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Negative symptoms and the formation of social affiliative bonds in schizophrenia

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ABSTRACT

Negative symptoms in schizophrenia are characterized by deficits in normative experiences and expression of emotion, and they are associated with poor social functioning. Negative symptoms relating to deficits in motivation and pleasure may hinder the development of affiliative bonds. The current study used a novel procedure to examine the relation between negative symptoms and the development of social affiliation within a laboratory setting. Fifty-five men (35 controls; 20 with a schizophrenia spectrum disorder) completed three Social Affiliation Enhancement Tasks with an experimenter partner. Self-reported affiliation and affect ratings were assessed before and after the affiliative interaction. Across groups, social affiliation and positive affect increased following the interactive tasks. However, the schizophrenia group reported less positive and more negative affect than controls. Within individuals with schizophrenia, negative symptoms reflecting motivation and pleasure deficits and self-reported social anhedonia were associated with less affiliative feelings of interpersonal closeness and less willingness to interact. Additionally, these self-reported reactions to the interaction partner were significantly related to social functioning in the community. These findings indicate that though individuals with schizophrenia can form affiliative bonds, the extent to which this is possible may be limited by negative symptoms relating to motivation and pleasure. Additional research will be necessary to examine just how these negative symptoms interfere with social affiliation.

1. Introduction

Negative symptoms are well documented in schizophrenia and characterized by persistent deficits in emotional experience and expression (Kirkpatrick et al., 2006). Deficits in social affiliation, such as social anhedonia and asociality (Horan et al., 2011), have a substantial impact on functioning (Buchanan et al., 2010), yet available pharmacological treatments have limited impact on such symptoms (Kirkpatrick et al., 2006). To develop improved treatments for social affiliative deficits, it is necessary to understand how social anhedonia and asociality impact the formation of social bonds in schizophrenia. One of the greatest challenges in advancing this work is how to study social affiliation in the laboratory.

Blanchard et al. (2015) has noted that laboratory paradigms assessing emotional responses to evocative stimuli (e.g., photographs or movie clips; see meta-analysis by Cohen and Minor, 2010) may not tap social affiliative processes that are involved in forming and maintaining relationships. Furthermore, studies that do examine social responding via skills assessments in role plays (Bellack et al., 1994; Sayers et al., 1995) may be limited in their ability to contribute to our understanding of affiliation as their evaluative nature can elicit negative affect rather than engender affiliative bonding (Horan and Blanchard, 2003). Finally, experience sampling studies of social interactions lack control of the different social experiences encountered by participants, and information on the nature of such social experiences can be limited (e.g., comparing responses when alone versus with others; Oorschot et al., 2013). Thus, current laboratory methods are not designed to measure social affiliation deficits during positive social encounters.

Understanding how negative symptoms are related to social impairment requires examining how these symptoms are associated with affective responses to social interactions (Blanchard et al., 2015). Using a task in which participants with schizophrenia and controls passively viewed and responded to a video of an affiliative confederate, Blanchard et al. (2015) found that individuals with schizophrenia and

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controls increased positive affect and decreased negative affect after the interaction with no group-level differences in appraisals of the interaction partner. However, within the schizophrenia group, motivation and pleasure deficits (negative symptoms) were related to less positive affect and less positive appraisals of the video affiliative partner (Blanchard et al., 2015). This study suggests there is an association between negative symptoms and affective and affiliative responding to social partners, but these findings are limited by the use of a video stimulus.

Negative symptoms are related to affective responding in a social affiliation paradigm, but available experimental tasks do not measure affiliation using a live social interaction. The current study addresses this limitation with a face-to-face paradigm specifically designed to enhance social bonding and affiliation. We chose three Social Affiliation Enhancement Tasks to create an affiliative bond between participants and their partners. Before and after these tasks, participants completed measures of affiliation and affect. We hypothesized that 1) participants with and without schizophrenia would exhibit increased affiliation and positive affect after completing the social tasks with their partner, 2) in the schizophrenia group, more negative symptoms (motivation and pleasure deficits, including social anhedonia) would be associated with diminished affiliation and positive affect ratings following the tasks, and 3) to examine the external validity of the affiliation task, we explored the hypothesis that diminished self-reported affiliation from the laboratory interaction would be associated with poorer clinical ratings of social functioning in the community.

