INVESTIGATION OF SOCIAL DYSFUNCTION AND AFFECT IN SCHIZOPHRENIA

by

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Dedicated to my family.

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ABSTRACT

Social dysfunction is a hallmark of schizophrenia and leads to significant disability and distress. Decreased positive and increased negative affect predict poorer social functioning in those with schizophrenia. Social functioning and affect have traditionally been measured in the laboratory; yet, these methods are limited. Experience sampling methods (ESM) offer more immediate, ecologically valid assessments of these constructs. The purpose of this study was to examine social functioning and affect in schizophrenia using a novel form of ESM that passively collects audio data. The two primary hypotheses were: 1) clinical status (schizophrenia versus control) will predict social functioning, level of positive affect, and level of negative affect; and 2) the relationship between clinical status and affect will be moderated by context (social versus non-social). Additional exploratory aims tested the convergent validity between traditional, laboratory-based assessments of social functioning and this novel ESM. Data was collected from 38 people with schizophrenia and 36 control participants; Results partially supported the hypotheses. As expected, laboratory measures of social functioning revealed that those with schizophrenia performed worse than controls. ESM measures of social functioning found that the schizophrenia group interacted with others at the same rate as the control group but did not exhibit as much social engagement. ESM measures of affect revealed the schizophrenia group reported more negative affect than controls, but no differences in positive affect were found. Social context did not moderate the relationship between clinical status and affect. Lastly, correlations between laboratory measures and ESM measures of social functioning were significant for the schizophrenia group but not the control group. Results further our understanding of social functioning and affect in those with schizophrenia and yield important implications for future work.

INTRODUCTION

Overview

Social dysfunction has been characterized as a hallmark of schizophrenia-spectrum disorders that leads to considerable disability and distress (APA, 2013). Thus, it has been the topic of much clinical research in this population (Bellack et al., 2007). One line of research has focused on the relationship between affect and social dysfunction in schizophrenia. Research suggests people with schizophrenia exhibit significantly decreased positive affect and increased negative affect when compared to healthy controls (Barch et al., 2008; Strauss et al., 2011; Strauss et al., 2013; Cho et al., 2017). Moreover, this pattern of decreased positive and increased negative affect predicts poorer social functioning in those with schizophrenia-spectrum disorders (Blanchard et al., 1998). However, most of this research has measured social functioning and affect in laboratory settings using performance-based, interview-rated, or self-report measures. These methods are limited by their inability to observe the complexity of peoples' daily social behaviors and reliance on historical report. Experience sampling methods (ESM) involve more immediate, ecologically valid assessments of functioning and affect. Moreover, ESM offers the opportunity to test relationships between social functioning and affect at multiple time points. Thus, the purpose of the current study is to examine social functioning and affect in schizophrenia-spectrum disorders using two forms of ESM: traditional self-report as well as a novel method of passive assessment using audio recording. By collecting real-world data, this project aims to elucidate associations between social functioning and affect and test for potential interactions.

Social Dysfunction

Social dysfunction, characterized by few social interactions and poor social engagement, is a core and disabling feature of schizophrenia-spectrum disorders (APA, 2013). It often begins prior to the onset of psychotic symptoms and persists even after their remission (Robinson et al., 2004). Social dysfunction is a primary factor in the disability associated with psychotic illnesses; it significantly predicts quality of life and has been described as one of the most distressing impairments by those with psychotic disorders and their family members (Bellack et al., 2007).

Furthermore, social dysfunction in schizophrenia has been related to greater health-care costs (Rupp & Keith, 1993). Given these burdens, it is vital to accurately identify and measure how people with schizophrenia exhibit social dysfunction in their daily lives.

Social dysfunction has been measured in a variety of ways such as performance-based measures, rating scales, and ESM. Performance-based measures assess social skills in people with schizophrenia via structured role plays that are rated for domains like fluency, clarity, and social appropriateness. Rating scales use thorough, clinical interviews with subjects to gather evidence to determine real-world functioning. ESM often involves collecting self-report data of socially relevant activities in the moment that they are occurring in the subject's everyday life (Chun, 2016). In ESM, data can be collected in a variety of ways ranging from written diaries and telephones to electronic surveys and physiological sensors. Performance-based assessments and rating scales typically take place in a laboratory or treatment setting, whereas ESM collect data in the natural environment. Although these methods differ in the strategy or method by which data is collected, they all similarly assess for certain elements of social functioning.

Across methods, two commonly assessed elements of social functioning are frequency of social interactions and social engagement. Social interactions involve any conversations, activities, or time spent with other people. Research has found that, compared to their healthy peers, people with schizophrenia spend significantly less time in the presence of and interacting with other people (Oorschot et al., 2012; Schneider et al., 2017). Moreover, ESM data suggests that people with schizophrenia, particularly those with higher levels of social anhedonia, are more likely to be alone and have fewer intimate relationships (Brown et al., 2007; Kwapil et al., 2009).

Social engagement can be thought of as a person's level of interest and involvement in social interactions (Pinkham & Penn, 2006). Engagement has been operationalized as affiliative behaviors toward another person (e.g., eye contact, language reflecting interest, positive facial expressions; Garcia et al., 2018). Research suggests those with schizophrenia display significantly less engagement during social interactions (Blanchard et al., 2015). Moreover, impairments in social engagement have led to serious consequences for this population such as mental suffering, impaired occupational functioning, diminished social networks, and reduced social support (Carpenter, 2019). Studies examining social engagement in schizophrenia have been conducted in laboratory settings (e.g, Pinkham & Penn, 2006, Schneider et al., 2017); level

of social engagement, as opposed to frequency of social interactions, has yet to be studied using ESM.

Although people with schizophrenia generally have fewer social interactions and less engagement compared to their peers, there is evidence suggesting increases in both interaction and engagement is related to a number of positive outcomes for this population. Specifically, increased social interactions and larger social networks may serve as protective factors in recovery from a psychotic illness (Bjornestad et al., 2017). In a recent longitudinal study examining recovery in first episode psychosis, Bjornestad and colleagues (2017) found that frequency of social interactions with friends was a significant positive predictor of clinical recovery over a two-year period. Thus, people with schizophrenia benefit from participating and engaging in social relationships. Moreover, these constructs are not only important indications of social functioning but may also play an important role in general illness recovery and quality of life for this population.

Given the above research, both frequency of social interactions and social engagement are crucial aspects of both social and overall functioning. As a result, substantial research has focused on examining these areas of social dysfunction and their correlates to better understand impairments, further develop treatments, and measure outcomes for people with schizophrenia.

Laboratory versus Real-World Measurement

Social dysfunction has traditionally been measured in the laboratory with interview-rated assessments (Bellack et al., 2007). Like all laboratory measures, interview-based assessments are imperfect and vulnerable to issues of ecological validity. Often, these assessments require the subject to report on behaviors from days, months, and/or years ago (e.g. The Global Functioning Scale: Social; Cornblatt et al., 2007). In this way, data gathered from these assessments rely on the accuracy of the individual being interviewed. Yet, human memory and information processing are not perfect systems; people cannot possibly store all their perceptions and experiences permanently nor can they report on their experiences in a completely unbiased and objective way (Schwarz & Sudman, 1993). These issues are especially problematic in the assessment of those with psychotic illnesses, who often experience cognitive impairment, poor memory, and lack of insight, which affects subjective reports. According to Bellack et al. (2007), people with schizophrenia become progressively less accurate in their reporting as the

information being assessed gets more specific and/or historical. Similarly, clinical ratings of laboratory interviews are limited by rater variability and their inability to observe and account for the complexity of peoples' daily social behaviors. Consequently, the ecological validity of these methods is questionable.

