Attentional Biases Toward Social Stimuli:
Group Differences, Clinical Correlates, and Cognition

BY

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THESIS

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This thesis is dedicated to my husband, Deep, who offered his unwavering patience and support every step of the way, and to my parents, who instilled in me the value of higher education.
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LIST OF ABBREVIATIONS

ANOVA Analysis of Variance
ASD Autism Spectrum Disorder
BACS Brief Assessment of Cognition in Schizophrenia
BOLD Blood Oxygenation Level Dependent
DSM-IV-TR Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision
HC Healthy Participants
HCQLS Heinrichs-Carpenter Quality of Life Scale
HAM-D Hamilton Depression Rating Scale
MATRICS Measurement and Treatment Research to Improve Cognition in Schizophrenia
PANSS Positive and Negative Syndrome Scale
PERT Penn Emotion Recognition Test
SZ Schizophrenia Participants
WTAR Wechsler Test of Adult Reading
SUMMARY

The present study examined attentional biases toward social information in 42 individuals with schizophrenia (SZ) and 47 healthy controls (HC). Participants completed a dot probe task designed to assess whether they exhibited a preferential gaze toward social (i.e. neutral faces) or nonsocial (i.e., flowers) visual stimuli, which yielded an attentional bias score. Clinical ratings were collected and performance on various cognitive domains was also assessed. Attentional bias group differences, clinical correlates, and cognitive correlates were then analyzed.

The results indicated that the SZ and HC groups did not significantly differ in their attentional biases toward social stimuli, nor were there any significant correlations between attentional bias scores and clinical ratings in the SZ group. However, significant correlations between attentional bias scores and a subset of cognitive domains emerged; in the HC group, attentional bias was significantly correlated with processing speed and in the SZ group, attentional bias was significantly correlated with attention, working memory, and visual memory. This supported our hypothesis that social attentional biases would be significantly associated with nonsocial visual neuropsychological deficits.

These findings have potential implications for treatment, as cognitive remediation methods targeting cognitive deficits in attention, processing speed, visual memory, or working memory may in turn have an effect on attentional biases toward social information. Additional research and modifications to the dot probe task are needed in order to further delineate the factors that influence attention to social stimuli in individuals with schizophrenia.
I. INTRODUCTION

Poor social functioning is a common characteristic in schizophrenia (Corrigan & Toomey, 1995; Penn & Mueser, 1996). Deficits in the ability to process information relating to the self and others in social situations, referred to as social cognition or social competence, have been identified as a contributing factor to social deficits in schizophrenia (Penn, Sanna, & Roberts, 2008). One modality through which social information is processed is through visual pathways. In fact, visual information processing deficits are well-documented, especially when content is emotional and social. In particular, deficits in accurate identification of emotion and gender from images of faces in schizophrenia have been widely replicated in the literature (Bigelow et al., 2006; Yalcin-Siedentopf et al., 2014), with individuals with schizophrenia typically performing worse on these tasks than individuals with other severe mental illness such as bipolar disorder (Donohoe et al., 2012; Lee et al., 2013; Rowland et al., 2013).

A. Facial Processing

In an attempt to deconstruct these facial processing deficits, Chen, Norton, McBain, Ongur, and Heckers (2009) explored more basic visual and cognitive processing of facial and comparable non-facial visual stimuli in individuals with schizophrenia. They found that individuals with schizophrenia were less accurate at visually detecting faces as well as discriminating between emotional facial expressions than controls. Additionally, Chen and colleagues (2009) found that individuals with schizophrenia had poorer working memory for faces than controls. Some of these deficits may be due to physiological differences between individuals with schizophrenia and healthy controls. Facial processing has been linked to areas within the fusiform gyrus, including the fusiform face area, and structural imaging studies have revealed these regions to be decreased in size in people with schizophrenia (Lee et al., 2002;
Onitsuka et al., 2003). Furthermore, functional imaging studies have found that among individuals with schizophrenia, poorer performance on facial memory tasks is linked to decreased blood oxygenation level dependent (BOLD) activity in the left fusiform area (Yoo et al., 2005). Previous research from this lab also indicated that, compared to controls, individuals with schizophrenia showed decreased brain activation in occipital and temporal regions associated with early visual processing when viewing emotional social relative to nonsocial stimuli (Bjorkquist & Herbener, 2013).

In addition, Corrigan, Green, and Toomey (1994) found that nearly two-thirds of the variance in interpretation of social cues in schizophrenia could actually be accounted for by two of the five forms of nonsocial cognition that were assessed: visual scanning and verbal recognition memory. Social cognition was measured by participants watching brief videotaped vignettes and answering questions about the social cues they observed. Sergi and Green (2002) also found that individuals with schizophrenia with better social cognition, based on a task of assessing context of a videotaped social situation, were also more accurate in a nonsocial early visual processing task, in which participants identified the type and location of a masked target on a computer screen. These findings suggest that deficits in early aspects of visual processing may play a role in poor social functioning.

B. **Attentional Biases**

In fact, visual processing of emotional stimuli has also been shown to play an important role in the vulnerability to affective disorders such as depression (Joormann, Talbot, & Gotlib, 2007). Visual attentional bias refers to the tendency to attend toward or away from a particular visual stimulus. Joormann and colleagues (2007) found that after a negative mood induction, daughters of depressed mothers showed an attentional bias toward viewing sad faces, whereas
daughters of never-depressed mothers showed an attentional bias toward viewing happy faces. These findings supported the cognitive theory of depression, which suggests that depressed individuals selectively attend to negative stimuli and filter out positive stimuli.

Research on another mental disorder with prominent social deficits, autism spectrum disorder (ASD), has found significant social attention impairments in individuals with ASD relative to typically-developing individuals (Dawson et al., 2004; Jarrold et al., 2013). In particular, these studies have noted that across varying contexts, healthy individuals tend to spontaneously attend to social stimuli in their environment, while the participants with ASD often exhibit a social orienting impairment. Given that social deficits have been shown to be of similar severity in schizophrenia and ASD (Eack et al., 2013) and that the two disorders may share some common pathways to social dysfunction (Sasson, Pinkham, Carpenter, & Belger, 2011), individuals with schizophrenia would be expected to exhibit a similar social orienting impairment.

In fact, visual attentional biases also appear to play an influential role in social perception and cognition in schizophrenia. Selective attention to negative information has been documented in depressed individuals with schizophrenia, whereas this attentional bias was absent in non-depressed people with schizophrenia (Waters, Badcock, & Maybery, 2006). Further, Moritz and Laudan (2007) found that individuals with schizophrenia exhibited an attentional bias toward paranoia-relevant images (e.g., hostile-looking face, gun, or fight scene) relative to neutral images (e.g., cup, chair, or clock) or anxiety-relevant images (e.g., shark, spider, or snake), regardless of current paranoia status. These findings suggest that these subtle attentional biases may be an antecedent for, rather than a byproduct of, current delusional or paranoia status in
schizophrenia. When combined with other factors, these biases may contribute to the development and maintenance of paranoid delusions.