2. Methodology

2.1. Participants

Fifty-five participants (20 with schizophrenia spectrum disorders (SSD: 9 schizophrenia, 11 schizoaffective); 35 controls) were recruited from the Baltimore, MD metro area as part of a larger study of the buffering effects of social support on threat reactivity. All data presented below were collected prior to the threat task. Inclusion criteria for the SSD sample were 1) male gender,[2] 2) 18–65 years of age, 3) SDD diagnosis, 4) right-handed, 5) fluent in English,[3] 6) normal hearing, 7) stable medication regimen for at least 2 weeks, and 8) no substance use disorder within the past 6 months. Additional inclusion criteria for controls were: 1) no known psychiatric diagnosis or medication, and 2) no known family history of psychosis in a first/second-degree relative. Of the 59 participants recruited, 4 participants were deemed ineligible after screening, and no participants dropped out of the study.

2.2. Diagnostic and symptom measures

Diagnostic status was assessed with the Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Patient Edition (SCID-I/P; First et al., 2002). The Brief Psychiatric Rating Scale (BPRS; Overall and Gorham, 1962; Ventura et al., 1993) assessed psychiatric symptoms during the previous week. Using the Kopelowicz et al. (2008) factor structure, that has demonstrated consistency across a range of SSD participants, the Positive Symptoms subscale served as a measure of psychotic/positive symptom severity with adequate internal consistency in the current sample (SSD Cronbach's $\alpha = 0.79$). Negative symptoms were assessed with the Clinical Assessment Interview for Negative Symptoms (CAINS; Blanchard et al., 2011; Horan et al., 2011; Kring et al., 2013), a 13-item measure with two subscales: Motivation and Pleasure (MAP) and Expression (EXP) that have good validity and, in the present sample, excellent internal consistency (SSD Cronbach's $\alpha = 0.90$ and $\alpha = 0.92$, respectively). The primary measure of negative symptoms was the CAINS MAP subscale. The Social Anhedonia Scale – Brief (SAS-B; Reise et al., 2011), a 17-item true/false questionnaire, assessed trait levels of diminished pleasure from social interactions with good internal consistency in our sample (SSD Cronbach's $\alpha = 0.85$). The 4-item Role Functioning Scale (RFS; Goodman et al., 1993) assessed functioning in four areas and has good validity and reliability. The Family Network Relationships and the Extended Social Network Relationships scales were included as the two variables of social functioning. A continuous measure of heterosexuality from the Sell Assessment of Sexual Orientation (SASO; Sell, 1996) was used to control for differences in participant heterosexuality that could potentially impact affiliation ratings of opposite gender research partners.

2.3. Social affiliation self-report measures

The Inclusion of the Other in the Self Scale (IOS; Aron et al., 1992) assessed relationship closeness between participants and partners on a 7-point Likert scale. Aron et al. (1992) reported that the IOS has good test-retest reliability and convergent validity with other social connectedness measures. The 8-item Positive Reactions to Partner Questionnaire (PRP; Llerena et al., 2012) measured current social affiliation with the partner on a 5-point Likert scale. The PRP has good convergent validity with other social affiliation assessments and adequate internal consistency (Blanchard et al., 2015); internal consistency in the current sample was $\alpha = 0.64$ (pre) and 0.68 (post). The 6-item Willingness to Interact Questionnaire (WIQ; Coyne, 1976) assessed willingness for future social interactions on a 5-point Likert scale. The WIQ has support for construct validity (Coyne, 1976; Burchill and Stiles, 1988) and good internal consistency in the present sample (pre and post $\alpha = 0.87$ and 0.93). The latter two measures were reverse scored with higher scores representing more positive reactions and willingness to interact. The 20-item Positive and Negative Affect Scale (PANAS; Watson et al., 1988) assessed current affect using a 5-point Likert scale, and emotional experience ratings summed to form Positive and Negative Affect Scores. The PANAS has good convergent and divergent validity (Watson et al., 1988), as well as adequate to excellent internal consistency in our sample (Positive pre and post $\alpha = 0.92$ and 0.92; Negative pre and post $\alpha = 0.69$ and 0.76).