ESM offers a solution to gain more immediate, ecologically valid assessments of functioning in those with schizophrenia-spectrum disorders. In ESM, data on participants' thoughts, feelings, behaviors, and/or environment is collected directly in the moment or shortly thereafter (Hektner et al., 2007). The immediacy of ESM protects against retrospective bias, and the real-world context in which subjects are assessed increases the external validity of data and generalizability of results (Hektner et al., 2007). ESM data has been collected via paper assessments (Iida et al., 2012) or mobile devices (Depp et al., 2016). Some ESM collect data by actively engaging the subject in completing self-report assessments in the context of their daily lives; other methods passively collect data by observing and recording behaviors, sounds, or movements. This latter form of ESM bypasses the subject's recollection and biases and are thus thought to be more objective (Mehl, 2007). Moreover, passive data collection allows researchers to increase measurement frequency without overburdening subjects or increasing the likelihood of study goals being inferred.

Research applying ESM to measure daily functioning in those with schizophrenia-spectrum disorders is still in its relative infancy. Specifically, existing ESM research has only used frequency of social interactions and/or time spent alone as a proxy for social functioning. ESM research has yet to assess how socially engaged people with schizophrenia are during everyday interactions with others. Moreover, it is not yet clear how ESM measures of social functioning compare to standard assessments already used in the field. Although some researchers have begun to compare these methods (Schneider et al., 2017), further investigation is needed. Thus, studies testing the associations between ESM and traditional laboratory-based measures of social functioning in schizophrenia are necessary to determine the convergent validity of these methods.

The Role of Affect in Social Dysfunction

One important component of social dysfunction that has been studied is one's affect. Relative to their healthy peers, people with schizophrenia-spectrum disorders have been found to

exhibit reduced positive affect and increased negative affect (Barch et al., 2008; Strauss et al., 2011; Strauss et al., 2013; Cho et al., 2017). Moreover, reduced positive affect and increased negative affect have been linked to worse social functioning in this population (Blanchard et al., 1998). A review by Horan and colleagues (2008) concluded that positive affect has consistently been associated with more adaptive functioning such as larger social networks and higher quality of life. These results are consistent with research in healthy populations suggesting the experience of positive affect is correlated to frequency and duration of social interactions (Watson, et al, 1992). Likewise, increased negative affect has been associated with worse social functioning in both clinical and healthy populations; in those with schizophrenia, this relationship persisted after accounting for cognitive ability and severity of psychotic symptoms (Grove et al., 2016). Thus, it seems positive and negative affect are critical components of social functioning and investigating the interplay between affect and social functioning is a promising avenue for better understanding impairment in those with schizophrenia.

Although the association between affect and social functioning has been established (Blanchard et al.,1998; Horan et al., 2008; Grove et al., 2016), most of this work has only measured these constructs in the laboratory. In this way, research on social functioning and affect has problematically relied on the subject's report and has been unable to accurately assess these constructs across multiple times points. To address these issues, researchers have recently employed ESM to measure social functioning and affect in the daily lives of those with schizophrenia (Cho et al., 2017; Cohen et al., 2012; Oorschot et al., 2013). Yet, it is still unknown whether affective differences in those with schizophrenia are truly general deficits (consistent across contexts) or specific to certain situations.

One study by Oorschot and colleagues (2013) investigated emotional experience and social behaviors in daily life using ESM. They found that, although people with schizophrenia tend to generally report more negative and less positive affect compared with healthy controls, they reported similar emotional responses when in the company of other people. In this way, it seems context, specifically social context, matters; when people with schizophrenia are in similar social situations as their healthy counterparts, they may experience similar emotionality. Yet, we know that the social lives of those with schizophrenia drastically differ from those of healthy people; people with schizophrenia spend more time alone (Oorschot et al., 2012, Schneider et al., 2017) and have fewer number of friends and narrower social networks (Goldberg et al., 2003).

Thus, the well-established differences in positive and negative affect between those with schizophrenia and healthy controls may actually be due to differences in social functioning, namely the amount of social interactions they engage in. Consequently, it is possible that when in similar social contexts, these differences in affect may disappear. In this way, social context (i.e., whether or not the person is interacting with someone else) may moderate the relationship between clinical status (schizophrenia versus non-schizophrenia) and affect.

Aims of the Current Study

The current project aims to elucidate the relationship between social functioning and affect in schizophrenia by using two different forms of ESM: the Electronically Activated Recorder (EAR; Mehl, 2007) and daily social journals. The EAR is a portable device that collects direct, real-world observations of social interactions through audio recording and can yield objective measures of frequency of social interaction and social engagement. In contrast, daily social journals are paper assessments that prompt subjects to record their activities throughout the day and rate their affect (positive and negative) during each activity. Using these methods, this project compared people with schizophrenia to healthy controls on the constructs of interest and tested the potential influence of social context in moderating the relationship between clinical status (schizophrenia versus non-schizophrenia) and affect.

In order to achieve these aims, the current study tested two primary hypotheses. First, we hypothesized that clinical status (schizophrenia versus non-schizophrenia) significantly predicts social functioning and affect. Consistent with previous research on social functioning and affect (Bellack et al., 2007; Barch et al., 2008; Cohen et al., 2012; Strauss et al., 2011; Strauss et al., 2013), we anticipated that those with schizophrenia would exhibit worse social functioning, more negative affect, and less positive affect compared to healthy controls. Second, we hypothesized that the relationship between clinical status and affect (both positive and negative) would be moderated by context (social versus non-social). This is based on findings that duration and frequency of social interaction has been associated with the experience of positive affect in the general population (Watson et al., 1992), and people with schizophrenia show similar affective responses in social interactions as controls (Oorschot et al., 2013). A secondary aim of this study was to explore the associations between social functioning data collected by the EAR and social functioning data assessed via a traditional interviewer-rated assessment, the Global Functioning

Scale-Social (GFS-S; Cornblatt et al., 2007). Because convergent validity between these measures has yet to be investigated and ecological validity of the GFS-S has not been directly examined, this aim was exploratory.

In this way, this project will use novel methods to develop a better understand of the daily social experiences of those with schizophrenia. Importantly, this will be the first ESM study to measure social behavior in this population using passive, audio recording. This method not only lets us objectively measure frequency of everyday social interactions, but it also allows for a real-world assessment of social engagement. This will also be the first study to examine the potential moderating effect of social context in determining differences in reported positive and negative affect in those with schizophrenia. Finally, this project will be the first study to test the convergent validity of real-world audio-recording ESM and the interviewer-rated GFS-S. Thus, findings will make important contributions to the ESM literature on social functioning in those with schizophrenia.

METHOD

Participants and Design

The current project involved secondary analysis of data combined from two studies. In the first study, people with schizophrenia-spectrum disorders as well as healthy controls were recruited for participation; the second study only recruited people with schizophrenia-spectrum disorders for participation. Both studies used the same inclusion and exclusion criteria for the clinical sample. That is, participants in the clinical sample were recruited from Midtown Community Mental Health Center, Larue Carter Hospital and Roudebush VA Medical Center and have a primary diagnosis of schizophrenia, schizoaffective disorder, delusional disorder, or psychotic disorder NOS according to the Mini International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 2006). Other inclusion criteria included: a) age 18–60; b) English fluency; c) no change in medication or outpatient status in the 30 days prior to testing; d) ability to give informed consent; e) no active substance dependence; f) no documented intellectual disability; and g) no history of a neurological illness or traumatic brain injury that resulted in loss of consciousness greater than five minutes. Participants in the control group were recruited via flyers, local health care centers, and a volunteer registry. Criteria mirrored the schizophrenia-spectrum group except those who: a) met current criteria for a psychiatric disorder or b) had a history of psychotic symptoms were excluded.

Measures

Real-world measures.

The electronically activated recorder (EAR; Mehl, 2007).

The EAR is a portable device that collects direct, real-world observations of social interactions through audio recording. Previous studies have demonstrated its promise for capturing accurate behavioral information in workplace settings (Holleran et al., 2011) and everyday social settings (Pennebaker et al., 2003), as well differentiating individuals with depression from controls (Robbins, Mehl et al., 2011). In this study, participants wore the EAR

device for two days; research suggests this length of time shows good temporal stability in healthy individuals (Mehl & Robbins, 2012) and convergence with four-week time frames (Mehl et al., 2001; Mehl et al., 2012).