Further, eye-tracking studies in schizophrenia have suggested that difficulties with facial affect recognition may result from insufficient visual attention to salient facial features (Green, Williams, & Davidson, 2003; Marsh & Williams, 2006). In fact, certain visual scanning patterns found in people with schizophrenia, such as exhibiting an attentional bias away from the mouth, have been shown to predict poorer recognition of anger when viewing facial images (Leppaunen, Niehaus, Koen, Schoeman, & Emsley, 2008). Notably, while individuals with schizophrenia are often able to identify extreme facial expressions, they tend to perform less well with more subtle facial expressions that are likely more typical of most daily interaction. Further, these performance deficits do not typically improve with pharmacotherapy (Daros, Ruocco, Reilley, Harris, & Sweeney, 2014).

C. Clinical Correlates of Attention

The relationship between attention and social functioning in schizophrenia has been examined previously (Tyson, Laws, Flowers, Mortimer, & Schulz, 2008). Tyson and colleagues (2008) found that performance on tasks of sustained, selective, and divided attention was significantly correlated with measures of social functioning in schizophrenia, such that intact attention was associated with better social functioning. Tanaka and colleagues (2012) found that attention and processing speed, as measured by the Brief Assessment of Cognition in Schizophrenia (BACS; Keefe, Poe, Walker, & Harvey, 2006), has been shown to correlate significantly with both the negative symptoms subscale and the total score of the Positive and Negative Syndrome Scale (PANSS; Kay, Fiszbein, & Opler, 1987). In particular, Tanaka and colleagues (2012) found that intact attention was associated with fewer negative symptoms.
Notably, they did not find a significant correlation between attention and depression in their sample.

D. Dot Probe Tasks and Visual Processing

Dot probe tasks, which use response latencies to measure visual attentional bias, have been used in several different clinical populations (Joormann & Gotlib, 2007; Pishyar, Harris, and Mendiez, 2008). Pishyar and colleagues (2008) used the task to assess attentional biases in individuals with social phobia, and found that using stimuli presented for 500 ms was enough time for the individuals with social phobia to exhibit an attentional bias toward threatening stimuli. Joormann and colleagues (2007) used the dot probe paradigm to study attentional biases in depression and found that individuals at high risk for depression shown an attentional bias toward sad faces, whereas controls show a bias toward happy faces. In this study, stimuli were presented for 1500 ms; this longer exposure duration was used because depression was proposed to be associated with problems with disengaging from negative stimuli, rather than an initial orienting toward negative stimuli. These findings suggest that attentional biases to social stimuli can be captured at the 500-1500 ms range in at least some clinical populations, although the different delay periods purportedly assess different specific attentional processes.

An accepted theory of visual processing posits that a combination of feedforward and feedback mechanisms contribute to visual perception (Hochstein & Ahissar, 2002). This theory suggests that an early feedforward process first produces possible interpretations of visual stimuli, which are then confirmed against existing lower levels of processing. This process, connecting multiple levels of the visual system in order to decode object information, can take about 100 ms (Liu, Agam, Madsen, & Kreiman, 2009). One study comparing varying presentation lengths within a dot probe task found that only a small portion of participants were
able to scan both pictures when the presentation length was under 200 ms, whereas when the stimulus duration was increased to 600 ms, significantly more individuals were able to scan both pictures (Stevens, Rist, & Gerlach, 2011). This finding of eye movement between two pictures was comparable to studies using a stimulus duration of 500 ms (Bradley, Mogg, & Millar, 2000). Therefore, for a dot probe task that presents two pictures simultaneously, as was used in the present study, a presentation length of 500 ms would provide sufficient time for the participant to scan and interpret both stimuli. Therefore, the location of their visual attention at the 500 ms mark should be reflective of an initial preferential gaze toward that particular stimulus.

E. **Present Study Aims**

Visual attention biases appear to play a role in affect identification and may also contribute to poor identification or interpretation of social cues in people with schizophrenia. In the current study, we plan to assess whether attentional biases toward or away from social stimuli may contribute to symptoms or functional deficits often seen in schizophrenia. Perhaps poor social functioning is related to a failure to demonstrate the normative bias to selectively attend toward social stimuli. The primary aim of the present study is to examine whether people with schizophrenia exhibit attentional biases in their processing of social information. Given that healthy controls tend to attend toward social stimuli (Dawson et al., 2004; Jarrold et al., 2013), it is hypothesized that the attentional biases of individuals with schizophrenia will not be characterized by the same preferential gaze toward social over nonsocial stimuli.

A second aim of this study is to explore the clinical correlates of this social attentional bias paradigm, by determining whether attentional biases are significantly related to other aspects of social functioning and relevant clinical symptoms in schizophrenia. It is hypothesized that measures of social functioning, anhedonia, and negative symptoms will correlate with
attentional biases such that selectively attending toward social stimuli will relate to better social functioning (Tyson et al., 2008) and lower levels of social anhedonia and negative symptoms (Tanaka et al., 2012). As we do not plan to manipulate stimulus valence, we do not anticipate significant relationships between attentional biases and depressive symptoms in the current study.

The third aim of this study is to determine whether biased visual processing of social information is significantly associated with other nonsocial visual neuropsychological deficits, such as simple attention or visual scanning, sustained attention, and processing speed. Prior studies have indicated that nonsocial cognitive skills account for nearly two-thirds of the variance of social cognition in schizophrenia, such as understanding social cues during an interaction (Corrigan, Green, & Toomey, 1994). Therefore, it is hypothesized that these basic cognitive processes will also explain much of the variance in the present study’s social attentional bias task in both diagnostic groups.
II. METHOD

A. Participants

Prior to the initiation of data collection, a power analysis based on previous dot probe tasks (Joormann et al., 2007) was conducted to determine the minimum sample size for each diagnostic group that would be needed to detect an effect. It was found that a minimum of 35 participants would provide 80% power to detect a significant attentional bias that actually exists.

Participants in this study included 45 individuals between the ages of 18 and 65 who met DSM-IV-TR (Diagnostic and Statistical Manuals of Mental Disorders 4th ed., text rev.; American Psychiatric Association, 2000) criteria for schizophrenia. These individuals were recruited from the University of Illinois at Chicago Medical Center and were comprised of both inpatient and outpatient populations in order to include a broad range of symptom severity and presentation. Fifty one age and gender-matched healthy subjects were recruited through advertisements posted throughout the University of Illinois Medical District. Diagnoses were determined by experienced clinicians (MD or PhD) using the Structural Clinical Interview for DSM-IV-TR diagnoses (First, Spitzer, Gibbon, & Williams, 2002). Individuals in either group (schizophrenia or healthy control) were excluded for current substance abuse or a history of neurological disorders, seizures, major head injuries, and left handedness, such that the samples included 47 healthy controls and 42 individuals with schizophrenia. Demographic information was collected from all participants, including age, gender, race, hospital status, and premorbid intellectual functioning, and can be found in Table I.
# TABLE I

## SUBJECT DEMOGRAPHIC INFORMATION

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<tr>
<th></th>
<th>HC (n=47)</th>
<th>SZ (n=42)</th>
</tr>
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<tr>
<td><strong>Age (Range)</strong></td>
<td>42 (23-63)</td>
<td>45 (22-62)</td>
</tr>
<tr>
<td><strong>Gender: Male / Female</strong></td>
<td>21 / 26</td>
<td>24 / 18</td>
</tr>
<tr>
<td><strong>Race: White / Black / Asian / Hispanic</strong></td>
<td>9 / 25 / 7 / 6</td>
<td>3 / 30 / 2 / 7</td>
</tr>
<tr>
<td><strong>Hospital Status Inpatient / Outpatient</strong></td>
<td>n/a</td>
<td>4 / 38</td>
</tr>
<tr>
<td><strong>Premorbid Intelligence (WTAR)</strong></td>
<td>98</td>
<td>88</td>
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*Note: WTAR = Wechsler Test of Adult Reading.*
B. **Instruments**

