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Social Functioning in Schizotypy: An Exploration of Communicative Effectiveness through Speech Analysis and Observer Rated Performance in a Socially Demanding Task

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SOCIAL FUNCTIONING IN SCHIZOTYPY: AN EXPLORATION OF COMMUNICATIVE EFFECTIVENESS THROUGH SPEECH ANALYSIS AND OBSERVER RATED PERFORMANCE IN A SOCIALLY DEMANDING TASK

A Dissertation Defense

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Acknowledgments

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Variable Abbreviation/Measure Summary Sheet

Acoustic Analysis Variables
Pause. Mean: Average amount of compilations of 50 milliseconds of silence
F0.SD.Local: Standard deviation of frequency associated with pitch
F0.Pert: Frequency associated with jitteriness (perturbation)
F1.SD.Local: Standard deviation of the frequency associated with articulation of words (important for vowel expression)
F2.SD.Local: Standard deviation of frequency associated with tongue articulation (back and forth tongue movement), also important for vowel expression.
Intensity.SD.Global: Standard deviation of volume variability
Intensity. Pert: Volume of jitteriness through variability in vocal short frames of speech

LIWC Variables
LexPos: Positive factor computed from positive word stems on the LIWC
NegPos: Negative factor computed from negative word stems
Certainty: Computed by word stems of never and always, shown to demonstrate certainty and confidence in answers

Facial Expression Variables
Negfac: Factor computed for negative facial expressions and movements.
Posface: Factor computed for positive facial expressions and movements
Neutfac: Factor computed for neutral facial expressions and movements

HiSoc Variables
HiSocO: Total overall social functioning score
Beh/Lang: Behavior/language factor of the HiSoc
Affect: Affect factor of the HiSoc
Soc-Int: Social-Interpersonal factor of the HiSoc

SPQ Variables
SPQPos: Positive factor computed from positive symptom traits on the SPQ
SPQNeg: Negative factor computed from negative symptom traits on the SPQ
SPQDisorg: Computed by factors with disorganized symptoms of the SPQ

SPQ Distress Variables
PosDis: Distress over positive traits on the SPQ
NegDis: Distress over negative traits on the SPQ
DisorgDis: Distress over disorganized traits on the SPQ

BPRS Variables
BPRS: Item 17, evaluating emotional withdrawal

Abstract

Individuals with schizotypal traits have demonstrated sub-clinical symptoms of psychosis (e.g.

perceptual disturbances, self-reported social functioning impairment, self-reported memory

problems, and delusions). However, the evidence has been mixed regarding what impairments

exist, particularly with regards to social functioning domains. As schizotypy is posited to reflect

an underlying vulnerability for development of clinical levels of psychosis/risk conversion,

individuals with these traits are an important group to study in order to identify these

vulnerabilities. Research has indicated that current measures of social functioning (whether they

are localized objective measures of verbal and non-verbal communication or global self-report of

functioning) are missing some of the key insights into susceptibility of impairments. While

localized and specific measures of social functioning are highly related to schizophrenia, the

measures tell us little about vulnerability for individuals with schizotypy. This project explored

how a global assessment of social functioning that includes a more expansive assessment of

engagement through non-verbal and verbal communication (related to social functioning) could

potentially tell us more about how and where individuals with schizotypy demonstrate social

dysfunction. Contrary to prediction, schizotypy scores were unrelated to global functioning

scores. As predicted, local measures of functioning showed extremely minimal relationships to

schizotypy scores, confirming the proposed theory that these measures do not identify

discernible differences in schizotypy scores. Implications for future research and the subjective-

objective dysjunction with relation to schizotypy are considered below.

Social functioning in schizotypy: An exploration of communicative effectiveness through speech analysis and observer rated performance in a socially demanding task

Evidence indicates that individuals with psychotic disorders experience profound impairments in speech and social characteristics as compared to healthy controls (Gibson, Penn, Perkins, & Belger, 2010; Minor, Cohen, Weber, & Brown, 2011; McCleery et al., 2012). Individuals with sub-clinical symptoms of psychosis (e.g. hallucination, delusions, social dysfunction and withdrawal) – often referred as having "schizotypy" show mixed evidence for similar impairments, particularly in social domains. Of note, evidence of objective social impairments among those with schizotypal symptoms is relatively limited, while evidence for subjective impairments is relatively pronounced and consistent across studies. Thus, additional research is needed to classify these impairments. The present study used a sensitive experimental behavioral and global measure of social functioning and objective localized computer-based measures of speech and facial expression to evaluate the relationship between social functioning and schizotypy.

Schizotypy & Schizophrenia

Schizophrenia

Schizophrenia is a psychiatric diagnosis characterized by incapacitating symptoms of disturbed behavior and thoughts. The disease is prevalent in approximately 1% of the world's population and is responsible for 1-2% of national healthcare costs in industrial countries (Tsuang, Stone, & Faraone, 1999; Wu, Shi, Birnbaum, Hudson, & Kessler, 2005). These numbers do not account for the severe and vast costs to quality of life of patients and families.

To meet criteria for schizophrenia according to the Diagnostic and Statistical Manual of Mental Disorders 5.0 (American Psychiatric Association, 2013), an individual must have two or

more of the following symptoms occurring for one month (at least one of these must be 1-3): 1. hallucinations, 2. disorganized speech, 3. catatonic or grossly disorganized behavior. Additional criteria include social and occupational distress and disturbance lasting at least 6 months (including prodromal or symptoms of impairment similar to negative and positive clusters that have been present prior to the one month onset). Symptoms must not be a product of an identifiable medical condition or substance use disorder or better characterized by a different developmental disorder (APA, 2013; Tandon, Nasrallah, & Keshavan, 2009).

Schizophrenia is heterogeneous in type, intensity and duration of symptoms (e.g., Cohen & Docherty, 2005). For instance, individuals with schizophrenia may experience positive symptoms including hallucinations (false sensory perception) and delusions (false beliefs). They may also experience negative symptoms in tandem, including poverty of speech (alogia) and emotional deficits such as difficulty communicating emotion (alexithymia) or/and difficulty experiencing emotion (anhedonia) (Sutker & Adams 1993; APA, 2013). Differences in symptom expression such as the severity of symptoms, length of symptoms, comorbidity, amount and frequency of positive and negative symptoms, as well as response to intervention are vastly different depending on the individual (Sutker & Adams, 1993; Bruder et al., 2011; Kendler, Thackler & Walsch, 1996).

Schizophrenia is also characterized by profound social functioning deficits. Disruptions in social skills and ability to maintain social norms and relationships are inherent to the diagnosis. Difficulties in maintaining jobs, activities of daily living, communication, social anxiety and difficulties with interpersonal interactions, and objective quality of life and societal costs (such as the high cost of insurance and tax related hospital costs) are present in this population. Individuals with schizophrenia suffer from pervasive functional deficits related to

social interactions such as planning and keeping appointments, contacting appropriate people in daily and emergency circumstances, and appropriate dialogue with strangers and acquaintances. There has been little success in remediating these social dysfunctions (Addington & Addington, 2000; Bowie, Reichenberg, Patterson, Heaton, & Harvey, 2006; Simon, Wagner, & Vonderkoff, 1995).Therefore, it is important to look at individuals with schizotypy (discussed below), where vulnerability markers can be identified early and prior to clinical symptom development.

Schizotypy

Since the early inception of research and diagnosis of schizophrenia (Bleuler, 1911; Kraeplin, 1919), research suggested that individuals with schizophrenia experienced impairment prior to a psychotic break, and that many individuals show trait-like schizophrenia-like characteristics without ever meeting criteria for schizophrenia– defined as schizotypy. Vulnerability data show that approximately 10% of the population has schizotypy (with 10% of that population eventually converting to psychotic spectrum illness) (Meehl, 1990; Korfine & Lenzenwegger, 1995). Individuals with schizotypy experience disorganized, positive and negative symptoms such as sub-clinical hallucinations and delusions, and social withdrawal (Korfine & Lenzenwegger, 1995).

Studying schizotypal traits allows researchers to evaluate predisposition to schizophrenia and generate information about markers that may identify individuals who need early intervention and prevention to avoid transitions to psychotic spectrum illnesses. This research also results in identification of individuals who may have functional, social, and/or cognitive differences compared to healthy controls that may be impairing. Studying schizotypy also allows researchers to understand the schizophrenia-spectrum without having to control for confounding

variables present in schizophrenia samples, such as treatment compliance, treatment response, and duration of untreated psychosis (Minor & Cohen, 2012).

It is important to note three commonly used methods of identifying and defining schizotypy. The first involves classifying individuals at high genetic risk based on having at least one biological parent with diagnosable schizophrenia. Behavioral genetic studies have revealed approximately a 13% chance of developing the illness if one parent has the disorder, and approximately a 39% of developing schizophrenia if an individual has two parents with schizophrenia, and a 48% likelihood if a monozygotic twin has the disorder (O'Donoven, Williams, & Owen, 2003; Herson, 2011). Therefore, one method of identifying those with a predisposition to psychosis is screening individuals at ultra-high risk. These individuals are identified by showing one or more of three criteria that make their propensity for a psychotic break within one year extremely high. The three criteria include (1) attenuated positive symptoms or sub-clinic positive symptoms occurring for at least one week in the previous month or brief intermittent psychotic syndrome or brief psychotic symptoms that have occurred within the last three months, (2) and/or genetic risk and recent deterioration or (3) if the individual has a first degree relative with schizophrenia or schizotypal personality disorder, as well as a significant decrease in functioning lasting at least a month (Yung et al., 2006; Cannon et al., 2008; Addington et al., 2011).

Another broader method of identifying risk is the use of psychometric detection, which involves identifying individuals with schizotypy who report symptoms and behaviors comparable, but sub-clinical to psychotic spectrum disorder. They may not be at imminent risk of psychotic illness, but they show traits that are associated with psychotic illness. These populations may reveal more about what is happening for individuals earlier and also

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information about those who may not transition to a complete psychotic illness. These individuals can be identified through self-report screenings. Psychometric questionnaires are advantageous because they allow large screenings of individuals with schizotypy traits. They are beneficial due to their efficiency and lend themselves nicely to a dimensional approach to assessment. A recent meta-analysis identified some of the advantages of dimensional measures of psychopathology. These screening measures are more inclusive as they show more people with propensity to illness. The measures do this by capturing higher sample sizes with a more expansive screening of symptoms that are not achievable with stricter guidelines about ultra-high risk. Additionally, broader measures have increased validity (>35%) and reliability (15%) compared to discrete or categorical measures of risk (Markon, Chmielewski, & Miller, 2011). Therefore, by using these measures, identification is expanded to show more subtle symptoms that are associated with psychotic illness and with more confidence in the reliability and validity of these results.