Because the EAR audio recordings collect sensitive information, safeguards were put in place to protect subject's confidentiality. First, when subjects returned the EAR device, they were given the opportunity to hear and delete any recordings they did not wish to share prior to anyone from the research team hearing them. Second, because the EAR is designed to pick up noises close to the participant, this may, at times, include conversations with others. If others felt uncomfortable that their conversations may be recorded, subjects were instructed to explain that only short periods of conversations are recorded and that they can remove the EAR device if the other person is uncomfortable.

Objective ratings of social behaviors were coded from the EAR audio recordings (Appendix A.1). Specifically, amount of time in social interactions and engagement in social interactions over the two-day period were coded from EAR audio recordings. Social behaviors were coded using the Social Environment Coding of Sound Inventory (SECSI; Mehl, 2017; Mehl et al., 2012; Mehl et al., 2007). According to this system, social interactions are calculated as frequency of recordings where subjects speak with another person. Social engagement is calculated as frequency of recordings where subjects engage in personal or substantive exchanges with others. Coding occurs for each file on a 4-point scale (0 = No subject conversation; 1= Small talk from subject; 2 = Substantive conversation from subject; 3 = Personal/emotional disclosure from subject). Small talk is defined as practical conversations with little information exchanged (e.g., "How's the weather"). Substantive conversation is defined as exchanges of thoughts, information, and ideas about non-emotional topics (e.g., "What I found interesting about the book was…"). Personal or emotional disclosures are defined as conversations where personal feelings or emotions are shared (e.g., "I feel really upset today"). Scores of '2' or '3' signify social engagement. Coding for social interaction and social engagement occurred simultaneously.

The SECSI was developed and validated to rate social behaviors from EAR recordings across several studies (Mehl, 2017; Mehl et al., 2012; Mehl et al., 2007). The SECSI has shown feasibility for the EAR in healthy and psychiatric samples (e.g. Alisic et al., 2015; Baddeley et al., 2013; Bollich, et al., 2016) as well as replicability for social interactions (e.g. Mehl et al.,

2007; Robbins et al., 2014) and social engagement (e.g. Robbins et al., 2014; Robbins, Focella et al., 2011). Five trained raters completed the coding for this project. A subset (10%) of all files were coded by a second rater to assess for inter-rater reliability. A high degree of reliability was found, ICC = 0.950, 95% CI [0.910, 0.972], $p < 0.001$.

Daily social journal.

Daily social journals (Appendix A.2) are paper assessments that prompt subjects to record and rate their activities throughout the day. Participants were instructed to fill the social journal each hour over the two-day period. For each hour, participants recorded what they were doing and if they were wearing the EAR during this time. They also recorded ratings for both their positive and negative affect during that hour. Affect ratings were made on seven-point Likert scale (0 = No positive/negative affect, 6 = Extreme positive/negative affect); higher scores indicate higher levels of positive/negative affect. Similar forms of ESM using daily diary entries have been widely and successfully implemented for both clinical and healthy populations (e.g., Csikszentmihalyi & Larson, 1987; Myin-Germeys et al., 2003; Myin-Germeys, et al., 2001). This specific social journal has been used to detect differences in affect between people with schizotypy and healthy controls (Minor et al., 2018).

Laboratory measures.

The global functioning scale: social (GFS; Cornblatt et al., 2007).

The GFS-S (Appendix A.3) is a clinician-rated assessment of social functioning. It measures age-appropriate social contact and friendships outside of the family via a thorough clinical interview. The GFS-S uses a 10-point scale and greater scores represent higher functioning. The GFS-S was adapted from two "gold-standard" instruments for measuring social functioning in schizophrenia-spectrum disorders, the General Assessment of Functioning (GAF; Hall, 1995) and the Social and Occupational Functioning Assessment Scale (SOFAS; Skodol et al., 1988). The GFS-S has demonstrated high interrater reliability (ICC = 0.85, $p < 0.001$; Cornblatt et al., 2007) as well as high construct validity in schizophrenia-spectrum populations (Auther et al., 2006). This scale takes approximately 15 minutes to administer.

Procedure

Subjects were offered two-way transportation to the research session and paid $10/hour as compensation for their time conducting laboratory testing. Upon arriving at the lab, all subjects underwent an extensive informed consent process prior to participation. Subjects were then assessed on all study measures. After this research session, subjects were given an iPod Touch with the EAR application as well as a blank social journal. Subjects were instructed to wear the iPod Touch in a protective carrying case attached to the outside of their clothing (e.g., belt, shirt pocket, pants pocket) over the course of two days. The device was programed to record speech and other ambient sounds for 5 minutes every 90-minutes from 6:00am to 12:00am. Blackout periods (e.g., periods where participants are instructed not to wear the device and EAR will not be set to record) occurred every day between 12:00 AM and 6:00AM. Thus, participants were asked to wear the device for up to 18 hours per day, with twelve recordings occurring during those hours. Participants were also instructed to complete an entry on the daily social journal for each hour they were wearing the EAR. Participants were paid up to $50 for completing and returning the EAR recordings and social journal.

Analyses

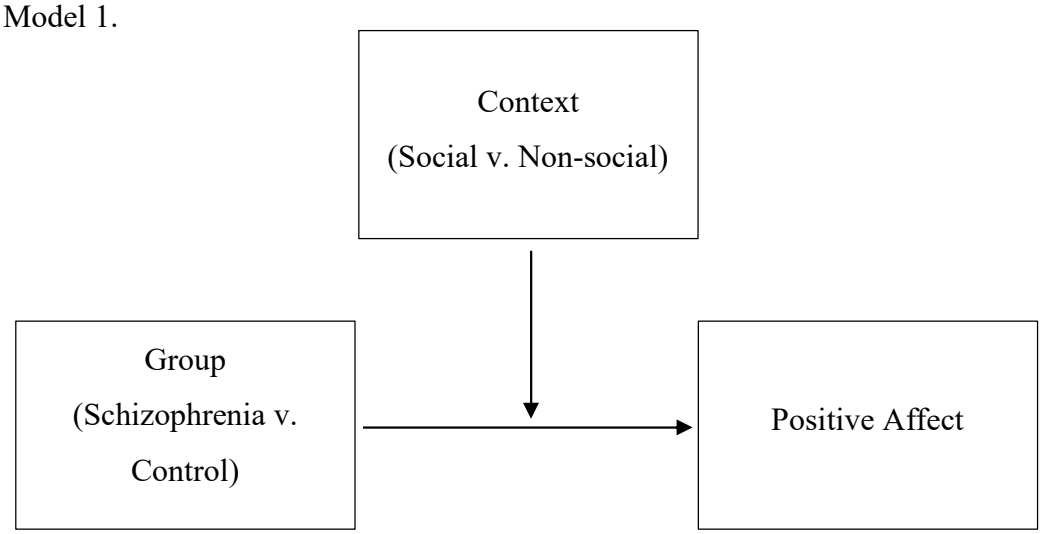
Analyses were conducted using IBM SPSS Statistics 24. An alpha level of $p < 0.05$ was used to interpret significance for all analyses. Analyses were conducted in four parts. First, using chi-square tests for independence, the schizophrenia group and the control group were compared on demographic variables such as sex (% female), race (% Caucasian), and ethnicity (% non-Hispanic). Chi-square tests for independence were also used to determine if groups differed on which days of the week they wore the EAR and completed social journals (e.g., weekday versus weekend). Independent samples t-tests were used to determine group differences in age. If groups were found to differ on any demographic or weekday variables, those variables would be controlled for in the following models.

Next, regression analyses were used to test the first primary hypothesis that clinical status (schizophrenia versus non-schizophrenia) predicts social functioning and affect. First, a regression analysis was used to test if group status (schizophrenia/control) predicted social functioning as measured by the laboratory-based GFS-S. Next, two regression analyses were

conducted to determine if group status (schizophrenia, control) predicted frequency of social interactions or social engagement as coded by the EAR (Model 1: interactions, Model 2: engagement). In these regression models, group status was included as the predictor variable and each of the social functioning measures were included as the outcome variables. Two additional regression analyses were conducted to determine if group status (schizophrenia, control) predicted positive or negative affect ratings (Model 1: positive, Model 2: negative). In these models, group status was again the predictor variable, and each type of affect was included as the outcome variables.