1. **Dot probe task**

   The dot probe paradigm is a well-established task for assessing attentional bias (MacLeod, Mathews, & Tata, 1986). In this paradigm, two stimuli (such as words or pictures) are presented next to one another on a computer screen for a brief period of time. Historically, these paired stimuli are of different emotional valences, where one is neutral and the other is either positive or negative, with the aim of determining whether the participants have an attentional bias toward or away from positive or negative images. After these paired images disappear, a dot appears in one of the positions on the screen where an image had previously been displayed. Participants are then instructed to respond quickly and accurately by pressing a key that corresponds to the side of the screen where they saw the dot. Their attentional biases are reflected by relatively fast responses to probes that appear at one stimulus location versus the other. In previous dot probe experiments, faster response times for dots that had appeared at the previous location of a negative stimulus would reflect an attentional bias toward negative stimuli (Joormann et al., 2007). However, the dot probe task has not been used to study attentional biases toward social stimuli, nor has it been used to compare individuals with schizophrenia and healthy controls.

   In the social dot probe task, the social stimuli are composed of a set of 48 faces expressing neutral emotion from the PERT-96 Color emotional stimuli battery (Gur et al., 2002; Kohler et al., 2003). These pictures represent a diverse range of ages and ethnicities, including Caucasian, Black, and Asian faces. The nonsocial stimuli are represented by a set of 24 flowers of varying colors and species, with only one flower in focus and at the center of each picture. The 24 male and 24 female pictures are paired with a flower picture, and each of these 48 face-
flower pairs are presented twice, for a total of 96 trials within one block that lasts about 5 minutes. The trials are presented in a new, fully randomized order for each subject.

Each trial opens with a white screen with a black fixation cross in the center of the screen for 1,000 ms, followed by the face-flower pair on the screen for 500 ms. After the picture pair disappears, a small black dot appears in the center of the area where one of the two pictures had been shown, and remains on the screen until the participant pressed a key on the keyboard indicating which side of the screen (left versus right) the dot had appeared. Participants are instructed to keep their left index finger on the “C” key, which is labeled with an “L” for left, and their right index finger on the “M” key, which is labeled with an “R” for right. Participants are instructed to press the key labeled “L” if they see the dot appear on the left side of the screen, and to press the key labeled “R” if they see the dot appear on the right side of the screen. They are also informed that both speed and accuracy are important in this task.

Prior to completing the full task, participants complete ten practice trials, guided by the researcher. The first six practice trials include only the fixation cross and a dot presentation, and corrective feedback is provided on the screen after each trial. The next four practice trials are comprised of the full task presentation, including the fixation cross, face-flower pairing, and the dot presentation. After the participants complete the practice trials and become comfortable with the task, they complete the 96 test trials on their own.

The facial stimuli appear in the right and left sides of the screen with equal probability, with the flower stimuli appearing on the other side of the screen. The dot also appears on the right and left sides of the screen with equal probability. When shown on the screen, the face and flower pictures are each approximately four inches by six inches, about three inches apart when
measured from their centers. The task is presented on a Dell laptop computer with a 17-inch color monitor using E-Prime 2.0 software.

Prior to running the dot probe task on the present study’s sample, pilot data was collected through the University of Illinois at Chicago subject pool. The task was run on 43 undergraduate students enrolled in introductory psychology for two semesters, from August 2013 until May 2014, to determine whether healthy individuals would exhibit an attentional bias toward social stimuli. This pilot data indicated that healthy undergraduate students do, in fact, exhibit an attentional bias toward social stimuli, $t(42) = 3.87, p < .001$. However, given that this was a convenience sample of college-aged students, further data collection on age-matched healthy controls was needed in order to make a valid comparison with the schizophrenia group.

2. **Clinical ratings**

As a measure of trait anhedonia, the Chapman Social Anhedonia scale (Chapman, Chapman, & Raulin, 1976) was administered to all participants. This self-report questionnaire includes 40 items assessing social anhedonia, the inability to enjoy social interactions. Also included in this measure is a 13-item symptom validity subscale which assesses whether the performance indicates poor effort, malingering, or random responding.

As a measure of daily functioning, the Heinrichs-Carpenter Quality of Life Scale (HCQLS; Heinrichs, Hanlon, & Carpenter, 1984) was also administered. The HCQLS is a 21-item assessment rated by a masters- or doctoral-level clinician from a semi-structured interview, with each item scored on a 7-point Likert scale. The four subscales within the measure are Intrapsychic Foundations, Interpersonal Relations, Instrumental Role, and Common Objects and Activities. Lower scores indicate poorer functioning. This study focused on the Interpersonal Relations scale, as this provides a measure of the participants’ current level of social functioning.
This subscale not only measures the frequency of interpersonal encounters, but also assesses tendencies to avoid or withdraw from social situations, active versus passive participation in these situations, and the ability to form intimate relationships. This scale was used to determine whether tendencies to look away from social stimuli are related to reported behavioral levels of social engagement.

In order to assess current symptom type and severity in the schizophrenia group, the Positive and Negative Syndrome Scale (PANSS; Kay, Fiszbein, & Opler, 1987) were administered. The PANSS is a 30-item measure rated by a masters- or doctoral-level clinician based on a clinical interview and observations, and includes assessment of positive and negative symptoms. For the purposes of this study, more emphasis was placed on the negative symptoms, as the hypotheses focus on the prominent role of this aspect of schizophrenia in relation to social functioning. The negative symptom subscale includes ratings of stereotyped thinking, lack of spontaneity, blunted affect, social and emotional withdrawal, and difficulty in abstract thinking, with higher scores reflecting greater symptomology.

As a measure of depressive symptomology, the Hamilton Depression Rating Scale (HAM-D; Hamilton, 1980) was administered. The HAM-D is a 24-item measure rated by a masters- or doctoral-level clinician based on a clinical interview and observations of depressive symptoms, with each item scored on a 3-5-point Likert scale. Areas assessed include depressed mood, feelings of guilt, insomnia, and helplessness. All items are summed to create a total HAM-D score, with higher scores indicating greater depressive symptomology.

Notably, the PANSS and the HAM-D were only administered to the schizophrenia patients, since the healthy controls are not expected to score within the clinical range on these
measures. Therefore, the data from the PANSS and HAM-D will only be used in analyses within the patient sample.

3. Cognitive measures

The Wechsler Test of Adult Reading (WTAR; Holdnack, 2001) was used to estimate premorbid intelligence in the schizophrenia group, and was also administered to the healthy controls in order to provide a direct performance comparison in intellectual capabilities between groups. The WTAR yields a predicted full scale intelligence quotient (FSIQ) score based on age- and education-based norms. In addition, a subset of both the patient and control groups were administered the Measurement and Treatment Research to Improve Cognition in Schizophrenia (MATRICS) Consensus Cognitive Battery (Nuechterlein & Green, 2006). This neuropsychological screening battery assesses the cognitive domains of processing speed, attention/vigilance, working memory, verbal learning, visual learning, and reasoning and problem solving using age- and education-based norms. For the present study, emphasis was placed on the cognitive domains with a visual component, such as attention and processing speed.