Like schizophrenia, it is widely recognized that the schizotypy construct is heterogeneous in its symptom presentation and may be best understood from continuum models of its dominant symptom clusters of positive, negative, and disorganized symptoms (Kerns, 2006). While these symptom cluster definitions are not without some controversy, there is a large body of empirical evidence that supports this three factor model (Chapman & Chapman, 1983; Korfine & Lenzenwegger, 1995). Positive schizotypal traits are typically defined in terms of perceptual disturbances, while negative schizotypal traits involve aspects related to social anhedonia (e.g., social withdrawal, apathy, lack of enjoyment) and social cognition deficits (e.g., difficulty appraising positive emotion and reduced emotional expression). Disorganization schizotypal traits include disinhibit ion, nonlinear speech and thoughts (Mata et al., 2003). Given continuum

models of pathology towards schizophrenia, in relation to schizotypy traits and putative underlying mechanisms, schizotypy has important clinical implications as it is linked to both affective and behavioral dysfunction that impairs overall quality of life (Cohen, Auster, MacCauley, & McGovern, 2014). This makes studying this group imperative in order to identify features that may help to prevent a transition to psychosis which would result in the costs of illness and quality of life related to schizophrenia.

Additionally, schizotypy has been associated with profound deficits in social impairments, at least per self-reported measures (Cohen & Davis, 2009) as well as greater propensity toward substance use (Nunn, Rizza & Peters, 2001; Esterberg, Goulding, MClure-Tone, & Compton, 2009), and a greater incidence of mood disorders and social adjustments over a ten year period compared to healthy controls and matched peers (Kwapil, Gross, Silvia, & Barrantes-Videl, 2013). However, there is something incongruent in the results of assessment research in schizotypy. It is evident that the way we evaluate symptoms, whether that be through computerized, self-report, or behavioral measurement reveal different manifestations of impairment.

The Subjective-Objective Dysjunction in Schizotypy

There is an interesting, and seemingly paradoxical, finding within schizotypy that warrants potential importance to the study of vulnerability markers in psychosis proneness. This is particularly interesting in the study of psychometric schizotypy most commonly based on college students without clinically significant symptoms. The subjective-objective dysjunction involves findings that schizotypal individuals self-report pathology that, in certain domains of functioning, is comparable to individuals with chronic schizophrenia. However, objective functioning abnormalities are less pronounced. There is minimal research to support this

dysjunction across social functioning, although this may be a good place to start investigating the where and when with regards to the differences discussed above. However, before discussing the potential benefits of using social functioning as an example and how to measure this, the next section will review what we already know from the literature regarding this dysjunction. The below review will demonstrate what the literature shows us about this finding that local objective measurement of schizotypy reveal null findings that are unexpected due to both the relationship to higher-risk and psychotic individuals, and the self-reported differences.

Subjective-objective dysjunction: Quality of life. Individuals with psychometric schizotypy report differences in quality of life often on the order of two standard deviations lower than healthy controls (Cohen & Davis, 2009). Objective differences in quality of life (QOL) in terms of social, health, legal, social support and capacity, and security experiences are well documented for individuals with schizophrenia (Fervaha, Agid, Takeuchi, Foussias, & Remington, 2013; Margariti, Ploumpidid, Economou, Christodolou, & Remmington, 2014). Interestingly, individuals with schizotypy report subjective accounts comparable to chronic out-patients even though their objective functioning in these domains are not significantly different than their healthy matched peers (Cohen, Morrison, & Callaway, 2013). While the domains above are discrepant for individuals with schizotypy, correlations between schizotypy and quality of life are much larger for subjective reports and perceptions of QOL. These differences are not reflected in objective differences, such as amount of social support, safety in living or legal problems (Cohen & Davis, 2009; Cohen et al., 2014). In summary, individuals with schizotypy report experiences comparable to chronic outpatients, yet their objective functioning is comparable to individuals not on the psychotic spectrum.

Subjective-objective dysjunction: Emotional functioning. Laboratory studies with individuals with schizotypy show abnormalities in emotional expressivity across multiple domains. Individuals with schizotypy report lower levels of pleasurable experience when exposed to positive, neutral, and negative stimuli than both healthy matched peers *and* chronic patients with serious mental illness (Cohen, Callaway, Larsen, & Strauss, 2012). Additional studies (>10) show similar pathological levels of anhedonia (inability to experience pleasure) when exposed to pleasurable incentives such as food, scenery, and social interactions (Fitzgibbons & Simons, 1992; Fiorito & Simons, 1994; Ferguson & Katkin, 1996; Gooding, Davidson, Putnam, & Tallent, 2002; Mathews & Barch, 2010; Najolia, Cohen, & Minor, 2010; Cohen et al., 2012). Yet, objective measures of emotional functioning such as startle response (Gooding et al., 2002) and skin conductance (Fitzgibbons & Simons, 1992) do not show the same group differences. For example, a study in 2002 of approximately 36 participants with high levels of social anhedonia identified through a psychometric measure used to identify psychosis proneness (Chapman Psychosis-Proneness Scales) were compared to a group of approximately 40 healthy control participants on physiological evaluation of startle response when exposed to positive, negative or neutral pictures. There were no significant differences found between the control and socially anhedonic group (Gooding et al., 2002). Similarly, a study examining individuals with psychosis proneness and healthy controls revealed no differences in skin conductance, an objective measure of sweat gland response (Fitzgibbons & Simons, 1992). Skin conductance differences are seen in patients with schizophrenia with results showing differences in fluctuations of sweat response, differences in habituation, and higher rates of sweat response, especially when exposed to emotional stimuli (Gruzelier Seymour, Wilson, Jolley, & Hirsch, 1988; Cooklin, Sturgeoin, & Leff, 1983). The results of these local objective measures show no

differences for individuals with schizotypy. These results further demonstrate the dysjunction across subjective and objective experiences for individuals with schizotypy.

Subjective-objective dysjunction: Olfaction. A similar phenomenon occurs for individuals with schizotypy with regards to olfactory, or smell identification. Dating back to the 1970s, olfaction deficits have been a recognized identifying feature of schizophrenia (Campbell & Gregson, 1972). Since then research has demonstrated olfactory dysfunction in schizophrenia including odor detection (Gross-Isseroff et al., 1994; Serby, Larson, & Kalkstein, 1990) and odor memory (Campbell and Gregson, 1972). Studies have also found that odor discrimination is deficit for individuals with schizophrenia (Sreenivasan, Abraham, & Verghese, 1987). Individuals who are at ultra-high risk for schizophrenia, as well as those who eventually transition to psychosis also show some of these deficits (Moberg et al., 2003). Therefore, this is an important feature to look out for amongst all individuals with schizotypy in order to identify comparable impairment and potential early identification. However, individuals with psychometric schizotypy show less objective identifiable differences in smell identification (Kamath & Bedwell, 2008; Cohen, Brown, & Auster, 2012; Auster, Cohen, Callaway, & Brown, 2014). However, a recent study revealed a dysjunction with subjective reports of identification of pleasurable stimuli (i.e. smell) among individuals with schizotypy that are comparable to patients with serious mental illness and significantly discrepant from matched peers (Auster et al., 2014). This reveals another potential dysjunction in subjective compared to objective differences among those with schizotypy.

Social Functioning: An Important Area of Research in Schizotypy

Despite social functioning being important in schizophrenia, it is presently unclear in what ways it is important in schizotypy. As noted above, there is evidence that social functioning

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is impaired in schizotypy when evaluated using self-reported measures (Cohen & Davis, 2009; Cohen et al., 2014). The evidence is more complicated when measured using objective means. Social functioning is a complicated and multidimensional construct – manifesting across subjective, behavioral, and objective domains (Sayler & Mueser, 2001; Brackett, Rivers, Shiffman, Lerner, & Salovey, 2006; Eisenberg, Spinard & Morris, 2002). Importantly, a study with 228 participants characterized at different levels of risk (e.g. some having some schizotypy traits and others with high genetic susceptibility to schizophrenia) revealed that the most salient predictor of risk of transition to psychosis was social deterioration. In this study, participants who showed more odd behavior and social withdrawal were more likely to transition to psychotic symptoms than those who revealed sub-clinical psychotic symptoms (Miller et al., 2002). Therefore, it is necessary to consider social functioning as a potential predictor of risk for illness among individuals with schizotypy. The next sections will focus on how social functioning is normal across many objectively-defined domains of social functioning, and is abnormal in others. Of note, the first part of this section focuses on computer-based objective measures of communication, acoustic, facial and lexical analysis of speech in schizotypy. These measures tap basic components of social functioning – "local" components as they will be referred to later in the introduction. Research has shown that these measures are abnormal in patients with schizophrenia (Brozgold et al., 1998; Bediou et al., 2007; McClure et al. 2007).

Objective Measures: Acoustic Analysis of Speech

Physical properties of speech, such as vibration, sound, ultrasound, and infrasound (Slaney & Naylor, 2011) are important to understanding nonverbal aspects of communication (and therefore social functioning) and can be measured using acoustic analysis. Objective measures of acoustics include measuring variables such as silence, pauses, utterances, and range. Acoustic

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analysis of speech has been used to understand social functioning in patients with schizophrenia and schizotypy. For example, individuals with schizophrenia reveal blunted expression and lack of word use, which have characterized some of the social symptoms and dysfunction for these individuals (Argyle, 1976; Hooker & Park, 2002; Brackett et al., 2006). In a recent study, participants with psychometric schizotypy were compared to matched healthy control on speech production using prosodic analysis. Little to no group differences was found suggesting the same kind of speech production deficits found in schizophrenia (Cohen & Hong, 2011). Similarly, a study in 2012 with approximately 40 individuals with psychometric schizotypy and matched controls revealed no group differences in speech production when evaluated in different cognitive load conditions. Individuals with schizotypy showed the same decrease in speech production as healthy controls when faced with an increasingly difficult simultaneous or a dual cognitive task (Cohen et al., 2012). This further demonstrates the lack of evidence for local objective differences in speech communication for individuals with schizotypy compared to healthy controls.

Objective measures: Facial analysis. Facial expression research, which has been studied in depth by researchers such as Paul Ekman and Charles Darwin, is based on the notion that the movement of facial muscles conveys non-verbal emotional state and expression (Ekman, 1970; Fridland, 1994). Measurement of facial expression includes computerized measurement of facial movement and intensity of this expression through head and facial muscle movement. For example, facial expression of emotion is objectively different for individuals with schizophrenia (Gabay, Kempton, & Mehta., 2014). Some of the deficits in facial expression among individuals with schizophrenia include reduced movement, expressivity, and response to emotional stimuli (Earnst et al., 1996; Kohler et al., 2003). However, these data indicate null findings for

individuals with psychometric schizotypy (Cohen et al., 2012). A recent laboratory study with 37 participants with psychometrically defined schizotypy and matched controls (33) showed that individuals with schizotypy did not reveal significantly abnormal or different movement or expressivity than healthy controls. They did not differ from healthy controls in head or mouth movement or intensity of expression to positive or negative images. This is further evidence that this population does not show these local objective differences compared to patients with schizophrenia (Cohen, Morrison, & Callaway, 2013).

