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Social functioning in schizotypy: How affect influences social behavior in daily life

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Abstract

Objective: Social deficits are already exhibited by people at risk for schizophrenia-spectrum disorders. Technological advances have made passive detection of social deficits possible at granular levels.

Method: In this real-world study, we tested if schizotypy status (high/low) predicted two types of social behavior: (1) being around other people; and (2) actively socializing with others. We also examined if schizotypy influences relationships between social behavior and affect using subjective and objective instruments.

Results: Our findings revealed that socializing with others was significantly decreased in the high schizotypy group. Positive affect increased in social situations and predicted later social behavior in those low, but not high, in schizotypy.

Conclusion: Decreased social behavior in schizotypy may be explained, in part, by these individuals being less incentivized than their peers to pursue social situations. Future studies should test this explanation in larger samples exhibiting elevated positive, negative, and disorganized schizotypy traits.

Keywords

affect; ecological momentary assessment; experience sampling; schizotypy; social functioning

1 | INTRODUCTION

Early adulthood is often defined by our social experiences: forming new friendships, navigating the dating world, and maintaining family connections are key landmarks of this period. For many people, engaging in social interactions is difficult. Social deficits are a core diagnostic criterion for schizophrenia and impact people across the schizophrenia-spectrum

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(Abu-Akel, Baxendale, Mohr, & Sullivan, 2018; Minor, Marggraf, Davis, Mehdiyoun, & Breier, 2016). This includes those with schizotypy, a personality framework thought to reflect putative genetic liability for psychotic and other psychiatric disorders (Lenzenweger, 2006; Meehl, 1990). Past studies, mostly occurring in the laboratory with young adults (Dinzeo, Serna, Pujji, & Sledjeski, 2018; Moore, Chan, Huang, & Martin, 2019), show that social functioning deficits are independent of social cognitive and neurocognitive functioning (Aghvinian & Sergi, 2018; McCleery et al., 2012).

Over the past decade, schizotypy researchers have moved out of the lab to capture social deficits in daily life (Chun, Barrantes-Vidal, Sheinbaum, & Kwapil, 2017; Minor, Davis, Marggraf, Luther, & Robbins, 2018). A recent study from our team observed that those high in schizotypy generated approximately 40% fewer words in daily life compared to those low in schizotypy—resulting in about an hour less time spent interacting per day (Minor et al., 2018). Kwapil, Brown, Silvia, Myin-Germeys, and Barrantes-Vidal (2012) found that those high in negative schizotypy reported decreased social contact compared to peers, whereas those with positive schizotypy endorsed more social ambivalence. In the current study, we tested if schizotypy is linked with two objectively measured social behaviors: (1) being around others (i.e., in the presence of others with or without interacting); and (2) socializing (i.e., actively engaging in sustained interaction). Our goal was to determine if schizotypy predicted behaviors requiring active social engagement at a similar rate to behaviors that could include passive involvement.

A potential contributor to social deficits in schizotypy involves the reduced positive and greater negative affect observed in response to social stimuli (Statucka & Walder, 2017; Wastler & Lenzenweger, 2018). Lab-based (Kemp, Gross, Barrantes-Vidal, & Kwapil, 2018; Moore et al., 2019) and real-world studies (Chun et al., 2017; Minor et al., 2018) have generally shown that schizotypy is linked with less positive and more negative affect. This may hold important implications for social deficits in schizotypy: when less pleasure or more stress is experienced, there is likely reduced incentive to engage in social activities. Research in healthy populations supports this, as affect has shown strong relationships with social functioning (Sanmartin et al., 2018; Watson, Clark, McIntyre, & Hamaker, 1992). Positive affect, in particular, is associated with larger social networks and more time spent in social activities in both healthy adult and schizophrenia samples (Horan, Blanchard, Clark, & Green, 2008; Watson et al., 1992).