To test the second hypothesis, two multilevel models were created to determine if affect differed across groups based on context (social versus non-social). Multilevel modeling is commonly used in ESM research since it allows for the examination of how behaviors vary as a function of specific time points (Level 1) nested within individuals (Level 2). In each model, the interaction between group status and social context on affect was tested (Model 1: positive affect, Model 2: negative affect). In this way, group status was included as the predictor variable (X), social context was included as the moderator (W), and each type of affect was included as the outcome variables (see Figure 1).

Model 1.



Model 2.

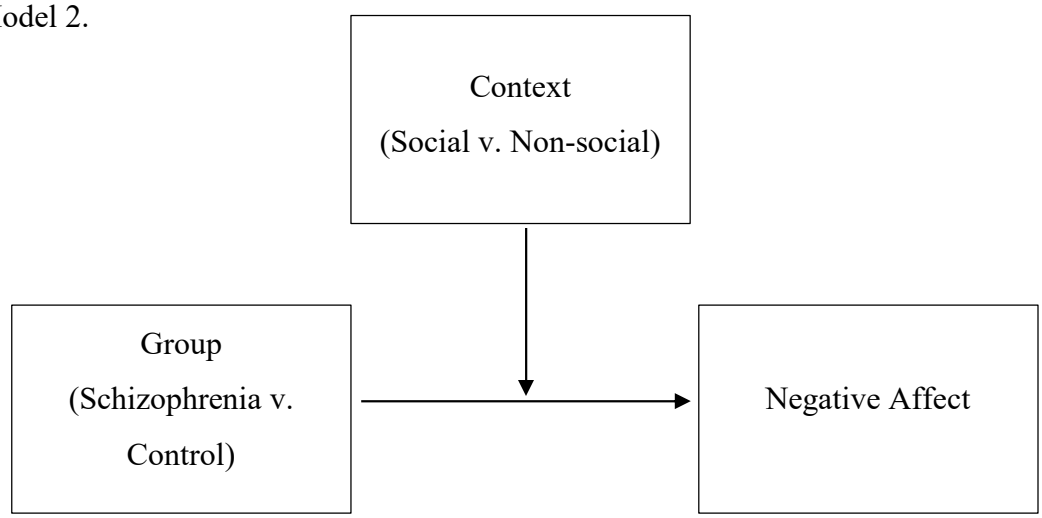


Figure 1. Moderation models testing the influence of social context on the relationship between group status and affect.

Finally, to address the exploratory aim, correlation analyses were used to determine if the GFS-S is related to daily social functioning. We analyzed associations between the GFS-S score and overall frequency of social interactions as well as the GFS-S and overall social engagement score. These correlations were each run separately for schizophrenia group and the control group.

Power Analysis.

In order to determine the appropriate sample size for our analyses, a power analysis was conducted for each of the statistical tests using G*Power 3.1 (Faul et al., 2009). Expected effect sizes for each of the analyses were determined based on findings from the literature. Studies examining differences in social functioning in those with and without schizophrenia have yielded moderate to large effects (e.g. Kimhy et al., 2014; Schneider et al., 2017). Yet, no previous studies have used real-world audio recording to measure differences in social functioning in those with and without schizophrenia. Thus, we included a moderate effect in the power analysis to ensure sufficient power. Using G*Power 3.1 (Faul et al., 2009) and setting the effect size to f^2 = 0.15, the power to 0.8, and the probability of making a type I error to 5%, it was determined that a minimum total sample size of 55 participants would allow sufficient power for the first group of regression analyses (testing group differences in social functioning).

A recent meta-analysis (Cho et al., 2017) investigating differences in positive and negative affect in those with and without schizophrenia reveals large effects (0.84 for differences in negative affect and -0.75 for differences in positive affect). Thus, using G*Power 3.1 (Faul et al., 2009) and setting the effect size to f^2 = 0.35, the power to 0.8, and the probability of making a type I error to 5%, it was determined that a minimum total sample size of 25 participants would allow sufficient power for the second set of regression analyses (testing group differences in affect).

Effect size for the moderating effect of social context in the relationship between clinical status and affect is less clear as little research has been conducted thus far. Therefore, using G*Power 3.1 (Faul et al., 2009) and setting the effect size to f^2 = 0.15, the power to 0.8, and the probability of making a type I error to 5%, it was determined that a minimum total sample size of 71 participants would allow sufficient power to detect a moderate effect for this moderation analysis.

For our final analyses testing the correlations between the GFS-S and the EAR estimates of social functioning, we expected a moderate effect based on validity research of the GFS-S. Thus, using G*Power 3.1 (Faul et al., 2009) and setting the effect size to $\rho = 0.5$, the power to 0.8, and the probability of making a type I error to 5%, a minimum sample size of 26 participants per group would allow enough power for the correlation analyses. Given the results of these

power analyses, we concluded that a minimum sample of 71 participants would be necessary for 80% power across analyses.

RESULTS

Descriptive Analyses

Across the two studies, 74 participants completed all parts of the ESM procedure (i.e., EAR and social journal data collection). The final sample included 38 people with schizophrenia and 36 control participants. Of those participants, 71 also completed the GFS-S. Results of an independent samples t-tests revealed no significant difference in age between the schizophrenia group ($M = 46.24$, $SD = 10.40$) and the control group ($M = 43.20$, $SD = 11.92$), $t(71) = 1.162$, $p = 0.249$. Chi square tests for independence revealed no group differences in sex, X^2 (1, $N = 74$) = 0.85, $p = 0.358$, race, X^2 (2, $N = 74$) = 3.90, $p = 0.143$, ethnicity, X^2 (2, $N = 74$) = 1.21, $p = 0.546$, nor the day of the week that the EAR was worn, X^2 (2, $N = 74$) = 1.62, $p = 0.444$. All data was found to be normally distributed using skewness and kurtosis estimates, with skewness >3.0 and kurtosis >10 indicating non-normality (Kline, 2011). EAR audio files were excluded from analyses if subjects were sleeping, if there was a problem with the audio file (e.g., inaudible), or if the subject was not wearing the EAR. See Table 1 for detailed demographic and audio data between groups.

Table 1. Demographic and Audio Data in Schizophrenia and Control Groups.

	Schizophrenia Group (n = 38)	Control Group (n = 36)
Demographic data	M (SD)	M (SD)
Age	46.24 (10.40)	43.20 (11.92)
Sex: % Female	57.9	47.2
Race: % Caucasian	34.2	55.6
Ethnicity: % Non-Hispanic	86.8	91.7
Group-level EAR data		
Day of Week wearing EAR (% Weekday)	39.5	41.7
Total audio files	755	701
Files included in analyses	573 (75.9%)	563 (80.3%)
Files not analyzed	182	138
Subject sleeping	140 (18.5%)	102 (14.6%)
Subject not wearing EAR	14 (1.9%)	33 (4.7%)
Audio problems	28 (3.7%)	3 (0.4%)

Notes: n = number; M = mean; SD = standard deviation; EAR = Electronically Activated Recorder.

Group Status as a Predictor of Lab-based Social Functioning Measure

Regression analyses were run to test if group status (schizophrenia/control) predicted social functioning as measured by the laboratory-based General Functioning Scale—Social (GFS-S). Group status significantly predicted scores on the GFS-S; b = -2.39, $t(69)$ = -8.54, p < 0.001. Furthermore, this model accounted for 51% of the variance in GFS-S scores; R^2 = 0.514,

F(1,69) = 72.84 , $p < 0.001$. On average, those in the schizophrenia group ($M = 6$, $SD = 1.23$) scored 2.39 points lower on the GFS-S than those in the control group ($M = 8.39$, $SD = 1.12$).