Objective measures: Lexical analysis. An additional type of objective analysis of communication is through lexical analysis of speech. Lexical analysis examines properties of speech such as word content and valence (use of positive, negative, and neutral words). Computerized lexical analysis evaluates speech based on analysis of individual word stems using predefined dictionaries. Lexical analysis is related to social functioning. Research has demonstrated that lack of words and specific word choice (i.e. more negative and positive words) is related to depression and social communication disturbance as well as social functioning (Tauscik & Pennebaker, 2010; Pennebaker, Chung, Ireland, Gonzales, & Boothe, 2007). Additionally, studies with patients with schizophrenia reveal direct relationships between social dysfunction and abnormal expression of positive emotion (measured by lexical analysis; Cohen, St. Hilaire, Akra, & Docherty, 2009). There is very limited information regarding lexical analysis and social functioning in schizotypy. However, a recent study with individuals with schizotypy and matched controls had participants verbalize their thoughts and feelings regarding images that were categorized as pleasant, unpleasant, and neutral. In this study, there was no difference in the production of speech amount or content when looking at unpleasant stimuli. Yet, there was some evidence for reduced speech production using positive words when discussing a pleasant image.

Participants with schizotypy used fewer positively valence words when observing positively valenced stimuli than healthy controls. (Najolia, Cohen & Minor, 2011). These results demonstrate the need for further evidence of what the differences mean in speech among individuals with schizotypy.

Objective Measures: Behavioral-based ratings of social functioning

Interestingly, a recent study found evidence of social functioning abnormalities using objective-based behavioral measures of social functioning. Gibson et al. (2010) evaluated individuals with schizotypy and found significant impairments in the domains of affect, behavior, and social-interpersonal communication through behavioral measures. The variations between these domains revealed some of the specific differences between matched peers and those with schizotypy, including problems demonstrating appropriate affect through facial expression and tone, body language, behavior, and fluent speech when they are observed in behavioral measures. Please see Table 1 for different variables that were used in that study and were adapted for the present study to define social functioning.

Notably, social function was measured during a role-play task where participants were asked to communicate why they should be chosen for a reality show (High-Risk Social Challenge Task). During this task, individuals are asked to discuss why they should be chosen for a socially desirable television project (Gibson et al., 2010). There are a number of advantages of using this type of measure including attainment of both audio and visual data for individuals who are being asked to demonstrate their subjective positive qualities to make them competitive for winning a coveted job. This allows observers to rate participants' ability to convey these qualities, participant belief regarding their ability to actually attain the job, and basic social norms in communicating these abilities.

Another study of social functioning using behavioral measures in schizotypy also warrants mention. Collins, Blanchard and Biondo (2005) found differences in social functioning (i.e. engagement, constricted affect when communicating) in a sample of 170, 18–19-year-olds (85 social anhedonics, 85 controls). This study used a measure (i.e.,The Schizoidia Scale; Kosson, Byrnes & Park, 1999; Collins et al., 2005) which contains items related to schizotypy including constricted affect and detachment (defined as deficit in engagement). Ratings of frequency and severity of these items were observed in a single 30 minute videotaped session of a portion of a clinical interview (SCID-IV Clinical Interview for DSM-IV Axis I Disorders, Patient Edition-Research Version; First et al., 1996). The significant findings of this study were that aspects of social functioning were observed for individuals with high social anhedonia compared to healthy controls through behavioral ratings. The aspects of interpersonal functioning that were observed to be different than controls included constricted facial affect, lack of verbal and non-verbal expression and physical anergia.

Explaining the Variability in Findings of Objective Social Functioning Abnormalities in Schizotypy: Local and Global Measurement

Studies of social functioning in schizotypy using objective methods have thus far focused on relatively local measures (e.g. facial analysis, Cohen et al., 2013; acoustic analysis, Cohen et al., 2012; neurocognition, Chun et al., 2013) and on relatively subjective global measures (e.g. self-report; Cohen & Davis, 2009; Chun et al., 2013; Cohen et al., 2014). The aforementioned studies (Gibson et al., 2010; Collins et al., 2005) employed behavioral ratings of more global social functioning. Viewed through this distinction, localized objective measures may not be abnormal in schizotypy whereas global objective measures may be. Considering the differences between these types of measures may help disentangle what, if any, social functioning

impairments actually occur in schizotypy. Global behavioral measures may be a way to capture a missing piece of objective and subjective measures of social functioning. However, there has been minimal research to date regarding behavioral measurement in schizotypy. This study examined local objective measures as well as global objective behavioral measures in schizotypy.

What is the Missing Piece: Local versus Global?

Literature has demonstrated that detachment or emotional withdrawal is greater among individuals with schizophrenia and trauma histories (Le Lievre, Schweitzer, & Barnard 2011; Vogel et al. 2013). While little has been studied to highlight this potential symptom of schizotypy, the results of poor interpersonal communication in observer rated studies suggest this may be an ingredient to understand the difference in subjective and objective social functioning impairment in this population. Additionally, the Brief Psychotic Rating Scale (BPRS; Lukoff, Neuchterlein, & Ventura, 1986) defines a symptom called emotional withdrawal as an "invisible barrier" between interviewer and patient that causes detachment and inability to relate. This may be the reason we see subjective differences among individuals with schizotypy that are not captured by objective measures (which lack this piece of observer-rated interpersonal effectiveness) that can be conveyed through observed symptoms in a behavioral measure. The component of social observation and ratings in these symptoms may be essential to understanding differences between those with high schizotypy traits and healthier individuals. Therefore, this study proposed that emotional withdrawal (which can be measured by the BPRS) could potentially mediate the relationship between social functioning and schizophrenia, helping to explain the relationship between these variables, and also explaining a missing piece in

objective computerized measures of language and affect with regards to when/where this relationship is driven.

In considering how local and global objective measures of social functioning may relate to this "invisible barrier", it is important to discuss one of the elements of interpersonal communication evaluated in the Gibson et al.(2010) task involving engagement and specifically, emotional withdrawal. Emotional withdrawal is defined as the "lack of ability to connect" or "mental assertiveness" (Herman, 1992). Global measures of behavior and self-reported social dysfunction demonstrate social-interpersonal & communication differences in schizotypy (Collins et al., 2005; Gibson et al., 2010; Cohen et al., 2014). However, localized measures of social dysfunction, which are limited to specific deficits in speech production and facial expression, do not reveal social functioning differences from healthy controls (Cohen et al., 2012; Cohen et al., 2012). It is possible that global ratings of social functioning in schizotypy are disrupted by an over-arching, global or impressionistic factor that is abnormal, such as emotional connection. Insofar as local measures are focused on specific facets of social functioning that are not directly affected or biased by these global factors, they may be missing the component of social functioning that is impaired in schizotypy. To disentangle this issue, it was necessary to simultaneously evaluate local and global features of speech.

Present Study

This project examined the relationship between social functioning, using a validated observer rated role-play task, and local and global objective measures of functioning. The role play-task used in this study (Gibson et al., 2010) involves a stressful behavioral task that requires social communication. Replicating that the relationship between social functioning and schizotypy is not captured through local objective measures, potentially would help to isolate

whether there was a difference in assessment of functioning that is captured by global behavioral measures or rater observed effectiveness of social functioning. Additionally, I planned to explore whether emotional withdrawal is a mediating factor between social functioning and schizotypy, and potentially creates the "invisible barrier" that exists between an observer and an individual with schizotypy traits. I believed this barrier may be the piece that explained why local objective measures and global behavioral measures indicate different results (i.e. no differences in social functioning assessed through local measures compared to robust differences found in global measurement).

Aims

In this project my aims were to evaluate social functioning in schizotypy using a behavioral task. I planned to explore social functioning through local objective analysis of speech and facial analysis, as well as global interpersonal ratings of domains of social functioning (including affect, behavioral expression and social interpersonal domains).

Aim 1. My initial aim was to replicate and extend prior research demonstrating that there are social impairments in schizotypy. The above introduction demonstrated that current measures of social dysfunction may not be inclusive enough to classify or discern these dysfunctions. By assessing this through a global assessment of functioning, where participants are asked to participate in an engaging speaking task, it was possible to replicate the fact the social functioning is impaired for individuals on the schizophrenia spectrum and extend this to explore whether impairments occur with increasing schizotypy traits.

Aim 2. My second aim was to replicate and extend research demonstrating that social differences are NOT captured by local objective measures of social functioning. Interestingly, local objective impairments that are often characteristic of individuals with schizophrenia are

rarely identified for individuals with schizotypy. It is possible that this is a problem of measurement and demonstrates that this is not the right way to identify impairment in this population. Identifying that local objective measures such as facial expression, acoustic analysis, and facial movement may NOT reveal dysfunction couldguide research in new directions of identifying how social impairments impact individuals with schizotypy traits.

Aim 3. My initial exploratory aim was to look at how a symptom of social dysfunction that has been described as a barrier or wall, helps to explain the link between schizotypy traits and social functioning. I planned to evaluate how emotional withdrawal potentially mediates the relationship between social functioning on a global level and psychometric schizotypy.

Importance of This Topic

The importance of studying the nuances of symptoms across the schizophrenia spectrum is well-documented. In this project specifically, taking a dimensional approach (looking at schizotypy traits as they increase) allows for a more sophisticated and expansive investigation of potential risk markers. Additionally, comprehensive global behavioral evaluation of individuals may indicate social functioning differences (seen through observer ratings) that show communication is harder or less effective for individuals with schizotypy. This variance may not be captured through local, objective measures. Additionally, this is the first project, to our knowledge, that proposed to examine how emotional withdrawal contributes to social functioning deficits in schizotypy. Differences in social functioning related to emotional withdrawal may indicate a deficit or identifiable difference that may be too subtle to be detected by local, objective ratings. It is also the first study to our knowledge to compare a global measure of functioning to local measures of functioning in a dimensional sample examining psychometric schizotypy. Expanding assessment techniques to identify these differences in social functioning

may contribute to a better understanding of when/where social functioning becomes a problem for individuals with schizotypy traits.

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Method

</div>

Participants

Fifty seven adults were recruited from a university setting, where students were able to obtain course credit for their participation. A dimensional approach was used to define schizotypy. Participants were asked to read and sign an informed consent form (see Appendix A). Participants answered a number of online surveys and computerized tasks including a speaking task that was audiotaped as discussed below. There was no inclusion or exclusion based on gender or racial/ethnic origin. During the testing session, a confidential code was assigned to each participant. Participants were tested by trained undergraduate research assistants and debriefed at study's end. This study was approved by the Louisiana State University Human Subject Review Board.