C. Procedure

All participants were consented into the study and underwent a clinical interview to determine diagnosis. They were then administered the trait social anhedonia scale and the quality of life scale. The schizophrenia patients were also administered the depression scale and positive and negative symptoms scale, as previously noted. Following these assessments, all participants completed the cognitive screening battery, including a measure of premorbid intellectual functioning and current neuropsychological functioning. Finally, each participant completed the social dot probe task. All participants completed the study at the University of Illinois at Chicago
medical campus; healthy controls and outpatient participants were seen at the Neuropsychiatric Institute, while inpatient participants were seen on the psychiatric unit of the University of Illinois Hospital.
III. DATA ANALYSIS PLAN

This study’s aim is to compare the attentional biases to social stimuli in schizophrenia and healthy controls, and to explore the clinical and cognitive correlates of this bias across these diagnostic groups. In order to test this study’s hypotheses, the attentional bias must first be calculated for each group. The following formula has been utilized in previous research that utilized a similar dot probe paradigm (Joormann et al., 2007):

\[
\text{Attentional bias score} = \frac{1}{2} \left[ (R_pL_f - R_pR_f) + (L_pR_f - L_pL_f) \right].
\]

In this equation, “R” is right position, “L” is left position, “p” is dot probe, and “f” is face, such that \(R_pL_f\) refers to the average reaction time of the participant to respond correctly to seeing a dot on the right side of the screen when the facial stimuli had been presented on the left side of the screen, and so on. The formula calculates the extent to which participants attend toward facial stimuli by subtracting the average reaction time to the dot appearing on the same side as the facial stimuli from the average reaction time to the dot appearing in a different position from the facial stimuli. Positive attentional bias scores are interpreted as a bias of attention toward the position of the faces relative to the flowers, whereas negative attentional bias scores indicate a bias of attention away from the location of the faces relative to the flowers.

Preliminary analyses will be conducted to ensure that the schizophrenia and healthy control samples are well-matched on all major demographic variables, including age, gender, race, and general intelligence. If any of these variables are shown to differ significantly between groups, they will be controlled for in subsequent analyses assessing group differences. In addition, we will assess whether hospitalization status has a significant impact on task performance in the schizophrenia group, and include hospitalization status as an additional factor in analyses if indicated.
A. **Hypothesis #1**

This study’s primary hypothesis is that patients and controls will differ in their attentional biases such that controls will selectively attend to social stimuli whereas people with schizophrenia will not show this attentional bias. In order to determine whether group differences exist between the schizophrenia group and the healthy controls, a one-way analysis of variance (ANOVA) will be conducted with diagnostic group (schizophrenia patients, healthy controls) as the independent variable and attentional bias score as the dependent variable. Prior to the ANOVA, independent samples t-tests will be used to determine whether group differences exist on any of the demographic variables as well as on general intellectual ability. Any variables found to differ between groups will be included as covariates in the ANOVA. If the ANOVA omnibus test is statistically significant, further post-hoc testing would be completed to clarify the nature of the relationship between diagnostic group and attentional bias score.

In addition a pair of independent samples t-tests will be conducted to determine whether significant differences exist between inpatient and outpatient participants with schizophrenia in their attentional bias scores. Notably, if significant differences in attentional bias scores between inpatients and outpatients are found, then a pair of ANOVAs would need to be conducted to examine group differences, given that inpatient/outpatient status will only vary within the clinical group. The first ANOVA would include healthy controls and inpatient schizophrenia participants with attentional bias scores as the dependent variable, and the second ANOVA would include healthy controls and outpatient schizophrenia participants with attentional bias scores as the dependent variable.

In addition to analyzing group differences, further analyses would need to be done to clarify the nature of the attentional bias within each group, as group differences could be
attributed to only one group showing a bias, both groups showing the same bias but to a different degree, or each group showing an opposing bias (Gotlib, McLachlan, & Katz, 1988). In order to address the direction of effects, one-sample t-tests will be conducted that compares each group’s attentional biases scores to zero. If a group’s attentional bias score is significantly different from zero and their score is positive, they will be characterized as having an attentional bias toward social stimuli, whereas if their score is negative, they will be characterized as having an attentional bias away from social stimuli.

B. **Hypothesis #2**

The second aim of this study is to explore the relationship between the attentional bias scores and other aspects of social functioning and related clinical symptoms. Analyzing the relationships between attentional bias and social/clinical symptoms helps elucidate differences within diagnostic groups, given the heterogeneity of symptom presentation in schizophrenia. We hypothesize that selectively attending toward social stimuli, as indicated by positive attentional bias scores for the short duration, will be associated with better social functioning and lower levels of social anhedonia and negative symptoms in the schizophrenia group. Depression is not expected to significantly correlate with the attentional bias scores, as the task does not include stimuli that differ on valence, which was the case in previous studies that found attentional biases in depression (Joormann et al., 2007).

In order to test this hypothesis, bivariate correlational analyses will be run between the attentional bias scores calculated from the social dot probe task and measures of social functioning taken from the HCQLS (Heinrichs et al., 1984), social anhedonia taken from the Chapman anhedonia scale (Chapman et al., 1976), depressive symptoms taken from the HAM-D (Hamilton, 1980), and negative symptoms taken from the PANSS (Kay et al., 1987).
C. **Hypothesis #3**

The third aim is to analyze the relationship between the social attentional bias scores and nonsocial neuropsychological abilities. In particular, given their visual scanning components, the tasks of simple attention, sustained attention and processing speed are expected to correlate significantly with the social attentional bias scores. To determine whether the social attentional bias scores are associated with nonsocial cognition, as has been indicated in previous research (Corrigan, Green, and Toomey, 1994), bivariate correlational analyses will be conducted. Although we specifically predict that tasks requiring visual scanning will most strongly account for attentional bias scores, we will assess the specificity of this relationship by also including other cognitive variables in our analyses.

First, a correlational analysis will be run between attentional bias scores and the WTAR predicted FSIQ score, to determine if premorbid general intellectual functioning is significantly associated with attentional bias. If a statistically significant relationship is not found, then in each diagnostic group, bivariate correlational analyses will be conducted between attentional bias scores and the MATRICS domains of processing speed, attention/vigilance, working memory, verbal learning, visual learning, and reasoning and problem solving scores. If a significant relationship is found between WTAR performance and attentional bias, then the WTAR score will be entered as a covariate and partial correlational analyses will be run instead of bivariate correlational analyses. The expectation is that these correlational analyses will reveal that attention and processing speed will be the only variables to correlate significantly with attentional bias scores because we theorized that biased visual processing of social stimuli will be significantly associated with other nonsocial visual neuropsychological deficits that have an
attentional component. Further, Fishers r-to-z transformation will be used to determine whether correlations significantly differ between diagnostic groups.
IV. RESULTS

A. Group Differences in Social Attentional Bias

The first aim of this study was to examine whether patients and controls would differ in their attentional biases such that controls would selectively attend to social stimuli whereas people with schizophrenia would not show this attentional bias.

Given that individuals with schizophrenia in both inpatient and outpatient settings were included in the sample, a pair of t-tests were first run to determine whether there was a significant difference in attentional bias, based on inpatient/outpatient status. The independent samples t-test revealed that the inpatient and outpatient schizophrenia groups were not significantly different in their attentional bias scores, $t(40) = -1.23, p = .226$. As inpatient/outpatient status was not revealed to be a significantly differentiating factor within the schizophrenia group, this variable was not included in future analyses.