Group Status as a Predictor of ESM Measures

Regression analyses were used to test if group status (schizophrenia/control) predicted social functioning indices as measured by the EAR. Results partially supported hypotheses. The first model predicting frequency of social interactions from group was not significant, *F*(1,72) = 0.039 , $p = 0.844$. Thus, group status (schizophrenia/control) did not predict frequency of social interactions coded on the EAR recordings; $b = -1.199$, $t(72) = -0.198$, $p = 0.844$. The second model predicting frequency of social engagement from group was significant and accounted for 11% of the variance; $R^2 = 0.11$, *F*(1,72) = 8.45 , $p = 0.005$. Group status (schizophrenia/control) significantly predicted frequency of social engagement; $b = -12.70$, $t(72) = -2.91$, $p = 0.005$. See Table 2 for detailed results of regression analyses. These analyses show that those in the schizophrenia group exhibited social engagement less frequently (19.04%) than the control group (31.74%) The number of audio files with social interactions did not differ when the schizophrenia (41.4%) and control groups (42.6%) were compared (see Table 3).

Additional regression analyses were used to test if group status (schizophrenia/control) predicted ESM measures of positive and negative affect. Results partially supported the hypotheses. The first model predicting positive affect from group was not significant; *F*(1,72) =2.67 , $p = 0.107$. Thus, group status (schizophrenia/control) did not predict positive affect reported on the ESM measure; $b = -0.46$, $t(72) = -1.63$, $p = 0.107$. Although it did not reach the level of significance, the schizophrenia group generally reported lower positive affect scores (M = 4.42, SD = 1.43) than the control group (M = 4.87, SD = 0.92). The second model predicting negative affect from group was significant and accounted for 9% of the variance; $R^2 = 0.09$, *F*(1,72) = 6.68, $p = 0.012$. Group status (schizophrenia/control) significantly predicted negative affect; $b = 0.61$, $t(72) = 2.59$, $p = 0.012$. Specifically, more negative affect was reported in the schizophrenia group (M = 2.23, SD = 1.22) compared to the control group (M = 1.63, SD = 0.73). See Table 2 for detailed results of regression analyses and Table 3 for affective differences between groups.

Table 2. Results of Regression Analyses

	Frequency of Social Interaction *(n = 74)*				Frequency of Social Engagement *(n = 74)*			
	R^2	*B*	*SE B*	*β*	R^2	*B*	*SE B*	*β*
	0.001				0.11			
Group		-1.20	6.06	-0.02		-12.7**	4.37	-0.32**
	Mean Positive Affect *(n = 74)*				Mean Negative Affect *(n = 74)*			
	R^2	*B*	*SE B*	*β*	R^2	*B*	*SE B*	*β*
	0.04				0.09			
Group		-0.46	0.28	-0.19		0.61*	0.24	0.29*

Notes. Group: Schizophrenia/Control; * $p < .05$, ** $p < .01$

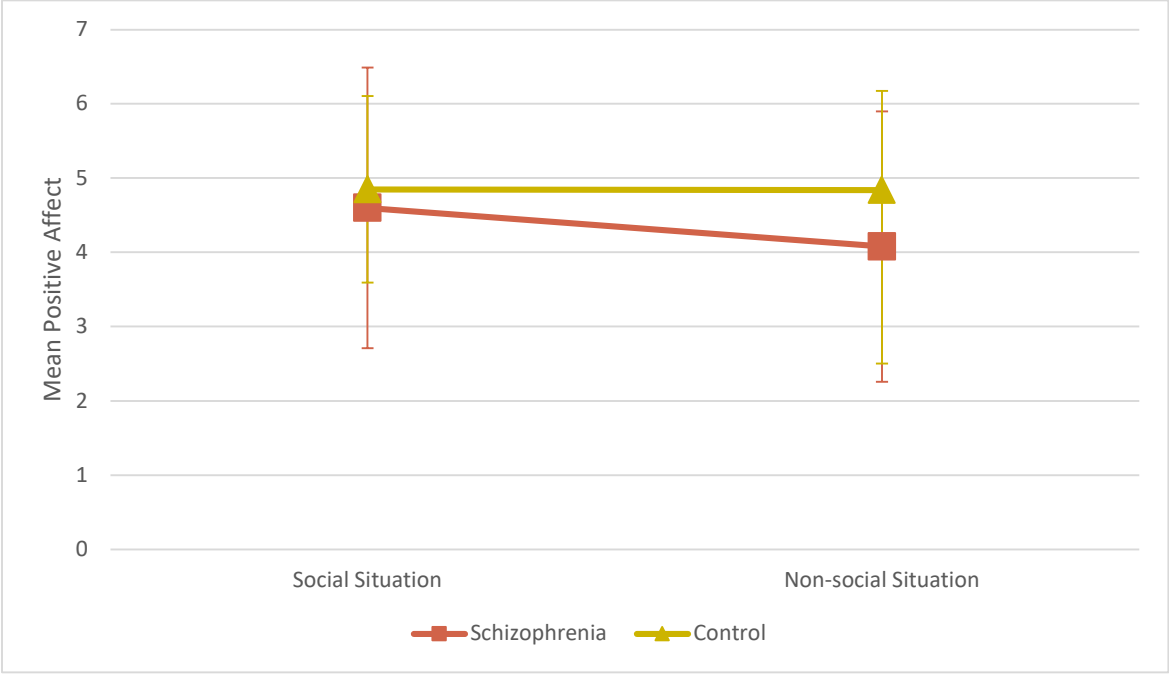
Table 3. Social Behavior and Affect in Schizophrenia and Control Groups

	Schizophrenia ($n = 38$)	Control ($n = 36$)
Interaction: Frequency (SD)	41.43% (27.22)	42.63% (24.76)
Engagement: Frequency (SD) **	19.04% (19.06)	31.74% (18.49)
Positive Affect: Mean (SD)	4.42 (1.43)	4.87 (0.92)
Negative Affect: Mean (SD) *	2.23 (1.22)	1.63 (0.73)

Notes. Frequency: Percent of audio records; SD: Standard deviation; Positive and negative affect scores ranged from 1-7. Significant group differences indicated by: * $p < .05$, ** $p < .01$

Moderation of Social Context on the Relationship between Group and Affect

Multilevel models were used to test the hypothesis that context (social versus non-social) moderated the relationship between group and affect. The group by context interaction was not significant for positive affect, $\gamma = -0.13$, $SE = 0.17$, $p = 0.448$, nor negative affect, $\gamma = -0.09$, $SE = 0.15$, $p = 0.543$. In the negative affect multilevel model, main effects were observed for group, $\gamma = 0.64$, $SE = 0.24$, $p = 0.009$, but not social context, $\gamma = -0.02$, $SE = 0.08$, $p = 0.789$. Neither group, $\gamma = -0.47$, SE = 0.27, $p = 0.088$, nor social context, $\gamma = 0.05$, $SE = 0.08$, $p = 0.584$, displayed significant main effects in the positive affect model. The hypotheses that group by social context interactions would occur for positive and negative affect were not supported. Mean affect ratings in the schizophrenia and control groups across social and non-social situations are displayed in Figure 2.