Measures

Schizotypy. The *Brief-Revised Version of the Schizotypal Personality Questionnaire* (SPQ-BR; Cohen et al., 2010; Callaway et al., 2014;) is made up of 32 items across seven domains of schizotypy (Magical Thinking, Unusual Perceptions, Ideas of References/Suspiciousness, Social Anxiety, No Close Friends/Constricted Affect, Eccentric Behavior, and Odd Speech). It was created using the full Schizotypal Personality Questionnaire (SPQ; Raine, 1991), a widely implemented measure for evaluating psychometrically defined schizotypy (Stefanis, Smyrnis, Avramopoulos & Stefanis, 2004;Callaway et al., 2014; Cohen et al., 2010). The SPQ-BR was chosen in this study because of its efficiency and conciseness and the SPQ-BR has resulted in fewer incomplete responses than the full SPQ (Cohen et al., 2010).

The SPQ-BR has a three factor superordinate structure consisting of positive (Magical Thinking, Unusual Perceptions, Ideas of References/Suspiciousness), negative (Social Anxiety, No Close Friends/Constricted Affect), and disorganized (Eccentric Behavior, Odd Speech) traits. In this study, a five-point Likert format was used for each question. Research on the SPQ has demonstrated high internal reliability (0.91), test-retest reliability (0.82), convergent validity (0.59 to 0.81), discriminant validity, and criterion validity (0.63, 0.68), (Raine, 1991; Wurthrich & Bates, 2005; Callaway et al., 2014). A study in 2005 revealed that the presence of distress and/or effects on role functioning helps to distinguish risk and distress/impairment of sub-clinical schizophrenia symptoms (Loewy, 2005). Therefore, the initial validation of the addition of distress to the SPQ surveyed over 600 undergraduate students at LSU found that each factor of the SPQ (positive, negative, and disorganization experience) and the distress subscales were related to lower satisfaction in quality of life across multiple domains including school, transportation, home life, recreational activities, sleep (Cohen, 2014). The addition of these factors to this scale allowed for greater exploration of distress over symptoms in this study.

Global measure of social functioning. The *High-Risk Social Challenge Task* (HiSoc; Gibson et al., 2010) is an experimental test of social skills where participants are video and audiotaped while being asked to speak for a 45 second mock audition to be a part of a new reality show. The task is rated on a five point Likert scale for 16 items (See Table 14 & Appendix B & C). Raters evaluate scores on Affect, Odd Behavior and Language, and Social-Interpersonal domains by evaluating behavior such as excessive or diminished expressivity of movement, language and speech, as well as content and style of speech and overall interviewer impression. All three of these factors have demonstrated high correlations with the total global social functioning score seen through factor analysis. Individuals with genetic high-risk for

psychosis reveal moderate to high effect size differences compared to healthy controls across these three domains of social functioning as well as global social functioning (.49-1.04) measured in this task (Gibson et al., 2010). As the first validated behavioral measure of social functioning in a high-risk sample, this task is a good standard of social functioning to use in comparable samples of individuals Additionally, the largest effect size difference (1.04) in social functioning for genetically high-risk individuals was found in the domain of social-interpersonal functioning. As described above, I proposed this was the theoretical underpinning of social functioning differences in schizotypy, which may not be captured in local objective measures that are too specific. Three raters, blind to SPQ-BR scores, evaluated scores in each item and domain and gave a global score of social functioning. The writer of this document trained these three raters by collaboratively going through the scoring and rating manual (Gibson, 2009). Scoring examples were discussed to make sure that each rater understood each of the concepts and scoring protocol. Each rater used the manual consistently while rating each item and then emailed the writer with any scoring questions. Averages of the scores for each item (for each participant) were calculated (computed from the ratings from all three raters) and used in these analyses. No individual scores on the items were more than two standard deviations from any other rater's scores.

Local Objective Measures of Social Functioning

Speech analysis. The *Computerized Assessment of Affect from Natural Speech Protocol (CANS;* Cohen, Alpert, Nienow, & Docherty, 2008; Cohen, Reshaw, Mitchell, Kim, 2015) is a sensitive computer program that detects speech variables that relay normal and abnormal speech such as pause length, prosody (i.e., inflection), and intensity of speech volume. The CANS has shown temporal stability across acoustic measures and moderate stability across prosodic measures

during repeated administrations, demonstrating overall statistically significant reliability (Cohen & Hong, 2009). This computes utterances (vocal statements) separately at a rate of 150 milliseconds and were applied to each social role play speech sample of 45 seconds each. The CANS protocol is used with Pratt (Boersma & Weenink, 2013), a program used to organize frame by frame analysis of speech samples converted to frequency values, in order to collectively show range and variability of utterances. Acoustic analysis variables used were based on a recent factor analysis (Cohen, Renshaw, Mitchell, & Kim, 2015) revealing the 6 variables of vocal expression with the most construct validity and least redundancy within the CANS software (*Pause. Mean:* Average amount of compilations of 50 milliseconds of silence; *F0.SD.Local:* Standard deviation of frequency associated with pitch; *F0.Perturbation*: Frequency associated with jitteriness; *F1.SD.Local:* Standard deviation of the frequency associated with articulation of words (important for vowel expression); *F2.SD.Local:* Standard deviation of frequency associated with tongue articulation (back and forth tongue movement), also important for vowel expression; *Intensity.SD.Global*: Standard deviation of volume variability; *Intensity. Perturbation*: Volume of jitteriness through variability in vocal short frames of speech).

The Linguistic Inquiry and Word Count (LIWC) (Pennebaker, Francis & Booth, 2001) is used to assess content of speech. The LIWC is a measure of lexical analysis software that utilizes transcribed speech samples by matching to a comprehensive dictionary of more than 2,200 words. This analysis determines the frequency of specific word usage which may be related to the variables of communicative social functioning, such as ease of communication, normative usage of positive language and pronouns, appropriate negative and positive appraisal, and the appropriate use of speech to be able to answer the questions being asked by the task. LIWC generates a frequency count of occurrences of target words in the category being evaluated.

Computed scores for positive and negative variables of the LIWC are used frequently for examining linguistic speech samples to determine frequency and amount of positive emotion (using the words: love, nice, sweet) and negative emotion (hurt, ugly, nasty) (Tauszik & Pennebacker, 2010). Positive and negative variables on the LIWC demonstrate high internal reliability (α 's >.89; Pennebaker, 2007) These variablesalso been used to look at differences in emotion words in samples of individuals with schizophrenia and schizotypy (Cohen & Docherty, 2005; Cohen, Beck, Najolia & Brown, 2011). The computed variable of certainty was of interest in these data analyses because it reflects amount and frequency of words used to express confidence (always, absolute, complete, and never). The certainty variable on the LIWC has also demonstrated high internal reliability (α =.85; Pennebaker, 2007). Previous research has indicated that the use of certainty language is related to positive outcomes in getting a point across assertively. For example, Corley & Wediking (2014) examined analysis of speech samples and found that supreme court decisions are accepted more positively when there are higher levels of certainty presented in decision. Additionally, Herringer (2014) found that individuals who used more certainty language also had higher levels of self-reported well being, and Guerini, Pepe, & Lepri (2012) found that scientific abstracts were more likely to be cited if certainty language was used. These data demonstrate a relationship between success in interpersonally related tasks, social functioning, well-being, and personal success with the use of certainty in language. This project examined social functioning through a measure that was created assuming that higher-functioning is related to assertive, confident and effortful language, affect and behavior. The use of certainty in a local measure is an interesting and seemingly related variable to demonstrate social functioning.

Facial analysis. The *FaceReader Version 4.0* (Noldus Information Technology, 2010) is a program used to measure facial expression. This automated and commercially available technology produces algorithms based on facial images captured on video (frame-by frame) to detect seven emotional states (happy, sad, angry, surprised, neutral and disgusted). FaceReader captures movement from eye gazes and head movements to produce percentages of emotional valence frame by frame (Noldus Information Technology, 2010; Cohen et al., 2013). Reliability analyses of expressions have been found to be highly stable (r's between .60-.89) The total amount of time participants display sad, angry, scared, and disgusted expressions are reported. This resulted in total scores of positive, negative, and neutral categories based on a standard deviation for each category (measured by facial movement variability-eye, head and mouth movement).

Measure of emotional withdrawal at the global level of social functioning. *Expanded Brief Psychiatric Rating Scales* (BPRS; Lukoff, Neuchterlein & Ventura, 1986). The BPRS is a 24-item symptom rating scale that evaluates frequency and intensity of psychiatric symptoms on a scale of 1-7 (very mild-extremely severe). For this study, only item 17, which measures emotional withdrawal was assessed. The item reads, "Deficiency in patient's ability to relate emotionally during interview situation." Three different raters were trained to evaluate and score this item using the 1-7 scale. Reliability for individual items range from .63-.83, with inter-rater reliability among raters between .85-.95 (Mueser, Curran, & McHugo, 1997; Ligon & Thyman, 2000). The writer of this document went through the scoring and rating of item 17, and did sample ratings to determine whether the raters understood the concept and scoring. Each rater used the BPRS manual consistently while rating the item and then emailed the writer with any scoring questions. An average of the score of the item was calculated for each individual

(computed from the ratings from all three raters) and used in these analyses. No individual scores on the items were more than two standard deviations from any other raters scores.

Measure of psychopathology. *Brief Symptom Inventory* (BSI**;** Derogatos & Mellisaratos, 1983).The BSI is a brief self-report scale of psychological symptoms. The rating scale is 53-items designed to assess psychological symptoms in a number of settings (outpatient and inpatient medical settings, general screening for psychiatric symptoms). Nine primary symptom dimensions and 3 subscales of general distress and severity reflect reliable and valid factors of mental health clusters using the BSI (Chronbach alpha's .80-.90). In this study, the subscales of depression, anxiety and general severity index were of interest due to the relationship between these mental health symptoms and schizotypy.

Hypotheses & Data Analyses

Statistical analyses for this project were carried out in four parts. First, preliminary analyses were tested for significant relationships between demographic characteristics (sex, ethnicity, years of education, and age) and dependent variables of interest (HiSoc scores, LIWC, CANS, Facial Expression; Emotional Withdrawal) using independent-sample t-tests and correlations (age). Due to the number of DV's of interest in this study, bonferonni family wise adjustments were made to control for these multiple comparisons. Field (2009) indicates that this is a conservative method to control for error due to multiple comparisons, and that the definition of "family" or groupings can be "loosely defined" as long as they are consistent across variables. In these data, groups of local and global measures (e.g., global [HiSOC] & local functioning [all acoustic variables]) are grouped together. The alpha level was divided and adjusted by the number of comparisons for each group. Each table reflects a correction for all significant values.