Premorbid intellectual functioning based on the WTAR, was found to significantly differ between groups, $t(81) = 3.84, p = 0.0002$, such that controls scored slightly higher than patients (see Table I). To assess for group differences between the schizophrenia group and the healthy controls on attentional bias scores, an ANOVA was conducted. Given that groups significantly differed on their premorbid intellectual functioning, WTAR scores were included as a covariate. The ANOVA found that there was not a statistically significant difference in attentional bias based on diagnostic group, $F(2, 82) = .49, p = .614$. Therefore, additional post-hoc testing was not completed.

Although group differences were not found in attentional bias to social stimuli, in order to further examine the nature of the attentional bias within each diagnostic group, a series of one-sample t-tests were conducted to compare each group’s attentional bias scores to zero. These
analyses found that the schizophrenia group did not show an attentional bias, $t(41) = .35, p = .730$. The healthy control group also did not show an attentional bias, $t(46) = .90, p = .374$.

**B. Clinical Correlates of Attentional Bias**

The second aim of this study was to take a more dimensional rather than categorical approach, by exploring the relationship between attentional bias scores and other aspects of social functioning and related clinical symptoms within the schizophrenia group. First, bivariate correlational analyses were run between attentional bias scores and WTAR FSIQ scores in each diagnostic group. These correlations were not significant in the schizophrenia group, $r (36) = .31, p = .064$, or the control group, $r (47) = -.12, p = .429$; therefore, WTAR scores were not entered as a covariate.

A series of bivariate correlational analyses were then run between attentional bias scores calculated from the social dot probe task and measures of negative symptoms taken from the PANSS, depressive symptoms taken from the HAM-D, social functioning taken from the HCQLS, and social anhedonia taken from the Chapman anhedonia scale. The results for the correlation analyses can be found in Table II, and clinical ratings can be found in Table III. No statistically significant bivariate correlations were found between attentional bias scores and the clinical ratings in the schizophrenia group.

**C. Cognitive Correlates of Attentional Bias**

The final aim of this study was to examine the relationship between the attentional bias scores obtained from the social dot probe task and other measures of cognition within the two diagnostic groups. As revealed in the previous section, the WTAR scores did not significantly correlate with attentional bias scores in either diagnostic group and therefore, these scores were not entered as a covariate in the following analyses. A series of bivariate correlational analyses
TABLE II
CORRELATION ANALYSES OF ATTENTIONAL BIAS SCORES AND CLINICAL RATINGS IN THE SZ GROUP

<table>
<thead>
<tr>
<th></th>
<th>Attentional Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Symptoms</td>
<td>-.107</td>
</tr>
<tr>
<td>Depression Symptoms</td>
<td>-.066</td>
</tr>
<tr>
<td>Social Functioning</td>
<td>.118</td>
</tr>
<tr>
<td>Social Anhedonia</td>
<td>-.091</td>
</tr>
</tbody>
</table>

*Note.* None of these correlations reached significance.
<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative Symptoms</td>
<td>18.76 (5.89) a</td>
</tr>
<tr>
<td>Depression Symptoms</td>
<td>19.71 (12.15) a</td>
</tr>
<tr>
<td>Social Functioning</td>
<td>25.20 (11.53) a</td>
</tr>
<tr>
<td>Social Anhedonia</td>
<td>15.00 (6.38) b</td>
</tr>
</tbody>
</table>

a n=41
b n=37
were run between attentional bias scores calculated from the social dot probe task and cognitive domains from the MATRICS battery, including processing speed, attention/vigilance, working memory, verbal learning, visual learning, and reasoning and problem solving. The correlational analyses can be found in Table IV, and cognitive scores for each group can be found in Table V. To test for potential differences between the correlations of schizophrenia patients and controls, the correlations were transformed into z-scores using Fisher’s r-to-z transformation and the difference between these two values was obtained for each set of correlations.

Statistically significant bivariate correlations were found in the healthy control group between attentional bias scores and processing speed, \( r(32) = .36, p = .043 \), such that faster processing speed was associated with a social attentional bias. Notably, a Fisher’s r-to-z transformation revealed that this correlation did not differ significantly from the schizophrenia group, \( z = -0.18, p = .857 \).

In the schizophrenia group, statistically significant correlations were found between the short duration attentional bias scores and measures of attention, \( r(17) = .60, p = .011 \), working memory, \( r(19) = .51, p = .025 \), and visual memory, \( r(19) = .62, p = .005 \), such that better performance in these cognitive domains was associated with a social attentional bias. A Fisher’s r-to-z transformation revealed that the correlations between attentional bias and attention, \( z = -2.28, p = .023 \), working memory, \( z = -2.28, p = .023 \), and visual memory, \( z = -2.07, p = .039 \), significantly differed from the healthy control group.
### TABLE IV
CORRELATION ANALYSES FOR ATTENTIONAL BIAS SCORES AND COGNITIVE DOMAINS IN SZ AND HC GROUPS

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Attentional bias</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controls</strong></td>
<td></td>
</tr>
<tr>
<td>Processing speed</td>
<td>.36*</td>
</tr>
<tr>
<td>Attention</td>
<td>-.06</td>
</tr>
<tr>
<td>Working memory</td>
<td>-.15</td>
</tr>
<tr>
<td>Verbal memory</td>
<td>-.26</td>
</tr>
<tr>
<td>Visual memory</td>
<td>.08</td>
</tr>
<tr>
<td>Reasoning</td>
<td>.13</td>
</tr>
<tr>
<td><strong>Schizophrenia</strong></td>
<td></td>
</tr>
<tr>
<td>Processing speed</td>
<td>.41</td>
</tr>
<tr>
<td>Attention</td>
<td>.60*</td>
</tr>
<tr>
<td>Working memory</td>
<td>.51*</td>
</tr>
<tr>
<td>Verbal memory</td>
<td>-.03</td>
</tr>
<tr>
<td>Visual memory</td>
<td>.62**</td>
</tr>
<tr>
<td>Reasoning</td>
<td>.40</td>
</tr>
</tbody>
</table>

* Correlation is significant at 05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)
<table>
<thead>
<tr>
<th>Diagnostic Group</th>
<th>SZ mean (SD)</th>
<th>HC mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processing Speed</td>
<td>33.74 (10.24)</td>
<td>47.56 (9.30)</td>
</tr>
<tr>
<td>Attention</td>
<td>29.47 (10.04)</td>
<td>42.57 (10.32)</td>
</tr>
<tr>
<td>Working Memory</td>
<td>29.21 (12.36)</td>
<td>43.19 (10.47)</td>
</tr>
<tr>
<td>Verbal Memory</td>
<td>34.68 (5.44)</td>
<td>42.88 (9.74)</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>33.84 (13.90)</td>
<td>46.16 (10.57)</td>
</tr>
<tr>
<td>Reasoning</td>
<td>41.42 (10.56)</td>
<td>45.38 (8.47)</td>
</tr>
</tbody>
</table>

\( ^a n=19 \)
\( ^b n=17 \)
\( ^c n=32 \)
\( ^d n=30 \)
\( ^e n=31 \)
V. DISCUSSION

A. **Attentional Bias in Schizophrenia and Controls**

The results of this study found no significant group differences between the schizophrenia group and healthy control group in their attentional bias scores, drawn from the social dot probe task created for this study. This did not support our first hypothesis that healthy controls and people with schizophrenia would differ in their selective attention to social stimuli. However, when social attentional biases of each group were examined separately, the results partially supported our hypotheses.