The nature of the relationship between social deficits and affect is a central unanswered question in schizotypy. It is unclear if: (a) social situations contribute to reduced positive and greater negative affect; (b) reduced positive and greater negative affect contributes to a lower likelihood of social behavior; or (c) both occur and have compounding effects. Each of these potential explanations would lead to a different conclusion about the relationship between social deficits and affect in schizotypy. An advantage of real-world approaches is that relationships between constructs can be tested in multiple ways. In this study, we tested if schizotypy and social behavior intersected to predict affect at a concurrent time point. Additionally, we assessed if schizotypy and affect at one time point converged to predict social behavior later in the day.

1.1 | Study objectives and hypotheses

This study had two primary aims. First, we tested the role of schizotypy in social behavior. We hypothesized that schizotypy status (high vs. low) would predict fewer social behaviors (i.e., being around others, socializing). Second, we examined relationships between social behavior and positive and negative affect. To accomplish this, affect and social behavior both served as outcome variables in subsequent analyses. Using affect as the outcome, we expected schizotypy to moderate relationships between social behavior and concurrent affect (e.g., those high in schizotypy report more negative affect in social situations). Using social behavior as the outcome, we hypothesized that schizotypy would moderate relationships between affect at one time point and social behavior at the next time point (e.g., those high in schizotypy exhibit less social behavior after reporting low positive affect). This is only the second study to objectively measure real-world social behavior in schizotypy (Minor et al., 2018); it goes beyond our initial study by testing the relationship between affect and social functioning in multiple ways. Given that deficits in schizotypy often reflect small effects, compared to the large effects observed in schizophrenia, this granular approach of assessing constructs like social functioning is needed and allows for a nuanced examination of how schizotypy traits are related to social behavior.

2 | METHODS

2.1 | Participants

Participation occurred in two phases. First, undergraduate students completed an online schizotypy measure for course credit (n = 1,271). Four items from the Chapman Infrequency Scale (Chapman & Chapman, 1983) were embedded as a validity check (n excluded = 154, 12%). Those scoring ≥95th percentile on positive, negative, and/or disorganized subscales were considered high in schizotypy and those scoring <50th percentile on all three subscales were classified as low in schizotypy. Next, selected participants completed the ecological component of the study (n completed = 70). Exclusions were made if participants: (a) reported a previous psychotic episode (n excluded = 1, 1%); or (b) had no audio files from daily life (n excluded = 5, 7%). In total, 64 people completed all procedures (high schizotypy n = 34, low schizotypy n = 30). Within the high schizotypy group, eight people had elevated positive traits, 10 had elevated negative traits, nine had elevated disorganized traits, and seven were elevated on multiple scales. A subset of this sample had data previously reported (Minor et al., 2018). All procedures were approved by local institutional review boards.

2.2 | Materials

2.2.1 | Schizotypy scale—The Schizotypal Personality Questionnaire (SPQ; Raine, 1991) was administered online to measure schizotypy traits. It consists of 74 questions across three factors (positive, negative, and disorganization; Raine et al., 1994). All questions were administered using a Likert-style format ranging from 1 (*strongly disagree*) to 5 (*strongly agree*); this approach has shown high convergence with forced-choice designs (Wuthrich & Bates, 2005). One negative schizotypy subscale (Excessive Social Anxiety) was excluded based on our goal of capturing traits that are consistent with subclinical negative symptoms (Cohen & Davis, 2009).

2.2.2 | Social behaviors—The Electronically Activated Recorder (EAR; Mehl, Pennebaker, Crow, Dabbs, & Price, 2001; Mehl, 2017) is a computer application that was used to passively capture real-world social behaviors via audio recordings. While awake, participants wore an iPod Touch with the EAR for 2 consecutive days. Two days was selected based on recommendations from the cocreator of the EAR (Mehl, Robbins, & Deters, 2012) and findings that 2 days exhibited good temporal stability compared to a 4 week recording period (Mehl & Robbins, 2012; Mehl et al., 2001). Five-minute audio recordings were collected at 90-min intervals from 6:00 a.m. to midnight. Devices were locked and participants were not aware of recording times. Devices had a sign to alert third parties that recordings may occur. Participants approved their audio files and were able to delete files they did not wish to share before analysis by the research team (see Minor et al., 2018).