Analyses had statistical significance set at α < .05 (two-tailed) and data were reviewed for

violations of normality and skew (and corrected if necessary). Reliability of the behavioral

measure (HiSoc) was examined through consistency in the factor scores as indicated by Gibson

et al. (2010). In all analyses, outliers (> 3 SDs) were identified and transformed to the

minimum/maximum score that is within 3 SDs of the mean. Secondly, bivariate correlations

were computed to determine whether there were relationships between social functioning

(measured by the HiSoc) and schizotypy scores. Pearson's correlation coefficients were used to

compute variables that are on an interval scale. Thirdly, bivariate correlations were computed to

measure whether local objective measures (acoustic analysis, lexical analysis, and facial

expression) are related to schizotypy scores. Lastly, a mediation analysis was proposed to be

employed to examine whether emotional withdrawal explains the relationship between social

functioning (measured by the HiSoc) and schizotypy scores using steps outlined by Baron and

Kenny (1986).

Power Analysis

In order to obtain an upper-boundary for required sample size, power analyses were

completed for the primary experimental hypotheses. Power analyses conducted for the primary

hypotheses using G*Power software 3.1.2 (G*Power, 2010) indicated that a sample size of 55

(57 individuals were included in these analyses) was needed to observe a moderate effect size

(linear hierarchical regression (fixed model): effect size *Cohen's D* =.4-.7, α = 0.05, β = 0.80,

two-tailed). A standard of .4 is considered a moderate effect size using *Cohen's D* (Cohen &

Cohen, 1983

Results

Descriptive data is presented in Table 1. Means and ranges across the sample were reviewed on all outcome measures -- see Table 2 for data including ranges for the global functioning measure (HiSoc) and schizotypy measure (SPQ). Variables were screened for normality. All variables fell within ranges of acceptability for skewness(+/-3) and kurtosis (i.e., < 5; Curran, West, & Finch, 1996). Outliers were constrained to +/- 2 interquartile ranges around the median of each variable. Two subjects were determined to be outliers with significantly low scores outside this range on the global social functioning measure, HiSoc (with overall scores below 31, respectively 25 and 30). These outliers were further investigated for significant differences across outcome variables; a concern in that their test scores may be invalid due to lack of effort. However, it should be noted that these subjects did not have significantly lower scores in other outcome measures such as SPQ or BSIas identified through *t-test* evaluation of mean differences between groups. This indicates that they were not functioning significantly lower in psychopathology or cognitive ability than the rest of the sample. Based upon these results, the aforementioned data were included in the analyses. Rerunning the analyses without these two subjects did not change the results.

Table 1
Demographic Data (*N* = 57)

	Percent	Frequency (*n*)
Sex (Female)	72	41
Ethnicity		
Caucasian	74	42
African- American	11	6
Hispanic	1	1
Asian American	5	3
Other	9	5
Mean Age (years)	20.1	5.32 (*SD*)

Note. Percent rounded to the nearest whole number

See Table 2 for ranges, means and standard deviations for participants on measures of global functioning (HiSoc) and schizotypy scores (SPQ). The present study achieved excellent levels of internal consistency in the current sample on the overall score on the HiSoc ($\alpha = .95$). All individual items in this measure demonstrated high levels of internal consistency (α's ranged from .67-.94). This was comparable to the internal consistency found for this measure in Gibson (2009) which was $\alpha = .93$.

Table 2

Descriptive (Means, Ranges) for Global and Schizotypy Measure (HiSoc and SPQ)

	N	Min	Max	Mean	SD
HiSocO	57	25	78	54.86	8.63
SPQBR	57	2	25	12.65	5.31

The groups differed significantly between pause (an acoustic variable) and gender (i.e., males had significantly more pauses than females; see Table 3). All data computed for acoustic analysis were controlled for gender, and scores that changed in significance value after controlling for gender are noted throughout. There were no significant group differences in ethnicity. Correlations between age and outcome measures (local and global functioning measures and measures of schizotypy traits) showed no significant differences, but are not represented for brevity.

Table 3

T-Tests for Gender and Clinical Variables for Participants

Variable	Male (*N* = 19)	Female (*N* = 42)	*t*	*p*
	Mean (*SD*)	Mean (*SD*)		
Acoustic Variables				
Pause	1404.61 (547.69)	914.26 (308)	2.51	.01**
F0.SDLocal	2.31 (1.77)	2.58 (1.21)	-.69	.49
F0.Pert	10(1.77)	.09 (.03)	1.30	.23
F1.SD.Local	4.27(1.56)	4.09 (1.59)	.44	.66
F2.SD.Local	4.60 (1.09)	4.30 (1.59)	.54	.61
Intensity	10.47 (2.28)	9.54 (3.04)	1.18	.93
Intensity. Pert	.65 (.11)	.64 (.14)	.50	.62
Facial Expression				
Posfac	.26 (1.72)	.30 (.16)	-.84	.41
Neutfac	.14 (.09)	.15 (.12)	-.39	.70
Negfac	.22 (.11)	.20 (.11)	.43	.91
LIWC				
LexPos	.47 (.77)	.49 (.63)	-.12	.90
LegNeg	.23 (.69)	.50 (1.20)	-.91	.37
Certainty	2.3 (1.9)	2.53 (1.98)	-.39	.54
HiSoc				
Overall	55.73 (8.68)	54.41 (8.77)	.55	.59
Affect	14.00 (2.8)	14.6 (2.31)	-.80	.42
Social-Int	14.84 (2.56)	14.24 (3.00)	-.81	.42
Beh/Lang	15.87 (2.36)	15.57 (2.30)	.46	.65
SPQ	13.94 (6.07)	12.10 (5.43)	1.13	.29

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

Hypothesis 1. Schizotypy scores would be positively related to global assessment of social functioning. See Table 4 for correlations between factors of social functioning (i.e., behavior and language, affect and social interpersonal scores) and general social functioning across the sample. It should be noted that the 3 factors of the HiSoc (behavior, language and social-interpersonal domains) and general social functioning were highly correlated, and essentially redundant with each other (behavior and language, affect and social interpersonal scores; r's=.58-.60). See Table 5 for relationships between social functioning and schizotypy scores. However, the bivarate correlations demonstrated no significant relationships in these analyses. Interestingly, our measure of emotional withdrawal (BPRS, item 17) was unexpectedly unrelated to schizotypy scores and local measures (see Table 5).

Table 4
Pearson's Correlations Between Factor Scores and the HiSoc Total Scores (r)

HiSocFactors	HiSocO
Social-Int	.90**
Affect	.80**
Beh/Lang	.87**

**p<.01

Table 5
Pearson's Correlations of Schizotypy Scores, Global Social Functioning, and a Measure of Emotional Withdrawal

	HiSoc	Soc-Int	Affect	Behavior/ Language
SPQ	.14	.03	.03	.10
BPRS	.08	.04	-.04	.10

Note. Bonferonni family-wise correction applied, (HiSoc, SPQ, BPRS)=.05/3=.017
* $p < .017$, two tailed, none found

Hypothesis 2. Social dysfunction measured locally is not related to schizotypy. See Table 6 for bivariate correlational analyses of the relationships between Schizotypy (based on SPQ scores) and total scores on acoustic analysis where the IV (schizotypy scores) was predicted to not be

related to the outcome variable (acoustic analysis). As predicted there were no significant

relationships found between acoustic analysis scores and SPQ scores. BPRS scores were related

to acoustic analysis scores; a small effect size was observed. However, after controlling for

gender and conducting bonferonni adjustments, these results were no longer significant when $p <$

.025.

Table 6

Pearson's Correlations Between CANS Variables And SPQ

	SPQ Total	BPRS
Pause	.28	.19
F0SD Local	-.15	**-.20**
F0Pert	-.24	**-.25**
F1 SD Local	.09	-.24
Intensity	-.13	-.13
Intensity.Pert	-.01	-.02

Note. Due to a significant difference in gender performance on the variable pause, correlations were computed to control for gender. Bolded scores represent scores that changed in significance value after controlling for gender. Bonferonni family-wise correction applied, (LIWC variables, HiSoc)=.05/2=.025.

See Table 7 for results related to schizotypy scores and lexical analysis scores. As

predicted there were no relationships found between these LIWC variables and SPQ scores.

Table 7

Pearson's Correlations Between LIWC Variables and SPQ

	LexNeg	LexPos	Certainty
SPQ Total	.16	-.14	-.02
SPQNeg	-.02	.03	-.11
SPQPos	.03	-.09	.07
BPRS	-.08	.19	.05

Note. Bonferonni family-wise correction applied, (LIWC variables, SPQ)=.05/2=.025.

See Table 8 for the relationship between schizotypy scores and facial expression scores.

These results indicated a significant relationship between neutral facial expressions and the SPQ

total; a small effect size was observed. Interestingly, the present measure of emotional

withdrawal was also related to neutral facial expressions.

Table 8

Pearson's Correlations Between Facial Expression Variables and SPQ

	Negfac	Posfac	Neutfac
SPQ Total	-.10	-.15	*.30**
BPRS	.04	-.02	*.31**

Note. Bonferonni family-wise correction applied, (LIWC variables, SPQ, BPRS)=.05/3=.017. Scores in italics reflect scores that are significant after correction (* $p < .017$, two tailed).

Hypothesis 3. Emotional withdrawal could explain the relationship between schizotypy and

social functioning. A mediation model was proposed to examine whether emotional withdrawal

could explain the relationship between social functioning and schizotypy scores. Since the SPQ

was not related to social functioning as defined by the HiSoc, a mediation model could not be

computed as there would be no predictive relationship between these variable (See Table 4).

Post Hoc Analyses

A number of post analyses were computed to follow up on the findings from this study.

Post Hoc Analyses I

Null findings found between local scores and schizotypy scores potentially support the

above theory that local scores and global scores are measuring different facets of

communication. Local scores are examining specific features of communication (such as speech

and facial expression through computerized frequencies) and global scores are assessing more

overarching impressions of communication. Therefore, I was interested in further exploring the

relationship between global and local measures. See Table 9 for bivariate correlations of factor

scores on the global functioning measure (HiSoc) and all of the local measures (acoustic

analysis, facial expression and LIWC). As predicted, there were minimal relationships found between the global measure of functioning and these local measures of functioning. Additionally, there were no significant relationships found between facial expression and overall global functioning or word choice (LIWC) and global functioning (HiSoc). There were no significant relationships between global functioning and acoustic variable measures.