2.4. Social Affiliation Enhancement Tasks

Three interpersonal tasks were utilized to promote affiliative social interaction, positive affect, and social bonding: 1) the participant and partner completed a 3.5-minute *Conversation Task* developed for the current study to get to know the other person. To begin, the partner delivers a scripted introduction, then the participant is asked to speak about himself. The partner interacts with positive affect, positive body language, and self-disclosure to promote social affiliation, incorporating principles that contribute to the development of trust and cooperation (Declerck et al., 2013). 2) The *Implicit Fingertip Synchrony Task* (Yun et al., 2012) is an 8-minute task consisting of coordinated movements wherein the dyad mirrors each other's hand movements. The task aims to increase implicit interpersonal synchrony and is associated with decreasing social anxiety (Yun et al., 2012). 3) The *Team Building Task* was adapted from a competitive task to increase the level of acquaintance between individuals (South et al., 2005), drawing on principles of competition increasing in-group identification and cooperation (Brewer, 1979; Buttelmann and Böhm, 2014). Each participant and partner comprised a team; they were instructed to choose a team name and build a block structure in 10 min. They were told that they were competing against another team and that their structures would be judged. After completing the block construction, digital photographs were taken of the structure, and performance feedback was provided.

[2] Of note, we included a single gender in the current study to reduce within-group variability by establishing consistency with the gender of the research confederate who acted as the affiliative partner. In considering which sex to recruit for this study we ultimately considered the logistics of recruitment and the representation of gender within known outpatient samples of schizophrenia and in our available clinical samples.

[3] Confirmed by post-informed consent evaluation to check for understanding of study procedures.

The participant's team always "won," and the team was given two snacks to share. The partner always offered both snacks to the participant to develop further rapport, trust, and social affiliation by simultaneously offering praise, appreciation, and positive regard for the participant's contribution to the task. Tasks were video recorded for quality assurance.

2.5. Procedure

The Institutional Review Board at the University of Maryland School of Medicine approved the study. Each participant completed two visits. Visit 1 involved completing informed consent and clinical interviews and questionnaires. Visit 2 occurred approximately 1 week later. Upon arrival, participants viewed a picture of the female partner[4] and completed pre-task affiliation and affect ratings. They then completed the social affiliation tasks followed by post-task affiliation and affect ratings. Participants were debriefed and received $50.00 (plus $35.00, if they provided their own transportation) for compensation. Trained graduate students, master's level research assistants, or clinical psychologists administered study measures. Training included observing assessments, rating recorded example training assessments, and discussing early interview administrations with trained interviewers. Ongoing supervision was provided including watching video recordings of assessments to prevent rater drift. Research partners, but not assessors, were blind to patient status.

2.6. Data analysis

First, we assessed group differences in demographics and clinical characteristics using independent *t*-tests and chi-square tests. Next, we sought to consider whether having schizophrenia and participating in the social affiliation enhancement intervention affected social affiliation toward the partner (IOS, PRP, WIQ) and participants' positive and negative affect scores (PANAS). To do so, we conducted repeated-measures ANOVA assessed the effects of group, time (pre-post intervention), and group × time interaction on each social affiliation and affect rating; post hoc independent and paired *t*-tests were conducted for significant effects. Lastly, we conducted Pearson's correlations in the schizophrenia group to determine the association between negative symptoms (motivation and pleasure; social anhedonia; expression) and social affiliation, affect, and social functioning. Data were analyzed with SPSS 24.0.