Using the Social Environmental Coding of Sound Inventory (SECSI; Mehl et al., 2012; Robbins, Mehl, Holleran, & Kasle, 2011), we coded two social behaviors: (1) being around others; and (2) socializing. Being around others was coded to determine if a participant was in the presence of other people (0 = *no* and 1 = *yes*). A yes rating was applied if at least one other voice was heard at any point in the audio file (regardless of whether they were talking to the participant) and the source of the voice(s) was near the participant (e.g., a *yes* rating would not be applied if voices were only from television, internet, or radio). Socializing focused on whether the participant was actively engaged in social activity (0 = *no* and 1 = *yes*). A *yes* rating was given when the participant was in a social situation (e.g., conversation, restaurant, and group outing) with at least one or more people and was an active participant in the audio file (e.g., talking with others). Examples of socializing from our files included: teaming with a group of peers at trivia night; attending a local baseball game with a family member; and commenting on a popular television show while watching it with a friend. Codes of "1" (*yes*) were applied if the participant was around other people or socializing at any point during a 5-min file.

2.2.3 | Positive and negative affect—Participants completed a take-home social journal while wearing the EAR. As part of this journal, they recorded positive and negative affect for each hour the EAR was worn. Participants were instructed to keep the journal near them and to fill it out whenever possible throughout the day. They were encouraged to, at minimum, complete the journal at the end of the day by filling any remaining gaps. Affect was rated on a seven-point scale (1 = *No positive/negative affect*, 7 = *Extreme positive/negative affect*). Social journals have shown good compatibility with EAR assessments in past studies (Mehl & Pennebaker, 2003; Robbins, López, Weihs, & Mehl, 2014).

2.3 | Data analysis

Analyses occurred in four parts. First, those high and low in schizotypy were compared on demographic and general EAR data using chi-square and independent *t* tests. Second, two multilevel binary logistic regression models were run to determine if schizotypy status (high and low) predicted being around others (Model 1) or socializing (Model 2). Multilevel binary logistic regression models were chosen based on their ability to analyze dichotomous outcome variables (e.g., socializing is coded as 0 or 1) across several time points (see

Sommet & Morselli, 2017). Schizotypy status (high and low) was entered as the Level 1 predictor in each model.

Third, two multilevel regression models were created to determine if affect differed across groups based on the presence/absence of social behavior. In each model, the interaction between schizotypy status and social behavior on affect was tested (Model 1: positive affect and Model 2: negative affect). For both models, affect was the outcome variable; group (Level 1) and socializing (Level 2) were entered as predictors. Finally, two time-lagged, multilevel binary logistic regression models were conducted to assess whether affect (Model 1: positive and Model 2: negative) and schizotypy status at one time interacted to predict social behavior at a subsequent time. Socializing was the outcome variable in both models; group (Level 1) and affect (Level 2) were predictors. All multilevel models were run using the Mixed Model function in SPSS. For all multilevel analyses, participant (Level 1) and time point (Level 2) served as identifiers.

Analyses for this study had adequate power to detect medium to large effects. To test hypotheses using social behaviors as outcome variables (see Sections 3.2 and 3.4), it was estimated that sample sizes of 34 and 21 per group were adequately powered to detect medium and large effects, respectively, using standards outlined by Chen, Cohen, and Chen (2010). To test hypotheses with affect as an outcome variable (see Section 3.3), it was estimated that sample sizes of 68 and 31 per group had adequate power to detect medium and large effects (G*Power, 2020).

3 | RESULTS

3.1 | Demographic and audio data

High and low schizotypy participants did not significantly differ in age, sex, race, or ethnicity. As expected, those high in schizotypy displayed greater positive, negative, and disorganized traits. No significant differences were observed regarding EAR audio data (see Table 1).