While healthy controls were expected to attend toward social stimuli, the individuals with schizophrenia were not expected to exhibit this social attentional bias. Therefore, this notion that individuals with schizophrenia would not show a social attentional bias was supported by the present study’s findings. However, the prediction embedded within the first hypothesis, that healthy individuals would preferentially attend toward social stimuli, was not supported by our findings. In fact, the literature in this area is mixed. As reviewed previously, some studies would suggest that across varying contexts, healthy controls spontaneously attend to social stimuli in their environment, whereas individuals with disorders characterized by social deficits, such as ASD, often exhibit a social orienting impairment (Dawson et al., 2004; Jarrold et al., 2013). However, a lack of social attentional bias in healthy controls has also been found previously. One study, which used a dot probe task that measured attentional bias toward faces or household objects, found that healthy controls did not exhibit an attentional bias toward either type of stimuli, whereas individuals with social phobia preferentially directed their attention away from faces, or toward the household objects (Chen, Ehlers, Clark, & Mansell, 2002). This suggests that the types of stimuli compared also have a substantial effect on attentional bias.
Notably, we had demonstrated a significant attentional bias to the faces when we piloted this task in a healthy undergraduate group. In fact, some of the healthy control samples employed in previous studies that found an attentional bias towards faces used a university research participant pool, similar to what we used in our pilot study (Moore, Heavey, & Reidy, 2012). Thus, the failure to replicate this effect in our healthy control sample suggests that the greater variability in community-based samples may make it more difficult to identify clear group differences between healthy controls and patients. This provides support for the increasing movement toward highlighting dimensionality over categorization when conceptualizing mental disorders and their symptomatology, which the second and third hypotheses of the present study emphasize.

B. **Attentional Bias, Social Functioning, and Clinical Symptoms**

No statistically significant correlations were found between attentional bias scores and social functioning or clinical symptoms in the schizophrenia group that would support our second hypothesis. This may be due to additional factors that mediate the relationship between the basic attentional bias toward social information that our task measured, and the complex processes that make up an effective social interaction. Previous research has indicated that some measures of social cognition, such as emotion perception, are predictors of functional outcome in schizophrenia (Brekke, Kay, Kee, & Green, 2005; Kee, Green, Mintz, & Brekke, 2003). Perhaps this social attentional bias task would correlate with a more traditional measure of social cognition, or emotion perception, which in turn would be significantly associated with social functioning. Previous studies have examined the relationship between attention and emotion perception. Chung and Barch (2011) found that when attention is drawn toward emotional contextual information, facial emotion ratings improved. Further, eye-tracking studies indicate
that certain visual scanning patterns found in people with schizophrenia, such as exhibiting an attentional bias away from the mouth, have been shown to predict poorer recognition of anger when viewing facial images (Leppaunen et al., 2008). Therefore, our social attentional bias measure may also be significantly associated with tasks of social cognition. In fact, measures of social cognition, including emotion identification and acuity tasks, are being collected by our lab and we intend to test this hypothesis in future studies.

C. **Social and Nonsocial Cognition**

Significant correlations were found between attentional bias scores and aspects of nonsocial cognition, supporting our third hypothesis. In the healthy control group, faster processing speed was associated with a social attentional bias, as predicted. In the schizophrenia group, better performance in attention, working memory, and visual memory were associated with a social attentional bias, which went slightly beyond our original predictions of only attention and processing speed being associated with attentional bias.

The third aim of this study was to determine whether social attentional biases would be significantly associated with nonsocial visual neuropsychological deficits, such as attention and processing speed, given that earlier research has indicated that nonsocial cognitive skills account for nearly two-thirds of the variance of social cognition in schizophrenia (Corrigan, Green, & Toomey, 1994). Previous studies analyzing the factor structure of another commonly used cognitive screening battery used in schizophrenia research, the BACS (Keefe et al., 2004), have suggested the individual domain scores do not factor out separately and instead, only one factor emerges (Hochberger et al., 2016). However, the present study did find specific relationships between select cognitive domains and social attentional bias, although these varied by diagnosis.
Not only did attention and processing speed significantly correlate with attentional bias, as predicted, but visual memory and working memory were also found to have a statistically significant association with attentional bias. Further, processing speed and reasoning scores were trending significance (see Table 4) and with a larger sample size, may have reached significance. Notably, these additional cognitive domains all contain a visual component, whereas the only domain that was not found to correlate significantly with attentional bias, verbal memory, lacks a visual component. This aligns with the expectation that the visual social attentional bias measured by the dot probe task would be associated with nonsocial visual cognitive domains.

D. Concluding Comments and Future Directions

Overall, the absence of attentional biases found within either diagnostic group in the present study may reflect a number of different issues. First, samples that differ in age may respond differently to the dot probe task; some of the previous studies that found an attentional bias towards faces in its control sample used a university research participant pool, similar to what we used in our pilot study (Moore, Heavey, & Reidy et al., 2012). We did document the predicted bias toward social stimuli in our pilot study with an undergraduate population, but this did not hold with our adult community sample. This suggests that the community sample we used may be more heterogeneous in nature, making it difficult to detect significant differences between the control and patient groups. This highlights the importance of studying symptoms of mental illness as a continuum rather than focusing on classification.

Future studies are needed to further delineate the factors that influence attention to social stimuli in individuals with schizophrenia. For example, in the current study only neutral faces were used for social stimuli, with the intention of not introducing a confounding variable of emotional valence that might affect the tendency of either group to orient to social stimuli.
However, it may be that more expressive (happy or angry) faces would have stronger effects on attention and therefore might have more effectively captured group differences in attentional bias toward social information, as well as clinical correlates of social attentional bias within the patient group. In fact, Strauss, Allen, Duke, Ross, and Schwartz (2008) found that deficit syndrome schizophrenia patients lacked some of the attentional biases found in healthy controls, such that positive information did not automatically attract the attention of the patient group as much as it did in controls, leading the authors to conclude that the diminished emotional experience in deficit syndrome may be explained by an automatic processing impairment. Alternately, it may be that the non-social stimuli used in this study (flowers) was more attractive to our middle-aged schizophrenia and healthy control subjects, and use of a different comparison condition, might have led to more attention to faces. Therefore, future studies should consider incorporating faces with neutral, positive, and negative valence in order to determine if these factors contribute to a social attentional bias.