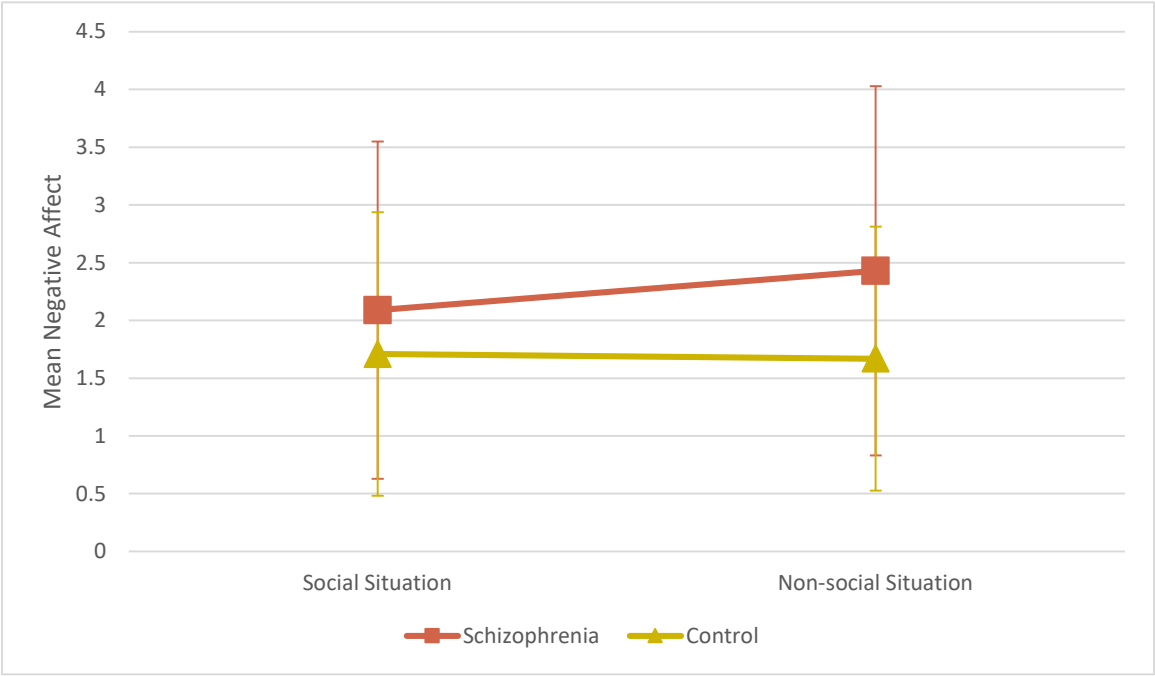


Figure 2. Affect in Schizophrenia (n = 38) and Control groups (n = 36) across social and non-social situations

Exploratory Analyses

To test exploratory aims, correlation analyses were run to test the association between laboratory and ESM measures of social functioning. First, the correlation between GFS-S scores and the percentage of audio recordings that included social interactions was tested in each group. Next, the correlation between GFS-S scores and percentage of recordings that included social engagement was tested in each group. Results revealed that, in the schizophrenia group, there were significant correlations between GFS-S and percent of audio recordings that included social interactions ($r = 0.39$, $p = 0.015$) and social engagement ($r = 0.35$, $p = 0.032$). However, in the control group, neither the association between GFS-S and percent of interactions ($r = 0.16$, $p = 0.366$) nor percent of engagement ($r = 0.28$, $p = 0.117$) was significant. Fisher's r to z tests revealed that correlations between GFS and percent of audio recordings that included social interactions were not significantly different between schizophrenia and control groups, $z = 1.01$, $p = 0.156$ (one tail). Likewise, Fisher's r to z tests revealed that correlations between GFS and percent of audio recordings that included social engagement were not significantly different between schizophrenia and control groups, $z = 0.31$, $p = 0.378$ (one tail).

DISCUSSION

The current project sought to investigate differences in social functioning and affect in people with schizophrenia-spectrum disorders and healthy controls using ESM. This study aimed to extend the literature on daily social functioning in those with schizophrenia by implementing a novel form of ESM, the EAR, to collect passive audio data. Importantly, this study employed the EAR to answer two novel research questions. This was the first study to investigate if people with schizophrenia differ from controls in the quality of their social interactions as defined by level of social engagement. Second, no other study to date has directly examined if social context (i.e. whether or not one is in a social situation) moderates the differences in positive and negative affect found between those with and without schizophrenia. Furthermore, exploratory aims of this research sought to determine the convergent validity between traditional, laboratory-based assessments of social functioning and this new method of measuring social functioning using the EAR. Results partially supported our hypotheses.

Contrary to hypotheses, clinical status (schizophrenia versus control) did not predict frequency of social interactions as coded on EAR recordings. Although the schizophrenia group tended to interact with others less often than control participants, this difference was not significant. ESM research comparing those with schizophrenia and healthy controls on amount of social interactions has yielded mixed results (Mote & Fulford, 2019). However, ESM studies with the largest sample sizes have found that those with schizophrenia spend significantly more time alone compared with controls (Oorschot et al., 2012; Schneider et al., 2017). Thus, our results are not in line with this previous work. One explanation for this discrepancy could be the novel way in which we assessed frequency of social interactions in this study. As opposed to asking participants if they were in an interaction, we coded whether they interacted with others using passive audio data.

Alternatively, previous ESM research has relied on self-report whereby participants indicate the frequency of their social behavior. For example, Granholm et al., 2013 used a series of ESM surveys that asked patients, “Since the last questionnaire, about how many times did you talk or communicate with someone else?” Although this method has the benefit of assessing social behavior between ESM intervals, it is vulnerable to retrospective error and leaves room for interpretation. That is, participants may not correctly recall every social interaction they

experienced since the last survey. Moreover, participants may not consider brief exchanges (e.g., saying "Bless you" when someone sneezes) as a social interaction. Other ESM surveys ask participants to report if they are currently interacting (Leendertse, et al., 2018). In these cases, participants may not report interactions that occurred a few minutes prior to being asked (but within the 5-minute interval of an EAR recording). Lastly, ESM researchers have asked participants to report on whether or not they are "currently alone" (Oorschot et al., 2012; Schneider et al., 2017). This method differs from the interaction code that the EAR yields in that it accounts for when subjects are in the company of others but not necessarily speaking.

Thus, previous ESM studies have assessed daily social interactions using slightly different definitions of the construct; both existing ESM and EAR approaches have strengths and weaknesses. By providing a sample of audio data to be coded, the EAR represents an objective assessment of frequency of social interactions as defined by conversations but may miss some social behavior in which there is no speaking or social behavior that occurred in between recorded intervals. In this way, the discrepancy between our results and what has previously been seen in the literature may be explained by differences in ecological assessment methods.

In line with our expectations, clinical status did predict frequency of social engagement as coded by the EAR with the schizophrenia group exhibiting significantly less social engagement. Whereas control participants exhibited social engagement in nearly a third of their files, those with schizophrenia demonstrated social engagement in less than one-fifth of files. This suggests that, although those in the schizophrenia group interacted as much as the control participants in our sample, the quality of those social interactions was not comparable. This is the first study to examine such qualitative aspects of social experiences; therefore, these results are innovative and crucial for understanding social deficits in those with schizophrenia. People with schizophrenia may interact with others as the same rate as healthy controls, but spend less time engaging in substantive, more personal conversations with others (e.g. sharing thoughts, opinions, or emotional information). This may have important clinical implications.

Previous research with the EAR has found less small talk and more substantive conversations is associated with greater happiness and well-being (Mehl et al., 2010). It has been theorized that these deeper conversations, rather than mere small talk, lead to stronger social connections and therefore greater well-being (Rabin, 2010). In line with this, Fiorillo & Sabatini (2011) found that quality of social relationships predicted individual's health above and beyond

quantity of interactions. Yet, when compared to healthy people, those with schizophrenia have fewer friends, narrower social networks, and diminished social support (Goldberg et al., 2003; Carpenter, 2019) Thus, the lack of engagement during social interactions found in the schizophrenia group may suggest that diminished engagement is driving these differences in quality and quantity of social relationships. People with schizophrenia desire social affiliation (Blanchard et al., 2015) and identify improving social functioning as a primary therapeutic goal (Shumway et al., 2003). Distinguishing between quantity and quality of social interactions in the treatment of schizophrenia could have important implications for social skills training programs. Results suggest that the development of treatment approaches that specifically foster social engagement, rather than mere social interaction, would be beneficial in order to increase social affiliation and quality of relationships.