3.2 | Social behavior as predicted by high schizotypy status

Multilevel binary logistic regression models tested if schizotypy status predicted social behaviors. Socializing was predicted by status, odds ratio (OR) = 0.55, 95% confidence interval (CI) = [0.29, 1.03], $p = .031$, with those high in schizotypy socializing less (10% of their day) than those low in schizotypy (17%). This means that for each unit increase in status (from low to high schizotypy), the odds of socializing at a given time point is lower by 45.4%. Being around others was not predicted by schizotypy status, OR = 1.334, 95% CI = [0.89, 2.01], $p = .082$. Both groups were around others over half of the time (high schizotypy: 63%; low schizotypy: 57%). Findings supported our hypothesis that schizotypy status would predict socializing. Our expectation that status would predict being around others was not supported.

3.3 | Affect across social and nonsocial situations

The role of schizotypy status and socializing on affect was tested using multilevel models. A group by behavior interaction was observed for positive affect, $\gamma = -0.48$, SE = 0.27, $p = .043$, but not negative affect, $\gamma = 0.14$, SE = 0.23, $p = .275$. Positive affect improved in low schizotypy participants when socializing occurred but remained stable in those high in schizotypy (Figure 1). The reverse pattern was observed for negative affect but it did not reach the level of significance. Main effects were observed for group, $\gamma = 0.62$, SE = 0.37, $p = .048$, but not socializing, $\gamma = -0.18$, SE = 0.20, $p = .191$, in the positive affect model. Neither group, $\gamma = -0.53$, SE = 0.32, $p = .053$, or socializing, $\gamma = 0.25$, SE = 0.17, $p = .071$, displayed significant main effects in the negative affect model. Our hypothesis that group by behavior interactions would occur for affect were partially supported.

3.4 | Affect as a predictor of subsequent social behavior

Time-lagged, multilevel binary logistic regression models tested the role of schizotypy status and affect on socializing at the next time point. A group by condition interaction was observed for positive affect as a predictor of socializing, OR = 1.62, 95% CI = [1.12, 2.33], $p = .010$, but not for negative affect, OR = 0.94, 95% CI = [0.61, 1.45], $p = .774$. Those low in schizotypy were more likely to later socialize when positive affect was greater, whereas variations in positive affect had little impact on whether those high in schizotypy socialized (Figure 2). In the positive affect model, main effects were found for positive affect, OR = 0.77, 95% CI = [0.64, 0.93], $p = .006$, but not schizotypy status, OR = 1.10, 95% CI = [0.54, 2.24], $p = .797$. Neither status, OR = 1.25, 95% CI = [0.61, 2.54], $p = .543$, or negative affect, OR = 1.23, 95% CI = [0.98, 1.53], $p = .066$, displayed significant main effects in the negative affect model. Our hypothesis that group by affect interactions would occur for socializing were partially supported.

4 | DISCUSSION

In this real-world study, we tested whether schizotypy: (a) predicted objectively measured social behaviors; and (b) impacted the relationship between social functioning and affect. Three key observations occurred. First, schizotypy status predicted socializing, but not being around others, in daily life. Across time points, those high in schizotypy were only half as likely to socialize compared to the low schizotypy group. Second, positive affect was influenced by schizotypy status when socializing. Those low in schizotypy exhibited increased positive affect when socializing, whereas those high in schizotypy remained stable across social and nonsocial contexts. Third, schizotypy status moderated positive affect's impact on socializing later in the day. Greater positive affect predicted a higher likelihood of socializing at a subsequent time point in the low, but not high, schizotypy group.

This is only the second schizotypy study to implement the EAR as an objective assessment. Our previous study showed that schizotypy status predicted the number of words spoken in social situations (Minor et al., 2018). The current study provides a more comprehensive picture of social functioning by separating social behaviors into multiple categories. We observed that high and low schizotypy groups did not differ in time spent around others; in fact, those high in schizotypy were around others at a slightly higher rate. Despite more

opportunities, however, those high in schizotypy were significantly less likely to engage in active socializing. This suggests that more passive types of social behavior may not be atypical in schizotypy but that differences emerge once those high in schizotypy are required to go beyond fundamental social behaviors and meaningfully connect with peers.