Nonetheless, the present study did reveal a significant correlation between attentional bias scores and various aspects of nonsocial cognition in both diagnostic groups. Remarkably, this relationship was detected despite the limited sample size of individuals who were administered the cognitive battery. Therefore, this suggests that the relationship between social attentional bias and nonsocial cognition is robust, which is corroborated by previous research that has found that much of the variance in social cognition can be accounted for by nonsocial cognition (Corrigan, Green, and Toomey, 1994). This association has clinically relevant implications on treatment, as cognitive remediation methods targeting cognitive deficits in attention, processing speed, visual memory, or working memory may in turn have an effect on attentional biases toward social information. In fact, dot probe tasks are able to provide valuable
information about general patterns of attentional bias within certain individuals, and some studies have used this type of task as an interventional tool, to alter attentional bias (De Voogd, Wiers, Prins, & Salemink, 2014). De Voogd and colleagues (2014) trained individuals with social phobia to attend toward positive facial stimuli, thereby reducing their attentional bias toward negative facial stimuli, as is typically the case in this population. Given its success in social phobia, if we were able to identify the specific factors that influence attentional biases in the schizophrenia group, this type of intervention could potentially be adapted for effective treatment of individuals with schizophrenia.
CITED LITERATURE


April 11, 2016

Ellen S. Herbener, PhD
Psychology
1007 W Harrison St
M/C 285
Chicago, IL 60607
Phone: (312) 413-2638 / Fax: (312) 413-4122

RE: Protocol # 2009-1095
“Emotion, Reward, Social Cognition and Social Interaction”

Please note that the following documents were not approved as neither a clean nor stamped copy of each of the documents were submitted: Consent - Social Cognition and Interaction-Friend (Version 1, 6/27/2011); Informational Talk Script (Version 1, 03/26/10); Telephone Screening Script (Version 2, 8/5/10); Web Ad A (Version 3, 3/20/13); Web Ad (Version 3, 3/20/13); Web Ad_C (Version 1, 3/20/13); Debriefing Form (Version 1, 02/10/10). Please note that if you wish to continue to use these documents, you must submit an Amendment to request to re-utilize the forms with an explanation as to why these forms were not included with the Continuing Review submission.

Dear Dr. Herbener:

Your Continuing Review was reviewed and approved by the Expedited review process on April 6, 2016. You may now continue your research.

Please note the following information about your approved research protocol:

**Protocol Approval Period:** April 6, 2016 - April 6, 2017

**Approved Subject Enrollment #:** 200

**Additional Determinations for Research Involving Minors:** These determinations have not been made for this study since it has not been approved for enrollment of minors.

**Performance Sites:** UIC, Rosalind Franklin University, Threshold's Inc
Please note that stamped and approved .pdfs of all recruitment and consent documents will be forwarded as an attachment to a separate email. OPRS/IRB no longer issues paper letters and stamped/approved documents, so it will be necessary to retain the emailed documents for your files for auditing purposes.

Recruitment Materials:
- HC, Version 2; as submitted to OPRS 10/23/2015
- SCZ, Version 2; as submitted to OPRS 10/23/2015
- SCZ, Tabs, Version 2; as submitted to OPRS 10/23/2015
- HC, Tabs, Version 2; as submitted to OPRS 10/23/2015

Informed Consent:
- Social Cognition and Interaction; Version 7; 01/15/2016

HIPAA Authorization - Please continue to use the following document which was previously approved and does not require a new stamp:
- Emotion, Reward, and Social Interaction; Version 3; 04/01/2013

Your research meets the criteria for expedited review as defined in 45 CFR 46.110(b)(1) under the following specific categories:

(4) Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving X-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing. (Studies intended to evaluate the safety and effectiveness of the medical device are not generally eligible for expedited review, including studies of cleared medical devices for new indications.) Examples: (a) physical sensors that are applied either to the surface of the body or at a distance and do not involve input of significant amounts of energy into the subject or an invasion of the subject's privacy; (b) weighing or testing sensory acuity; (c) magnetic resonance imaging; (d) electrocardiography, electroencephalography, thermography, detection of naturally occurring radioactivity, electoretinography, ultrasound, diagnostic infrared imaging, doppler blood flow, and echocardiography; (e) moderate exercise, muscular strength testing, body composition assessment, and flexibility testing where appropriate given the age, weight, and health of the individual.,
Research on individual or group characteristics or behavior (including but not limited to research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Please note the Review History of this submission:

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<th>Submission Type</th>
<th>Review Process</th>
<th>Review Date</th>
<th>Review Action</th>
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<tbody>
<tr>
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<td>Continuing Review</td>
<td>Expedited</td>
<td>04/06/2016</td>
<td>Approved</td>
</tr>
</tbody>
</table>

Please remember to:

→ Use your research protocol number (2009-1095) on any documents or correspondence with the IRB concerning your research protocol.

→ Review and comply with all requirements on the website: "UIC Investigator Responsibilities, Protection of Human Research Subjects" ([http://research.uic.edu/irb/investigators-research-staff/investigator-responsibilities](http://research.uic.edu/irb/investigators-research-staff/investigator-responsibilities))

Please note that the UIC IRB has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

Please be aware that if the scope of work in the grant/project changes, the protocol must be amended and approved by the UIC IRB before the initiation of the change.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact OPRS at (312) 996-1711 or me at (312) 413-8457. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Barbara Corpus
Associate Director, IRB # 2
Office for the Protection of Research Subjects

Enclosures - Please note that stamped and approved .pdfs of all recruitment and consent documents will be forwarded as an attachment to a separate email. OPRS/IRB no longer issues paper letters and stamped/approved documents, so it will be necessary to retain the emailed documents for your files for auditing purposes.

1. Informed Consent Document:
   a) Social Cognition and Interaction; Version 7; 01/15/2016

2. Recruiting Materials:
a) HC, Version 2; as submitted to OPRS 10/23/2015
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c) SCZ, Version 2; as submitted to OPRS 10/23/2015
d) SCZ, Tabs, Version 2; as submitted to OPRS 10/23/2015

cc: Michael E. Ragozzino, Psychology, M/C 285
OVCR Administration, M/C 672
VITA

Anjuli S. Bodapati, M.A.

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EDUCATION

Antic. 2016  PhD, Clinical Psychology, University of Illinois at Chicago
Dissertation: “Attentional Biases Toward Social Stimuli: Group Differences, Clinical Correlates, and Cognition”
Preliminary project: “Anhedonia as a Differential Predictor of Verbal Memory in Schizophrenia and Affective Disorders”

2012  M.A., Psychology, University of Illinois at Chicago

2008  M.A., Psychology (Psychopathology track), Columbia University
Project: “Childhood Predictors of Schizophrenia Using Videotaped Interviews”

2006  B.A., Clinical Psychology and Spanish, Tufts University
Tufts University study abroad program, Fall 2004, Universidad de Alcalá, Spain

CLINICAL EXPERIENCE

Clinical Neuropsychology Intern  June 2015-present
Jesse Brown VA Medical Center, Chicago, IL

- Conduct clinical intake interviews and administer neuropsychological testing using a flexible battery approach with inpatient and outpatient veterans with cognitive concerns due to TBI, current or past substance abuse, psychiatric issues, and neurodegenerative processes.
- Administer neuropsychological testing in a civilian population with cognitive concerns due to medical conditions including epilepsy, lupus, Moya Moya disease, and sickle cell anemia.
- Interpret and integrate test results into a written neuropsychological report and conduct feedback sessions to provide diagnostic impressions and treatment recommendations.
- Perform long-term individual therapy in a veteran population with chronic addiction within a methadone clinic.
- Facilitate group therapy for veterans with PTSD using manual-based CBT for Insomnia.
- Attend weekly applied neuropsychology and neuroanatomy seminars.

