotion recognition in adolescents with schizotypal personality disorder.

VITA

Emily K. Bell

Emily K. Bell was born in Peoria, Illinois on December 7, 1982. She graduated from Peoria High School in May, 2001. Emily Bell received her B.A. from Knox College in Galesburg, Illinois in June, 2004 with a degree in Psychology. There, she was advised by Dr. Frank McAndrew in the Department of Psychology. The author received her M.A. in May, 2006 at the College of William and Mary in Williamsburg, Virginia. She was advised by Dr. Glenn Shean in the Department of Psychology, and completed her degree in General Experimental Psychology.