Positive affect may provide one reason why those high in schizotypy are less likely than their peers to socialize. Whereas the low schizotypy group showed increased positive affect when socializing, those high in schizotypy displayed positive affect that was stable across social and nonsocial situations. Without incentive to pursue social situations, those high in schizotypy may be less willing to extend the effort needed for active socializing. This is consistent with findings in healthy and schizophrenia populations, which show that affect incentivizes social behavior (Catalano, Heerey, & Gold, 2018; Strauss & Gold, 2012).

An example of positive affect's impact on socializing is the significant relationship between these constructs in the low, but not high, schizotypy group. Based on observed associations in past schizophrenia (Granholm, Ben-Zeev, Fulford, & Swendsen, 2013; Grove et al., 2016) and schizotypy studies (Kwapil et al., 2012), the lack of a relationship between positive and negative affect with social behavior in the high schizotypy group was somewhat surprising. One explanation from the schizophrenia literature is that those high in schizotypy may have learned from past experiences that social activities are unrewarding (Strauss & Gold, 2012). There is evidence for the accuracy of this belief given that lower positive affect was observed in social situations for the high schizotypy group. A second explanation ties into the finding that lower positive affect is related to smaller social networks (Horan et al., 2008; Watson et al., 1992). Although groups did not differ in how much they were around others, having a smaller social network would lead to fewer opportunities to pursue more socially engaging activities regardless of preference for individual versus social activities. Future work should determine if those high in schizotypy have smaller networks and receive less incentive when socializing.

The real-world objective assessment and the separation of social behaviors into multiple components represent important study strengths. However, limitations also exist. One is the small sample size, which affected our goal of testing how schizotypy traits influenced social behavior. Although we examined schizotypy status, future work would benefit from recruiting larger samples demonstrating elevated positive, negative, and disorganized schizotypy to determine the relationship between specific traits and social behavior. A second limitation is that mobile technology was not implemented for affective assessments. Despite instructions to complete social journals throughout the day, a meaningful disadvantage is that there are no assurances that ratings were conducted "in-the-moment." Thus, the benefit of assessing affect in daily life may have been lessened for some participants. Future studies should implement widely used mobile devices to assess affect and compare affect ratings from these devices to social journals. A third issue involves the dichotomous coding scheme used here. Coding the time participants spent around others and socialized, as opposed to whether they occurred or not, may provide further information on the social behaviors measured here. Finally, using an undergraduate sample is common (Le et al., 2019; Minor, Luther, Auster, Marggraf, & Cohen, 2015) but may also raise generalizability concerns (Zhang & Brenner, 2017).

5 | CONCLUSION

Those high in schizotypy were less likely to socialize in daily life. When socializing, the low schizotypy group showed increased positive affect whereas positive affect in the high schizotypy group remained stable across social and nonsocial situations. Positive affect and schizotypy status also interacted to predict whether socializing would occur at subsequent time points. Our overall findings suggest that those high in schizotypy do not exhibit deficits in fundamental social behaviors but that deficits occur when active participation is assessed. Future studies should examine objective real-world behaviors in larger samples exhibiting elevated positive, negative, and disorganized traits. The utility of measuring objective behaviors and affect (see Cho et al., 2017) at other points on the schizophrenia-spectrum (e.g., clinical high risk, first episode, chronic schizophrenia) is also warranted.