Supervisors: Neil Pliskin, PhD, ABPP-CN, Rollin Socha, PsyD & Robert Walters, PhD.
Clinical Neuropsychology Extern
Edward Hines, Jr. VA Hospital, Hines, IL
- Conducted clinical intake interviews and implemented a flexible battery approach to assess current neuropsychological functioning.
- Interpreted test results and composed written neuropsychological evaluations for patients and their providers that present background information, behavioral observations, testing results, diagnostic impressions, and treatment recommendations.
- Provided individual feedback sessions to review results and answer questions.
- Attended weekly neuropsychology didactic seminars.
Supervisor: David Kinsinger, PhD, ABPP-CN & Amanda Urban, PhD

Clinical Neuropsychology Extern
Neuropsychology Service – UIC Medical Center, Chicago, IL
- Administered neuropsychological assessments in Spanish and English to examine current cognitive functioning using a hypothesis-driven approach.
- Interpreted test results and composed integrated neuropsychological reports for individuals that presented background information, behavioral observations, testing results, diagnostic interpretations, and treatment recommendations
- Observed clinical interviews to assess history of presenting problem.
- Attended seminars in applied neuropsychology, neuroanatomy, and behavioral neuroscience.
Supervisor: Neil Pliskin, PhD, ABPP-CN

Rehabilitation and Psychological Assessment Extern
Rehabilitation Psychology – UIC Medical Center, Chicago, IL
- Conducted clinical intake interviews and assessed presenting problem and contributory factors and administered neuropsychological assessments in Spanish and English.
- Composed reports that presented testing results, diagnostic interpretations, and treatment recommendations and provided direct feedback to patients.
- Performed individual adult and child therapy in Spanish and English that incorporated cognitive rehabilitation techniques to address neuropsychological deficits found in testing.
- Attended seminars in applied neuropsychology and neuroanatomy.
Supervisor: Linda Laatsch, PhD

Psychotherapy Extern
UIC Office of Applied Psychological Services, Chicago, IL
- Conducted semi-structured client intake interviews to assess presenting problem and determine suitability for psychotherapy.
- Performed individual adult therapy in English and Spanish using cognitive behavioral techniques, with experience in mood and anxiety disorders and adult ADHD.
- Recorded clinical observations to track symptoms and progress towards goals.
- Mentored novice doctoral students being trained in clinic procedures, e.g. conducting intakes.
Supervisors: Gloria Balague, PhD, Nancy Dassoff, PhD, & Elise Massie, PhD

Psychological Assessment Extern
UIC Office of Applied Psychological Services, Chicago, IL

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• Conducted semi-structured client intake interviews to assess presenting problem and determine eligibility for psychological testing.
• Assessed cognitive domains relevant to the presenting problem, e.g., intellectual ability, achievement, attention, memory, and impulsivity.
• Composed formal testing reports for individuals in need of academic accommodations, e.g., due to learning disorders, ADHD, and mood and anxiety disorders.

Supervisors: Neil Pliskin, PhD, ABPP-CN & Audrey Ruderman, PhD

LANGUAGES SPOKEN

• English – fluent in oral and written
• Spanish – fluent in oral and written
• Hindi – fluent in oral

AWARDS

• Student Presenters Award, Presented by Graduate College, $200 June 2011, January 2013, April 2014, February 2015
• Travel Award, Presented by Graduate Student Council, $300 August 2011, February 2014, October 2014
• Graduate Student Travel Award, Presented by College of Liberal Arts and Sciences, $500 October 2011, October 2012, February 2014

PEER-REVIEWED PUBLICATIONS


DOI: 10.1016/j.psychres.2015.09.012

DOI: 10.1016/j.jpsychires.2015.04.005
Bodapati, A. S., & Herbener, E. S. (2014). The impact of social content and negative symptoms on affective ratings in schizophrenia. Psychiatry Research, 218, 25-30. DOI:10.1016/j.psychres.2014.03.039


CONFERENCE PRESENTATIONS


presented at the 2011 Society for Research in Psychopathology Annual Meeting, Boston, MA.


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**CLINICAL SUPERVISOR EXPERIENCE**

**PSCH 582 – Practicum in Psychological Assessment**  
*University of Illinois at Chicago*  
Professor: Amanda Lorenz, PhD

- Observed first- and second-year Clinical Psychology PhD students administer cognitive assessment batteries, including WAIS-IV and Woodcock-Johnson Test of Achievement.
- Met with students for supervision and provide feedback on clinical assessment skills, including correct administration of tests and rapport-building techniques.

**PSCH 381 – Interviewing**  
*University of Illinois at Chicago*  
Aug 2011-Aug 2012  
Professors: Ellen Herbener, PhD & Kathryn Engel, M.A.

- Observed undergraduate-level students conduct clinical interviews.
- Met with students for supervision and provided feedback on clinical interviewing skills, including use of open-ended questions, reflections, paraphrasing, and nonverbal behaviors to promote rapport.

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**RESEARCH EXPERIENCE**
Schizophrenia Research Lab
*University of Illinois at Chicago*
Aug 2009-present
PI: Ellen S. Herbener, PhD; cross-sectional study assessing relationship between emotional processing, cognition, and social functioning in schizophrenia spectrum disorders.
- Administer, score, and interpret cognitive and clinical ratings to individuals with schizophrenia spectrum disorders and healthy controls.
- Conduct structured interviews to determine psychiatric diagnoses.
- Maintain Institutional Review Board research protocols to ensure ethical treatment of research participants while achieving research goals.
- Formulate new tasks to enable testing of proposed research questions.
- Analyze and present data at professional psychology and psychiatry conferences.
- Draft manuscripts assessing social and emotional factors in schizophrenia (see Publications section).

Epigenetics Translational Research Lab
*University of Illinois at Chicago*
Sept 2012-June 2015
PI: Rajiv Sharma, MD; Grant: R01 MH094358; cross-sectional study examining epigenetic predictors of clinical and cognitive factors in schizophrenia and bipolar disorder.
- Administer MATRICS neuropsychological battery and assess premorbid cognitive functioning on inpatient and outpatient schizophrenia and bipolar disorder patients.
- Conduct semi-structured interviews to assess current social functioning.
- Develop and implement tasks to measure various aspects of anhedonia and social cognition.
- Analyze and present data at professional psychology and psychiatry conferences and draft manuscripts (see Publications section).

Hyperactivity, Attention, and Learning Problems (HALP) Clinic
*University of Illinois at Chicago*
June 2012-May 2013
PI: Mark Stein, PhD; clinical trial examining the impact of pharmaceutical treatment of maternal ADHD on children with attention problems.
- Contributed to a symposium on unique predictors of side effects in stimulant and non-stimulant medication for the treatment of ADHD.
- Conducted phone screens to determine participant eligibility for Mothers First study on treating mothers with ADHD symptoms and coordinated study visits.
- Administered intake interviews and coordinated clinic appointments for assessments and consultations.

Schizophrenia Prodromal Clinic
*Columbia University Medical Center, New York, NY*
Dec 2007-June 2009
PI: Cheryl M. Corcoran, MD; 4-year longitudinal study that assesses changes in thoughts and feelings over time in young adults prodromal to schizophrenia.
- Administered and scored psychological measures to individuals putatively prodromal to schizophrenia as well as normal controls to track symptoms over time.
- Managed a database with 5 years of longitudinal data.
- Drafted manuscript on cannabis risk in schizophrenia prodromes (see Publications section).
• Analyzed the video data of children of schizophrenic parents to draft a manuscript used for master’s project.

PROFESSIONAL MEMBERSHIPS

• American Academy of Clinical Neuropsychology
• International Neuropsychological Society
• National Academy of Neuropsychology
• Society for Research in Psychopathology