Table 9

Pearson's Correlations Between Global Functioning (HiSoc) and Local Functioning (acoustic analysis, LIWC, facial expression)

	HiSocO	Soc-Int	Affect	Beh/Lang
Pause	-.11	-.05	-.21	-.16
F0 SD	-.07	-.11	.13	-.05
F0 Pert	-.02	-.02	.02	-.09
F1 SD Local	.03	-.07	.10	.02
F2 Local	.08	.01	.09	.12
Intensity	.08	.04	-.07	.01
Intensity.Pert	-.04	-.03	-.06	-.08
LexNeg	.05	.08	-.01	.03
LexPos	.00	.01	-.04	.19
Certainty	.20	.20	.19	.21
NegFac	-.19	-.10	*-.28**	-.24
PosFac	.19	.07	.24	.19
NeutFac	.21	*-.26^*	.13	*-.26^*

Note. Due to a significant difference in gender performance on the variable pause, correlations were computed to control for gender. Bonferonni family-wise correction applied, (acoustic variables, facial expressions, LIWC, HiSoc)=.05/4=.012. Scores with ^ reflect scores that are not significant after correction
** $p < .01$, two tailed. .

Schizotypy Factor Scores and Global Functioning

Post Hoc Analyses II

It is possible that these null findings between schizotypy and social functioning did not account for schizotypy heterogeneity. To further investigate whether these analyses were not

accounting for heterogeneity I examined how factor scores of the SPQ related to factor scores of the global functioning measure to review whether there may be relationships within the different domains of schizotypy scores that were not fully captured by the total score of the SPQ. See Table 10 for relationships between schizotypy factor scores and global functioning scores. The present study examined factor scores of the SPQ to explore relationships within the different domains of schizotypy scores that were not fully captured by the total score of the SPQ. Results corroborate what was found above based on total SPQ scores; no relationship between SPQ scores and global functioning was observed. Since how local measures related to schizotypy were examined, further investigation was warranted regarding whether SPQ domains may be related to each of the local measures as well. Further investigations of the SPQ factor scores and the local measures confirmed above mentioned results using the total SPQ score; neutral faces were significantly related to schizotypy total scores as well as factor scores. It should be noted that few significant relationships were found with additional measures of local functioning (CANS and LIWC variables), as predicted by the data above. There was a positive relationship found between positive affect language and the positive symptoms factor of the SPQ. However, this relationship disappeared after the bonferroni adjustment. The positive symptoms factor of the SPQ was related to more neutral and positive faces (see Table 11).

Table 10

Pearson's Correlations Between SPQ Factor Scores and Global Functioning (HiSoc)

	SPQPos	SPQNeg	SPQDisorg
HiSocO	.02	-.24	-.04
Soc-Int	.13	-.15	-.02
Affect	.04	-.11	-.03
Beh/Lang	-.06	-.13	-.04

Note. Bonferonni family-wise correction applied, (SPQ factor variables, HiSoc)=.05/2=.025.
* $p < .025$, two tailed

Table 11

Pearson's Correlations Between SPQ Factors and All Local Measures of Functioning (acoustic analysis, LIWC, facial expression)

	SPQPos	SPQNeg	SPQDisorg
Pause	-.07	-.16	-.11
F0 SD	-.13	-.18	-.23
F0 Pert	.00	.16	.06
F1 SD Local	.07	.15	.14
F2 Local	.07	-.04	.29
Intensity	-.11	.04	.02
Intensity.Pert	-.18	**-.22**	**.11**
LexNeg	.28^	-.02	.10
LexPos	-.09	-.17	-.40
Certainty	.12	-.07	-.16
NegFac	.05	-.23	-.04
PosFac	-.30*	-.04	-.40
NeutFac	.30*	.07	.30*

Notes. Due to a significant difference in gender performance on the variable pause, correlations were computed to control for gender. Bolded scores represent scores that changed in significance value after controlling for gender. Bonferonni family-wise correction applied, (acoustic analysis, facial expression, LIWX SPQ Factors)=.05/4=.01. Scores with ^ reflect scores that are not significant after correction. * $p < .01$, two tailed.

Schizotypy distress and global functioning.

Post Hoc Analyses III

The prior analyses were focused on the presence of schizotypy traits as opposed to their impact and distress on an individual's life. Further exploration of distress and impairment over symptoms (or perceived symptoms) in schizotypy would potentially allow for more information regarding how perception and stress over symptoms may be related to social functioning. This investigation was warranted due to extensive previous research that individuals with schizotypy report subjective accounts of distress in emotional, cognitive, and quality of life domains (Cohen & Davis, 2009; Chun et al., 2013; Auster et al., 2013; Cohen, Callaway, & Brown, 2014; Cohen et al., 2014).

In the present analysis, a new set of scores were calculated indicating how schizotypy traits may specifically be distressing the individual experiencing these symptoms (SPQ distress score; Loewy, 2005; Cohen et al., 2014). This offered the opportunity to explore how distress may relate to social functioning, potentially speaking to a relationship between global functioning and the subjective-objective dysjunction.

See Table 12 for correlations between distress over schizotypy traits and global social functioning (SPQ Distress and HiSoc). The HiSoc did not correlate with distress over schizotypy scores, building more evidence that this measure of global functioning is not related to psychometric schizotypy. Additionally, few significant findings were found between SPQ distress and dependent variables associated with the local measures of functioning, including facial expression, acoustic analyses and LIWC. A moderate sized relationship was observed between interpersonal distress and intensity-perturbation; however, after controlling for gender, this relationship was no longer significant. Additionally, a small effect size was observed in the relationship between cognitive distress and positive word choice. This relationship disappeared after the bonferonni adjustment for multiple comparisons (Table 13). Furthermore, the minimal

findings among local measures of functioning and SPQ scores continue to speak to the lack of

relationships across SPQ status and local assessment of speech, facial expression, and acoustic

analysis.

Table 12
Pearson's Correlations Between SPQ Distress Variables and Global Functioning (HiSoc)

	PosDis	NegDis	DisorgDis
HiSocO	-.06	-.07	-.03
Soc-Int	.04	-.05	.05
Affect	-.11	-.17	-.07
Beh/Lang	-.09	-.10	.01

Note. Bonferonni family-wise correction applied, (HiSoc, SPQ Distress)=.05/2=.025.

Table 13
Pearson's Correlations Between SPQ Distress Scores and All Local Measures of Functioning (acoustic analysis, LIWC, facial expression)

	SPQPosDis	SPQNegDis	SPQDisorg
Pause	.08	.21	.07
F0 SD	-.22	-.22	-.08
F0 Pert	-.13	-.23	-.10
F1 SD Local	-.04	-.12	.12
F2 Local	.09	.11	.20
Intensity	.04	-.08	.04
Intensity.Pert	-.13	**-.37**	-.08
LexNeg	.28^	.05	.03
LexPos	.05	-.08	.10
Certainty	.03	-.14	-.05
NegFac	.20	-.20	.02
PosFac	.02	-.11	.00
NeutFac	.08	-.13	.18

Notes. Due to a significant difference in gender performance on the variable pause, correlations were computed to control for gender. Bolded scores represent scores that changed in significance value after controlling for gender. Bonferonni family-wise correction applied, (acoustic analysis, facial expression, LIWC, SPQ Factors)=.05/4=.01. Scores with ^ reflect scores that are not significant after correction.

Discussion

The present study examined the relationship between global and local measures of functioning and psychometrically defined schizotypy. Global measures of social functioning were conceptualized as overarching impressions of social functioning. These measures potentially assess observable difficulty in expression and communication in social settings (Collins et al., 2005; Gibson et al., 2010; Cohen et al., 2014). Localized measures of communication and social functioning were conceptualized as specific mechanics of speech, language, and body language such as facial expression and linguistics. These measures have shown minimal, if any, relationship to schizotypy compared to matched peers (Cohen et al., 2012; Cohen et al., 2012). These local measures are focused on distinctive features of communication that may not be directly related to difficulties or differences that individuals with schizotypy report or express.

The present study explored the relationship between global social functioning, including global and local measures of functioning, and schizotypy scores using a dimensional sample with college age students. This study employed a novel methodology, utilizing local objective computerized measures of communication (i.e., facial expression, speech and language) across a sample of individuals with varying degrees of schizotypy traits. Social functioning was examined through a number of different measures, assessing features that were proposed to be related to social functioning among individuals with schizotypy traits. The present study proposed that global and local measures may measure different features of social functioning. Further, it examined whether global functioning may be superior to standard local measures when detecting subtle distinctions in social functioning for individuals who differ in amount of schizotypy traits.

As demonstrated by previous research on local measures of functioning related to schizotypy (e.g., facial analysis, Cohen et al., 2013; acoustic analysis, Cohen et al., 2012; neurocognition, Chun et al., 2013), this study found that the majority of local measures did not show a relationship between social functioning in those with higher or lower levels of schizotypy. While Gibson and colleagues (2010) demonstrated significant social functioning difficulties based on the HiSoc for individuals on the schizophrenia spectrum (i.e., individuals at high genetic risk), this present study demonstrated no significant differences between participants' scores in psychometric schizotypy and global social functioning. There are various interesting potential implications based on these findings.

Hypothesis I: Global social functioning and schizotypy scores arerelated.

The present data did not demonstrate a relationship between global functioning and social functioning, as exhibited in previous literature (e.g., Gibson et al., 2010). One explanation of these non-significant findings may be the dimensional nature of schizotypy traits in the current participant sample. Previous literature often categorically defines schizotypy traits (i.e., separating extreme-high scorers on the SPQ compared to low-scorers; i.e., Raine et al., 1999; Cohen et al., 2010; Cohen et al., 2011) when investigating the relationship between scores on social functioning measures (Chapman & Chapman, 1983; Korfine & Lenzenwegger, 1995; Kwapil, Gross, Silvia, & Barrantes-Videl, 2013; Cohen, Auster, MacCauley, & McGovern, 2014). The present dimensional approach potentially limits the findings, as the individuals included in the present sample were college students presumably functioning at a high level. Upon further examination, only a small number of individuals were extreme scorers on the SPQ ($n < 15$); this sample size did not allow for meaningful interpretations of these data.

It should be noted that the observed reduced range of social functioning in this sample is potentially a product of sampling procedures. There was a limited pool of individuals recruited for the study who exhibited traits consistent with the extreme end of the schizotypy spectrum. One can posit that the majority of the sample is at lower risk for schizotypy, as college students had low scores on the SPQ and demonstrated higher social and cognitive functioning. Thus, these individuals do not reveal the type of impairment on a global measure of functioning that we may see in a categorical sample. Additional exploration of this subset may show fewer psychopathological symptoms overall, indicating that this group may need separate identifiers of risk, as they are different from a categorical schizotypy construct.