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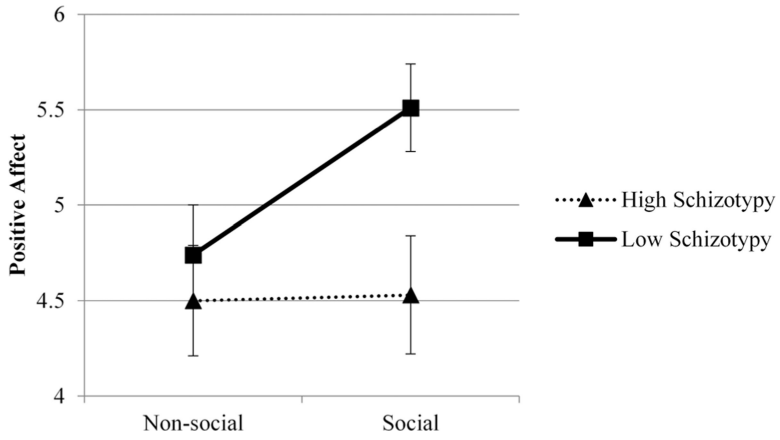

FIGURE 1.

Change in positive affect in high (n = 34) and low schizotypy (n = 30) across social and nonsocial situations

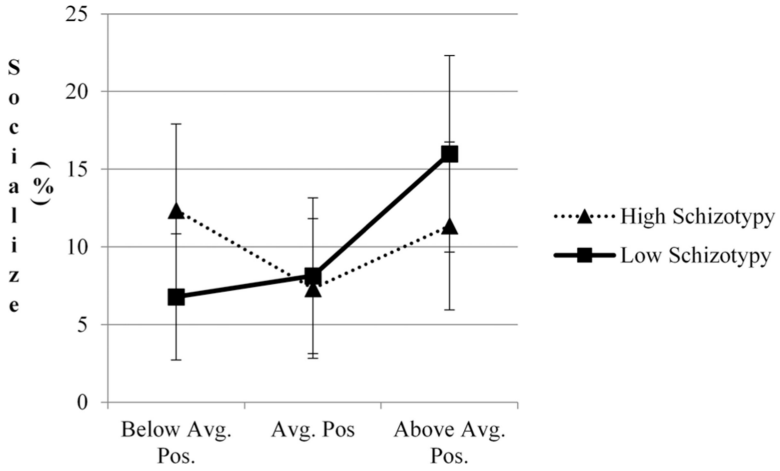

FIGURE 2.

Positive affect for people with high (n = 34) and low schizotypy (n = 30) and their frequency of socialization at the following time point

TABLE 1

Demographic and audio data in high and low schizotypy groups

	High schizotypy (*n* = 34)	Low schizotypy (*n* = 30)		
Demographic data	**Mean (*SD*)**	**Mean (*SD*)**	**Test statistic**	***p* value**
Age	19.97 (2.19)	20.03 (1.90)	0.12[a]	.903
Sex: % Female	64.7	56.7	0.43[b]	.511
Race: % Caucasian	70.6	83.3	1.44[b]	.230
Ethnicity: % Non-Hispanic	91.2	83.3	0.90[b]	.344
Schizotypy traits (*z*-scores)				
Positive	1.14 (0.89)	−0.44 (0.50)	8.88[a]	<.001
Negative	1.45 (0.85)	−0.52 (0.64)	10.27[a]	<.001
Disorganized	1.34 (0.84)	−0.48 (0.43)	11.08[a]	<.001
EAR data	**Total (Freq.)**	**Total (Freq.)**		
Total audio files	650	632	1.46[a]	.146
Waking audio files	460 (70.70%)	451 (71.36%)	0.07[a]	.944
Files not analyzed				
Subject sleeping	126 (18.69%)	109 (17.25%)	0.55[a]	.583
Subject not wearing EAR	31 (4.60%)	33 (5.22%)	0.16[a]	.875
Audio problems	57 (8.46%)	39 (6.17%)	0.80[a]	.428
Day of the week				
Weekend waking files (%)	94 (20.43%)	96 (21.28%)	0.10[b]	.752

Abbreviations: EAR, Electronically Activated Recorder; Freq., frequency; *n*, number.

[a]Test statistic is a *t* value.

[b]Test statistic is a χ^2 value.