Our prediction that group (schizophrenia versus control) would predict overall affect was only partially supported: group did not significantly predict positive affect ratings but did predict negative affect. Thus, compared to healthy controls, the schizophrenia group reported similar levels of positive affect but more negative affect. The affective experiences of those with schizophrenia has been a topic of psychiatric research for a long time, and mixed findings abound regarding the emotional experiences of this population (Cohen & Minor, 2010). Although people with schizophrenia often exhibit severe anhedonia and express less emotion, they have the same capacity to experience both positive and negative emotions as healthy people (Kring & Moran, 2008; Cohen and Minor, 2010). However, a meta-analysis of ESM studies suggests that, when reporting on their day-to-day experiences, those with schizophrenia consistently report more negative and less positive affect than healthy controls (Cho et al., 2017). Thus, our results are somewhat aligned with this ESM literature as the schizophrenia group reported significantly more negative affect compared with controls; however, we were unable to detect group differences in positive affect.

Social context did not moderate the relationship between group and affect. That is, whether or not participants were in a social interaction did not influence group differences in either positive or negative affect. For positive affect, these results are understandable given group differences in this domain were not found. Both groups reported similar positive affect overall, and these results did not change based on whether or not the participant was in a social interaction. This is in line with previous findings that those with and without schizophrenia do

not differ in positive affect during social experiences (Edwards et al., 2018; Kasanova et al., 2018; Oorschot et al., 2013). For negative affect, group differences were found, but participants' social context when reporting affect did not influence this difference. In other words, people with schizophrenia consistently reported significantly more negative affect than controls regardless of whether or not they were in a social interaction. As mentioned above, our study was the first to directly examine group differences in affect as a function of social context. Yet, Oorschot et al. (2012) conducted related research on affect in and out of social interactions using ESM. This study found that both people with schizophrenia and healthy controls reported significantly less positive affect when alone compared to with others. Moreover, those with schizophrenia reported more negative affect when alone compared to healthy controls (Oorschot et al., 2012). Our results do not align with those of the previous study as social context did not influence affect in either group. More research is needed to clarify if and how social context impacts positive and negative affect in those with and without schizophrenia.

Our exploratory aims investigated the convergent validity of the GFS-S and social functioning scores as coded by the EAR. Correlations between this lab-based measure and ESM of social functioning were significant for the schizophrenia group but not the control group. This suggests that the GFS-S exhibits a "ceiling effect" when measuring social functioning in healthy people. This result is to be expected as the GFS-S was created for the assessment of people with schizophrenia and validated using a patient population (Cornblatt et al., 2007). Thus, results of our exploratory analyses suggest that the GFS-S had high convergent validity with EAR social codes for the schizophrenia group and therefore correctly captures daily social functioning. However, since the GFS-S scores were not correlated with EAR codes in the control group, it seems that this assessment lacks sensitivity to detect minor differences in social behaviors, especially for those at the higher end of social functioning. This suggests that using ESM methods like the EAR to measure social functioning has added benefit over traditional interview-based assessments. This could become clinically relevant for the treatment of those with schizophrenia. Although interview-based assessments are useful for understanding broad aspects of one's social functioning (e.g. one's satisfaction with relationships, personal beliefs about one's social competence), ESM may be more suitable for understanding more minuscule details about social functioning such as how people interact, who they interact with, and the extent or quality of these interactions on the day-to-day. In a clinical setting, ESM can be used to harness

these aspects of patients' social lives and address them in therapy. More studies comparing ESM and tradition lab-based assessments of social functioning are needed. Eventually, research should examine both the incremental validity and clinical utility of ESM of social functioning. As technology advances, this work will determine if ESM proves useful to supplement, or even replace, traditional measures of social functioning.

We acknowledge this study has some key limitations. First, although the EAR offers an innovative method for collecting objective data, there are some complications and limitations that come with this methodology. For instance, it is possible that participants may exhibit the Hawthorne effect; that is, they may act differently in social situations because they know they are wearing a recording device. Although this type of reactivity is a concern, previous research suggests that participants habituate within a few hours of wearing the EAR (Mehl & Holleran, 2007). We also alleviated this issue by ensuring participants were unaware of exactly when they are being recorded. Moreover, participants were told they would have the opportunity to listen to and delete sensitive recordings before our team has access to them.

Another limitation in our study design using the EAR is that the final number of audio files we analyzed from each participant varied. Thus, we used percentage of total files to calculate frequency scores for our variables (i.e., frequency of social interactions, frequency of social engagement). Differences in number of files were due to factors such as differences in participants' waking hours, how much they wore the EAR, and number of recording/audio problems. Although some of these factors are unrelated to participants (i.e., audio problems), others may represent important variance in our participants. For instance, the control group tended to wear the EAR less than the schizophrenia group, and this could be due to significant group differences (e.g., control participants may be more likely to have jobs where they cannot wear a recording device). Moreover, differences in waking hours between participants is potentially relevant to social functioning; those who sleep more during the day may intentionally miss out on social interactions. Thus, our analyses did not account for this type of variance.

Lastly, we acknowledge a limitation in the way we measured affect using the Social Journal. The Social Journal relies heavily on subject compliance. We trust that participants fill out the Social Journal throughout their day, as instructed. However, participants may forget and complete their affect ratings at a later time point. Thus, some of the data on positive and negative affect may not represent true "in-the-moment" assessments. Although this is a significant

limitation of our design, we assert that our assessment is still more accurate than if participants waited until the next research session to report on their affect in and out of social situations. Research suggests people with schizophrenia become progressively less accurate in their report as the information being assessed becomes more historical (Bellack et al., 2007). In other words, retrospective bias becomes more of an issue as time increases between the event and the assessment. Thus, the Social Journal, although imperfect, is still a more valid assessment of affect than traditional laboratory-based self-report measures. Because of the limited nature of the Social Journal, our lab is beginning to implement ESM smartphone technology to compliment the EAR. This improved method will ensure assessments are completed at the appropriate time points.

This project tested novel questions regarding daily social functioning in people with schizophrenia; results yield important implications for future work. As mentioned, this is the first study to examine social functioning in schizophrenia using passive audio data. Additionally, we investigated differences in social engagement, or quality of social interactions, rather than mere quantity. Thus, future studies are needed to further implement these methods. For example, Kasanova et al. (2018) examined affective experiences during structured versus unstructured social activities. Results found that people with schizophrenia matched controls on frequency of unstructured social activities, but patients spent significantly less time in structured social activities. Moreover, patients reported the same affective experiences in both social contexts. Our research design using the EAR could extend Kasanova et al.'s (2018) findings by determining how social engagement maps onto both structured and unstructured activity in the lives of those with schizophrenia. Social engagement, rather than frequency of social activities, may be more related to differences in affective experiences. Relatedly, the EAR may also be applied to research examining differences in who people interact with. Granholm et al. (2008) examined how much time people spend with familiar versus unfamiliar people and found the schizophrenia group spent more time with family or friends (36%) compared to coworkers (5%) and strangers (5%). Future work may examine social engagement as a function who the person is interacting with and how that may differently affect those with schizophrenia compared to healthy controls. Overall, incorporating the EAR into future studies will help us better understand the real-life social experiences of those with schizophrenia. Examining social functioning at this more granular level is a promising avenue for ESM research in schizophrenia.

APPENDIX A. EAR CODING SYSTEM

CODE	Definition	0	1	2	3
Interaction	Social Interaction	No	Yes		
Engagement	Social Engagement	No Subject Speech	Small talk/practical conversation from subject	Substantive conversation from subject	Personal/ emotional disclosure from subject

Interaction Code Definitions

0 Definition	No interaction with anyone on file
1 Definition	Subject speaks to another person in file (baby or pet do not count here)

Engagement Code Definitions

0 Definition	No interaction with anyone on file
1 Definition	Non-instrumental conversations where little to no information is exchanged (e.g., "How's the weather")
2 Definition	Exchanges of thoughts, information, and ideas about non-emotional topics (e.g., "What I found interesting about the book was…")
3 Definition	Conversations where the subject shares personal feelings or emotions (e.g., "I feel really upset today")

APPENDIX B. SOCIAL JOURNAL

Social Journal

Please tell us about your MAJOR activities over the next two days using the time grids below. Please mark periods where you were and were not able to wear the iEAR and rate how positive, negative, and challenged you felt and your level of enjoyment during the activity. Also, we would like you to rate your level of social interaction at each timepoint. See the scales on this page for rating guidelines.