Meehl's model (see Figure 1) of the schizophrenia spectrum distinguishes a broad range of risk among the 10% of the population with schizotaxia, or a vulnerability to schizophrenia (Meehl, 1990; Korfine & Lenzenwegger, 1995). Research supports that ultra-high-risk individuals, those with high genetic susceptibility, exhibit a host of subclinical symptoms and evidence of functioning deterioration. These individuals often begin to demonstrate objective clinical and cognitive symptoms prior to psychotic episodes (Yung et al., 2006; Moburg et al., 2013). However to date, minimal research has investigated the individuals included in this 10% who fall in the lower end of the spectrum of distinct schizotypy traits (Ingram & Luxton, 2005). These findings imply that vulnerability within this spectrum is heterogeneous; individuals with lower self-reported schizotypy traits potentially need more sensitive instruments to discern if social functioning differences are present.

Gibson and colleagues (2010) explored the relationship between individuals at high-risk for schizophrenia and global functioning, as opposed to the current exploratory study which included high functioning individuals (i.e., college students) with varying levels of schizotypy

traits. It can be postulated that the measures of global social functioning (HiSoc) in the present student did not have the sensitivity for detection of differences in individuals with lower risk of schizotypy. This measure may not have determined the type or quality of differences in social functioning, which would have allowed meaningful interpretations about social functioning for the present study's sample to have been made.

Previous research has shown that neutral face expression and identification is an important factor that is different for individuals on the schizophrenia spectrum (Hooker & Park, 2002; Brown & Cohen, 2010). These findings were also observed in the current study, however, the HiSoc ratings of facial affect group together ratings of odd or aberrant facial affect and non-verbal communication (i.e., abnormal blinking, muted or excessive expression; see Table 14). It can be posited that these definitions are not clear enough. Given that HiSoc items are rated on a scale of "abnormal" to "normal", the measure does not allow for differentiation between abnormal muted communication and abnormally excessive language or body expression. It should be noted that, while global impression is important, differentiating what it means to be "abnormal" or "normal" may be an important piece of correctly identifying differences in social functioning. Additionally, it is important to operationally define and isolate the presence of impairment in individuals on the schizophrenia spectrum (i.e., perception of difficulty with social and cognitive tasks and neutral facial expression; Hooker & Park, 2002; Brown & Cohen, 2010; Chun et al., 2013). While the HiSoc is likely a measure to examine more global features and impression of social functioning, additional attention should be focused on methods to investigate social functioning difficulties in schizotypy (i.e., differentiating neutral expression and all affect expression). Specifically, the HiSoc examines rater-based social functioning in three domains of social functioning (social-interpersonal, affect, and behavior and language); this

evaluation may not be expansive enough to determine normal and abnormal domains of social communication. For example, a recent study of 223 individuals with schizotypy traits demonstrated that individuals with higher schizotypy scores performed worse on social functioning using the Social Functioning Scale (SFS; Birchwood, Smith, Cochrane, Wetton, & Copestake, 1990), which utilizes self-report to assess seven domains of social behavior, including: social engagement/withdrawal, recreation, independence-competence, interpersonal behavior, independence-performance, prosocial behavior, and employment/occupation (Henry, Bailey, & Rendell, 2008). Perhaps a more sensitive measure would include self-report ratings and objective ratings of all of these features of social functioning. This may suggest the need for development of a sensitive, yet objective global measure of social functioning and behavior, as pairing self-report measures with observer-rated tasks potentially could reveal more complete information about social functioning.

Hypothesis II: Schizotypy scores are not related to local measures of functioning.

One significant relationship was found between local measures of functioning and schizotypy scores, indicating that the amount of neutral faces expressed was related to scores on the SPQ. This finding suggests that neutral facial expressions may be related to schizotypy traits; further examination of neutrality may yield a method to discern social functioning differences for those with symptoms of schizotypy. Interestingly, a previous study observed that individuals with schizotypy demonstrated inaccurate facial recognition of neutral faces when compared with healthy controls (Brown & Cohen, 2010). It appears that facial expression and identification of neutrality may be a marker for schizotypy traits. The absence of affect is potentially more difficult for individuals with schizotypy to name or communicate. This suggests that observer-

rated global measures of social functioning could benefit from more expansive rating systems of facial expression.

Previous literature demonstrates that variables of acoustic analysis, facial expression, and linguistics are not highly correlated with self-reported schizotypy traits. The present study supports this assertion, as the local measures of speech and emotion do not detect difficulties in social functioning for those with schizotypy. This is similar to previous research in which these local measures of speech and emotion did not detect difficulties in the social functioning of individuals with schizotpy when compared to difficulties found in individuals with schizophrenia (i.e., abnormal speech or excessive or decreased emotional expression; Gruzelier et al., 1988; Cooklin et al., 1983; Najolia et al., 2011; Gabay et al., 2013; Cohen et al., 2014).

Relatedly, this study examined a measure of emotional withdrawal, which may be related to individuals with social functioning deficits. The present study did not establish a relationship between social functioning, schizotypy, and emotional withdrawal. Interestingly, emotional withdrawal was related to amount of neutral faces expressed. Perhaps future research should investigate the detection and expression of neutral faces when developing sensitive measures in social functioning distinctions. Previous research has demonstrated that individuals with schizophrenia have trouble accurately identifying social intentions when looking at faces with less intense affect (Hooker & Park, 2002). Impressions of facial affect are also generally found to be related to more obvious expression of emotion (Ekman, 1972). Thus, problems with discerning less intensive emotional faces and dysfunction in communicating less intense emotional faces may be markers for individuals with problems in social functioning. It is postulated that individuals with schizotypy traits struggle with this expression and are therefore perceived by others to have social functioning problems. Accordingly, future studies should

explore this dysfunction when developing sensitive and discerning measures of global social functioning.

Post Hoc Analyses I: The current study postulated that measures of global functioning would be superior to those of local functioning when examining different features of communication. The present data did not show that the global measure of social functioning was related to social functioning for those with schizotypy traits. However, local measures were also largely unrelated to schizotypy, demonstrating that these measures may not be helpful in determining discrepancies between those with higher traits of schizotypy and those with lower traits. Additionally as predicted, measures of global social functioning (HiSoc) were unrelated to local measures of functioning (acoustic, facial, and linguistic). Therefore, it is recommended that future research investigates whether these measurements are independent of each other, as the current data suggest that they are measuring different types of functioning. It is also important to acknowledge that local measures are consistently found to be unrelated to functioning for individuals with schizotypy; it is suggested that future research acknowledges this consistency among individuals with schizotypy.

Post Hoc Analyses II: Further, in addition to no relationships between the SPQ and HiSoc overall scores, SPQ factor scores were not related to the HiSoc factor scores. The present study did not find any relationship indicating subtle distinctions between SPQ traits and domains of global social functioning. Largely, the local measures of functioning did not show a relationship to symptom clusters of schizotypy. It should be noted that a few relationships indicated that the positive symptoms of the SPQ were related to more positive facial expressions, as well as more neutral faces. This finding reaffirms the prior assertion that future research will benefit from the exploration of facial expression in relation to schizotypy traits, as opposed to

local measures of speech. Additionally, this asserts that future studies should focus on the development of measures to detect social functioning distinctions in the schizophrenia spectrum.

Post Hoc Analysis III: No relationship between distress of schizotypy symptoms and local/global measurements of functioning was observed in the present study. This further suggests that both local and global measurements included in the present study were not sensitive enough to detect relationships between social functioning for individuals with higher schizotypy scores and global functioning. It is possible that the global measure of functioning (HiSoc) used in this study was also not sensitive enough to detect a relationship between schizotypy traits and objective social functioning (similar to the relationship observed between schizotypy and lack of objective evidence of poor functioning compared to self-reported functioning; Cohen & Davis, 2009; Chun et al., 2013; Cohen et al., 2014). This may be due to the dimensional nature of the samples, which included higher functioning individuals. However, it should be noted that a measure sensitive enough to explore global/local social functioning while identifying social functioning differences among those with or without schizotypy has yet to be developed.

Future directions and limitations

As discussed in the introduction of this project, there is evidence that individuals with schizotypy report subjective, local social functioning deficits; there is limited objective evidence of this phenomenon (Cohen & Davis, 2009; Cohen et al., 2012; Chun et al., 2013). This exploratory study sought to examine differential and discerning measures of functioning across a group that consistently reports symptoms that are not found in objective assessment. Perhaps future research should focus on establishing a means to quantify subjective reports of these perceived social function deficits. Observer-rated social role play began to examine this dysjunction; however, the present data did not support a relationship between objective global

social functioning and schizotypy. Future research should seek to examine increasingly sensitive measures that can reveal a convergence of subjective self-reported difficulties and objective difficulties.

Additional research is also needed to examine pre- and post-subjective experiences in every day experience and perception of social interactions. For instance, research could focus on whether individuals with higher schizotypy would perceive more difficulties in social interactions than those with few schizotypy traits. Additionally, pre- and post-task research is needed to discern whether the extent of one's schizotypy traits would impact negative perceptions of one's performance on the HiSoc task.

Exploration of in-the-moment accounts of social experience that can be measured by experience sampling methodologies is also recommended. In this type of research individuals note in-the-moment perceptions of the experience, which allow researchers to investigate both perceptions of the experience and the objective experiences itself. For example, Kwapil and colleagues (2013) asked 412 college students to keep daily, electronic structured diaries, which documented both the students' daily experiences and the affect related to these experiences. Individuals in this sample with schizotypy showed increased negative affect, thought impairment, and perceived rejection compared to matched controls (Kwapil et al., 2013). This is an example of future directions for the comparison of self-reported subjective concerns voiced by those with schizotypy in comparison to quantifiable objective experience. In developing additional sensitive measures of global functioning, detection, and expression of neutrality appears to be a salient feature that should be included when determining accurate measurement of schizotypy functioning.

Additionally, future research should address whether the subjective reports of dysfunction are related to a social functioning deficit, or if the perception of dysfunction is unrelated to capacity for social function. In the latter case, research would need to investigate whether perception by itself is an indication of schizophrenia-related risk, independently of objective functioning. Additionally, research should focus on social functioning, as it relates to engagement and emotional connectedness. This was an example used in this project because it is tangentially related to subjective complaints including quality of support system and quality of life and functioning. For instance, individuals with schizotypy report subjective quality of life deficits in domains of health and satisfaction of social support at levels up to two standard deviations lower than matched peers, and comparable to individuals with schizophrenia (Cohen & Davis, 2009; Cohen et al., 2013). Individuals with schizophrenia also show objective deficits in these domains of quality of life, whereas individuals with schizotypy do not (Cohen et al., 2014). Future research should include directly comparable questions about perception of these variables subjectively and objectively.