To rate **Positive Affect**, use the following scale:

1	2	3	4	5	6	7
No positive feeling	Mild positive feeling	Below Average positive feeling	Average positive feeling	Above Average positive feeling	Very positive feeling	Extremely positive feeling

To rate **Negative Affect**, use the following scale:

1	2	3	4	5	6	7
No negative feeling	Mild negative feeling	Below Average negative feeling	Average negative feeling	Above Average negative feeling	Very negative feeling	Extremely negative feeling

To rate **how cognitively challenged you felt**, use the following scale:

1	2	3	4	5	6	7
Not challenged	Mildly challenged	Below Average challenges	Average challenges	Above Average challenges	Very challenged	Extremely challenged

To rate **how much enjoyment you felt**, use the following scale:

1	2	3	4	5	6	7
No enjoyment	Mild enjoyment	Below Average enjoyment	Average enjoyment	Above Average enjoyment	Very Much enjoyment	Extreme enjoyment

To rate your **level of interaction with other people**, use the following scale:

1	2	3
None. I am alone.	I am with others but NOT interacting (e.g. talking or doing something) with them.	I am with others AND interacting with them.

Subject #:	Day One	iEAR		Affect/Challenges/Enjoyment/Interactions				
Time	What are you doing?	Yes	No	Pos.	Neg.	Chall.	Enjoy.	Interact.
06:00 am								
07:00 am								
08:00 am								
09:00 am								
10:00 am								
11:00 am								
12:00 am								
01:00 pm								
02:00 pm								
03:00 pm								
04:00 pm								
05:00 pm								
06:00 pm								
07:00 pm								
08:00 pm								
09:00 pm								
10:00 pm								
11:00 pm								
12:00 am								

Subject #:	Day Two	iEAR		Affect/Challenges/Enjoyment/Interactions				
Time	What are you doing?	Yes	No	Pos.	Neg.	Chall.	Enjoy.	Interact.
06:00 am								
07:00 am								
08:00 am								
09:00 am								
10:00 am								
11:00 am								
12:00 am								
01:00 pm								
02:00 pm								
03:00 pm								
04:00 pm								
05:00 pm								
06:00 pm								
07:00 pm								
08:00 pm								
09:00 pm								
10:00 pm								
11:00 pm								
12:00 am								

APPENDIX C. GLOBAL FUNCTIONING SCALE: SOCIAL

Initial GLOBAL FUNCTIONING: SOCIAL SCALE (GF: Social)

CURRENT _____	LOWEST PAST YEAR _____	HIGHEST PAST YEAR _____

☐ Check here if this is a retrospective rating

Please rate the patient's most impaired level of social functioning for the specified time period by selecting the lowest level which describes his/her functioning within that time frame. For current, rate most impaired level of functioning in the **past month**. Rate actual functioning regardless of etiology of social problems.

Note: The emphasis is on social contact/interactions with people other than family members, unless these are the only interpersonal contacts a person has (e.g., the lower end of the scale). Also note that ratings of intimate relationships are secondary to the rating of primary friendships and should take into account the age of the individual. For example, older individuals may be expected to have intimate relationships involving steady dating, cohabitation, or marriage whereas younger individuals may be expected to have only romantic interests (i.e., flirtations or crushes) or close friendships.

SUPERIOR SOCIAL/INTERPERSONAL FUNCTIONING	
Criteria: **10**	**Superior functioning in a wide range of social and interpersonal activities.** Frequently seeks out others and has multiple satisfying interpersonal relationships, including multiple close and casual friends. Is sought out by others because of his or her many positive qualities. Age appropriate involvement in intimate relationships.
ABOVE AVERAGE SOCIAL/INTERPERSONAL FUNCTIONING	
Criteria: **9**	**Good functioning in all social areas, and interpersonally effective.** Interested and involved in a wide range of social and interpersonal activities, including both close and casual friends. Age appropriate involvement in intimate relationships. No more than everyday interpersonal problems or concerns (e.g., an occasional argument with spouse, girlfriend/boyfriend, friends, co-workers, or classmates). Able to resolve such conflicts appropriately.
GOOD SOCIAL/INTERPERSONAL FUNCTIONING	
Criteria: **8**	**Some transient mild impairment in social functioning.** Mild social impairment is present, but transient and expectable reactions to psychosocial stressors (e.g., after minor arguments with spouse, girlfriend/boyfriend, friends, co-workers, or classmates). Has some meaningful interpersonal relationships with peers (casual and close friends), and/or age appropriate intimate relationships. Infrequent interpersonal conflict with peers.
MILD PROBLEMS IN SOCIAL/INTERPERSONAL FUNCTIONING	
Criteria: **7**	**Some persistent mild difficulty in social functioning.** Mild impairment present that is NOT just expectable reaction to psychosocial stressors (e.g., mild conflicts with peers, co-workers or classmates; difficulty resolving conflicts appropriately). Has some meaningful interpersonal relationships with peers (casual and/or close friends). Some difficulty developing or maintaining age appropriate intimate relationships (e.g., multiple short-term relationships).
MODERATE IMPAIRMENT IN SOCIAL/INTERPERSONAL FUNCTIONING	
Criteria: **6**	**Moderate impairment in social functioning.** Moderate impairment present (e.g., few close friends; significant but intermittent conflicts with peers, co-workers or classmates). Moderate difficulty developing age appropriate intimate relationships (e.g., infrequent dating). Occasionally seeks out others, but will respond if invited by others to participate in an activity.

SERIOUS IMPAIRMENT IN SOCIAL/INTERPERSONAL FUNCTIONING	
Criteria:	**Serious impairment in social functioning.**
5	No close friends or intimate partner, but has some casual social contacts (e.g., acquaintances, school/work friends only). Rarely seeks out others. Occasional combative or verbally argumentative behavior with peers. Beginning to withdraw from family members (e.g., doesn't initiate conversation with family, but will respond if addressed).

MAJOR IMPAIRMENT IN SOCIAL AND INTERPERSONAL FUNCTIONING	
Criteria:	**Major impairment in social functioning.**
4	Serious impairment in relationships with friends or peers (e.g., very few or no friends, frequent conflicts with friends, or frequently avoids friends). Frequent combative or verbally argumentative behavior with peers. Infrequent contact with family members (e.g., sometimes does not respond to family or avoids family members).

MARGINAL ABILITY TO FUNCTION SOCIALLY	
Criteria:	**Marginal ability to function socially or maintain interpersonal relationships.**
3	Frequently alone and socially isolated. Serious impairment in relationships with all peers, including acquaintances. Few interactions with family members (e.g., often alone in room). Serious impairment in communication with others (e.g., avoids participating in most social activities).

INABILITY TO FUNCTION SOCIALLY	
Criteria:	**Unable to function socially or to maintain any interpersonal relationships.**
2	Typically alone and socially isolated. Rarely leaves home. Rarely answers the phone or the door. Rarely participates in interactions with others at home or in other settings (e.g., work, school).

EXTREME SOCIAL ISOLATION	
Criteria:	**Extreme social isolation.**
1	No social or family member contact at all. Doesn't leave home. Refuses to answer the phone or door.

NOTE: This scale has been partially derived from the Social and Occupational Functioning Assessment Scale (SOFAS) from DSM-IV and the GAF as it appears in the SOPS. Item content has been changed to focus specifically on social and interpersonal functioning.

Citation: Auther, A.M., Smith, C.W. & Cornblatt, B.A. (2006). *Global Functioning: Social Scale (GF: Social).* Glen Oaks, NY: Zucker Hillside Hospital.

***Confidence SFS:* Please rate your confidence in the accuracy of this rating:**

Not at all Somewhat Good Excellent

If confidence is low, please note reasons below:

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