In accordance with the idea that studying schizotypy dimensionally may focus on a lower at-risk sample of individuals, additional research is needed to compare dimensional and categorical research in schizotypy. A major limitation of this study was that it included a small sample size that did not allow for further exploration into a broader range of scores on all dependent variables. Further research should examine a larger and more diverse group of schizotypy scores that can examine individuals' dimensionally, and also extreme groups of scorers. Relatedly, the Gibson (2009) study of individuals with categorically defined genetic high-risk to schizophrenia, showed an overall average social functioning score of 56.07 (SD: 12.97) while this sample of individuals comparably averaged approximately 55.07 in social

functioning, however the standard deviation (in this dataset) was 8.27. This sample (homogenous college students) potentially had a more limited range of social functioning compared to the genetic high risk sample evaluated in Gibson 2010. Evaluating a sample with greater variability in social functioning scores (at different levels of education, age and demographics) would possibly reveal differences in functioning that aren't captured from this limited range of scores.

An additional limitation of the current study was the absence of convergent validity measures to compare to the HiSoc global functioning measure. While we examined potential related measures of effort and performance on an IQ measure (WRAT) and psychopathology scores (BSI), the theoretical ties between the measures in these data were weak. Comparing convergent measures to the HiSoc would isolate whether the HiSoc measure was sensitive enough to demonstrate differences in motivation and effort in social functioning or psychopathology. Examining the results as a whole, the present data suggest that this global measurement was potentially not sensitive enough to detect a relationship between social functioning and schizotypy. Additional research is needed to examine whether the global measure (and all future global measures) of functioning are consistent with motivation, effort, and confidence that should be related to high scores in social functioning. Relatedly, it will be important to continue examining whether global measures, such as the HiSoc task, produce meaningful data related to social functioning outside of individuals at high risk for schizophrenia or psychopathology (i.e. content validity). This measure may not be sensitive enough to evaluate individuals who are generally higher in functioning across social functioning domains.

Conclusions

Individuals with schizotypy are an important group to study in order to understand risk status and to identify potential markers of risk that lend to possibilities for early intervention.

Understanding more about these risk markers can reveal a greater understanding of how to isolate individuals who are suffering from reported social functioning difficulties or distress that impact their quality of life. This study built upon previous research in that it examined potential ways to identify this risk through a more dimensional model that allows for greater identification of social functioning related to low-high schizotypy traits, employed local computerized measures of speech and facial expression, and also introduced a global measure of social functioning. The present study explored how global functioning and local functioning compare, as well as whether local measures reveal meaningful distinctions in social functioning for those with schizotypy traits. The results further confirmed that local objective measurement fails to find a relationship between social functioning and individuals with schizotypy traits. While the findings failed to confirm that a global measure of functioning would be superior at detecting social functioning distinctions among individuals with schizotypy compared to local measures, these data suggest a need for greater sensitivity in measures. These developments in assessment will help to determine whether it is possible to identify whether subjective reports of social functioning difficulties are related to other types of objective functioning difficulties for those with schizotypy, and how this can inform our understanding of individuals across the schizophrenia spectrum.

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Appendix A
Consent Form

Project Title: Identifying the vocal markers of schizophrenia spectrum disorders
Performance Site:
    322 Audubon Hall, LSU, Baton Rouge, LA 70803.
Investigator: The following investigator is available for questions Monday-Friday, 9:00 a.m.-4:30 p.m.

    Alex S. Cohen, Ph.D.
    Psychology Department, LSU
    (225) 578-7017

Purpose of the Study: The purpose of this research project is to understand the relationship between cognition, emotion and social functioning and personality characteristics in college students.

Inclusion Criteria: You are being asked to participate in this study because you are a Louisiana State University undergraduate who is over the age of 18 who showed a scoring pattern of interest on our on-line personality screening measures, or were recruited through the undergraduate psychology experiment pool.

Exclusion Criteria: Individuals showing the scoring pattern of interest on the personality screening measure are eligible to participate. There are no specific exclusion criteria.

Maximum Number of Subjects: The maximum number of participants for this phase will be 1000.

Study Procedures/Description of the Study: I am aware that this study will take approximately 2 hours. I will be asked to fill out a number of questionnaires that assess my emotion, personality, cognitive functions and mental health history. My voice and face will be recorded during several parts of this study. I will also be asked to play some memory and attention games on the computer. For participating in this session, I will receive 3 experimental credits. If I am not enrolled in a psychology course, I will be compensated $20 cash. For one of the attention games in this study, I will be entered in a lottery for one of three cash prizes of $50. I will be entered into this lottery regardless of whether I am enrolled in a psychology course or not.

For part of this study, I will have my eye movements tracked using a small headband mounted camera. This camera, sometimes referred to as an "eye-tracker" uses an invisible infrared light that shines a weak spot of light on the retina. The amount of infrared light absorbed by the retina will be less than 7.5% of the suggested Maximum Permissible Exposure for continuous sources of infrared light given by Sliney and Freasier (Evaluation of optical radiation hazards. Applied Optics, 1973, 12, 1-24). This level of light is comparable to what a person would receive on a sunny day. The eyetracker will be worn for approximately 10 minutes.

Benefits: I understand that I will not directly benefit from participating in this study. My participation will help researchers find out more information about mental illnesses.

Risks/Discomforts: I understand that I will be expected to complete the 2 hour-long session. This may be inconvenient. I also recognize that I will be asked to talk about my mental health history. Other than this discomfort, there are no known risks.

Right to Refuse: Participation in this study is voluntary. I may refuse to answer any questions or discontinue any test I am taking. Further, I can change my mind and withdraw from this study at any time without penalty or loss of any benefit to which I would otherwise be entitled to.

Privacy: All information obtained in this study will be kept confidential unless release is legally compelled. Limits to confidentiality include situations where an individual is at risk of hurting themselves (e.g., suicide) or hurting someone else (e.g., homicide, child abuse). I understand that the investigators are required by law to report any reasonable suspicions.

All records will be kept in a locked laboratory in a secure facility. Electronic data will be entered without identifying information and will be password protected. To ensure confidentiality, I will be assigned a number. All information collected during this study will be linked to this number and kept separate from any identifying information such as my name. Results of the study may be published, but no names or identifying information will be included for publication.

Financial Information: For participating in this study, I will receive four experimental course credits, or $20 cash if I am not enrolled in a psychology course. Additionally, for one of the attention games in this study, I will be entered in a lottery for one of three cash prizes of $50.

Withdrawal: Participation in this study is voluntary. I may withdraw from this study at any time without penalty or loss of any benefit to which I would otherwise be entitled to.

Signatures:

The study has been discussed with me and all my questions have been answered. I may direct additional questions regarding study specifics to the investigators. If I have questions about subjects' rights or other concerns, I can contact Robert C. Mathews, Chairman, LSU Institutional Review Board, (225)578-8692. I agree to participate in the study described above and acknowledge the researchers' obligation to provide me with a copy of this consent form if signed by me.

_____   _____

Participant Signature   Date

TO: Alex Cohen
Psychology
FROM: Dennis Landin
Chair, Institutional Review Board
DATE: November 21, 2014
RE: IRB# E9100
TITLE: Anonymous Survey for Support Systems to Improve Care for Mental Illness
New Protocol/Modification/Continuation: New Protocol
Review Date: 11/21/2014
Approved X Disapproved_____
Approval Date: 11/21/2014 Approval Expiration Date: 11/20/2017
Exemption Category/Paragraph: 2a,b
Signed Consent Waived?: Yes
Re-review frequency: (three years unless otherwise stated)
LSU Proposal Number (if applicable):
Protocol Matches Scope of Work in Grant proposal: (if applicable)
By: Dennis Landin, Chairman
PRINCIPAL INVESTIGATOR: PLEASE READ THE FOLLOWING –
Continuing approval is CONDITIONAL on:
1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report,
and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of
subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request
by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants,
including notification of new information that might affect consent.

6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.

7. Notification of the IRB of a serious compliance failure.

8. SPECIAL NOTE:

*All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS

(45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office

or on our World Wide Web site at http://www.lsu.edu/irb

Institutional Review Board

Dr. Dennis Landin, Chair

130 David Boyd Hall

Baton Rouge, LA 70803

P: 225.578.8692

F: 225.578.5983

irb@lsu.edu | lsu.edu/irb

Appendix C

Directions for HiSoc Task derived from Gibson & Penn, 2009

PARTICIPANT INSTRUCTIONS
Below are the instructions given to the participants before being video-taped:

"Ok, (participant's name) – now, we'd like you to pretend that MTV is coming up with a
new reality show about student's your age, and you really want to be on it. You are going to be
making a 45 second video speech to show the MTV judges why you should get picked
for the show. The time will begin immediately after you press the space bar. Press the space bar
when you are ready to begin speaking.

In the event that the participant said, "I wouldn't want to be on a reality show or on MTV," the
participants were told the following two probes, in order:
1. "Well, do your best, it is only for 45 seconds."
2. "If TV is not your thing, then imagine that a local newspaper wants to write a
story about kids your age and you really want to do that.

Table 14

Domains of Social Functioning
(Based on the High-Risk Social Challenge Task (HiSoc; Gibson & Penn, 2009).

Affect

Facial Affect	Facial movement (frequency of blinking, flatness, no smiling), excessive smiling.
Non-Verbal Expression	Capacity to use body language (such as posture) in a non-restricted style and to engage "audience"
Appropriate Affect	Ability to express emotions through facial expressions, gestures and vocal tone that is interpreted as natural, not forced, and not restrictive
Gaze	Ability to utilize eye contact that is appropriate during communication (that is neither distinctly avoidance, odd or exaggerated).
Physical Anergia	Ability to maintain appropriate energy level for what is asked of the individual (this includes being able to communicate effectual vigor or liveliness in answering questions that is neither deficit or inflated.

Behavioral and Language

Appearance	Capacity to appear and convey engagement in tasks or communication style. Avoiding excessive bodily fidgeting and appropriate motor control.
Tangential Speech	Staying on topic (deviation from answering the question)
Content of Speech	Ability to stay on task using appropriate speech, staying on topic, and answering the question being asked
Speech Valence	Using appropriate negative and positive appraisal, not excessively negativistic or internal or external negativistic language (e.g. this is stupid or I am terrible at everything) or excessively positive speech.
Clear Communication	Capacity to unambiguously convey ideas and answers without obscure language ,or noticeably divergent speech

Social Interpersonal

Fluency of Speech	Ease of communication and efficiency in conveying ideas

	through speech
Social Anxiety	How comfortable participant appears. Assess for excessive shaking, fidgeting, squirming or stuttering.
Guardedness	The ability to come off appropriately disinhibited in answering questions and able to use restraint from extreme familiarity when not called for
Engagement	Capacity to maintain proportionate interest in a task or communication.

VITA

Tracey Lauren Auster is from Briarcliff Manor, NY and a graduate of Franklin & Marshall College in psychology. She is currently a Postdoctoral Fellow at VA Boston practicing Evidence Based Psychotherapy for individuals who suffer from trauma-related mental health symptoms. She will continue to pursue a career in trauma focused psychotherapy.