3. Results

3.1. Sample characteristics

Demographics, clinical interview data, and self-report ratings are described in Table 1. There were no group differences in age or heterosexuality. The schizophrenia group reported significantly fewer years of education, more severe motivation and pleasure deficits, expression deficits, and social anhedonia, more positive symptoms, and worse social functioning in family and extended social networks compared to controls. The primary variables of interest (social affiliation, affect, social functioning, and symptom severity) did not significantly differ between participants with a schizophrenia or schizoaffective diagnosis.

3.2. Social affiliation and affect

We conducted a repeated-measures ANOVA to assess the effect of time (pre-post), group, and the group × time interaction for each social affiliation and affect measure (see Fig. 1 for illustration of time and group effects).

Table 1
Demographic and clinical characteristics.

	Control	Schizophrenia	χ^2/*t*-tests	*p*-Value
	N(%)	N(%)		
Male	35 (100%)	20 (100%)	–	–
African American	32 (91.4%)	19 (95%)	$\chi^2(3) = 1.32$	0.724
Caucasian	1 (2.9%)	1 (5%)		
Asian	1 (2.9%)	0 (0%)		
Multiple racial backgrounds	1 (2.9%)	0 (0%)		
	M (SD)	M (SD)		
Age	44.74 (13.22)	48.70 (11.22)	$t(53) = -1.13$	0.265
Education	12.66 (2.41)	10.75 (1.80)	$t(53) = 3.07$	0.003
Heterosexuality	5.94 (1.95)	6.60 (1.27)	$t(53) = -1.35$	0.184
CAINS_MAP	4.43 (3.99)	15.80 (9.99)	$t(22.52) = -4.87$	<0.001
CAINS_EXP	0.09 (0.51)	4.90 (3.99)	$t(19.35) = -5.38$	<0.001
SAS-B	3.11 (3.42)	7.85 (4.42)	$t(53) = -4.44$	<0.001
BPRS positive	8.23 (0.55)	14.80 (7.98)	$t(19.10) = -3.68$	0.002
RFS family social network	6.86 (0.49)	5.40 (2.04)	$t(20.29) = 3.15$	0.005
RFS extended social network	6.46 (1.24)	5.15 (2.18)	$t(26.21) = 2.46$	0.021

CAINS = Clinical Assessment Interview for Negative Symptoms; MAP = Motivation and Pleasure; EXP = Expression; SAS-B = Social Anhedonia Scale – Brief; BPRS = Brief Psychiatric Rating Scale; RFS = Role Functioning Scale.
Levene's test for equality of variances was violated for each of these tests: CAINS-MAP $F(1, 53) = 17.48$, $p < 0.001$;
CAINS-EXP $F(1, 53) = 91.15$, $p < 0.001$; BPRS-Positive $F(1, 53) = 37.06$, $p < 0.001$; RFS-Immediate $F(1, 53) = 44.61$, $p < 0.001$; RFS-Extended $F(1, 53) = 10.86$, $p = 0.002$, and *t* statistics were conducted with equal variances not assumed.

3.2.1. Social closeness

On the measure of social closeness, as measured by the IOS, a significant main effect of time reflected increased social closeness at the post-interaction assessment ($F(1, 53) = 104.07$, $p < 0.001$). The main effect of group was not significant ($p = 0.144$), but there was a significant group × time interaction for the IOS ($F(1, 53) = 4.34$, $p = 0.042$). Post hoc analyses indicated that controls had less interpersonally close ratings than the schizophrenia group at baseline ($t(53) = -2.18$, $p = 0.034$) but not following the interaction ($p = 0.678$). However, for both groups, closeness with the partner increased over time (SSD $t(19) = -5.40$, $p < 0.001$; HC ($t(34) = -9.88$, $p < 0.001$).

3.2.2. Positive reactions to partner

For positive appraisals of the interaction partner, as measured by the PRP, a main effect of time was significant ($F(1, 53) = 34.82$, $p < 0.001$), reflecting increased positive reactions to the partner following the interaction tasks. The main effect of group and the group × time interaction were not significant (*p*s = 0.925 and 0.144, respectively).

3.2.3. Willingness to interact

Similarly, for willingness to interact with the partner, as measured by the WIQ, a main effect of time was significant ($F(1, 53) = 33.11$, $p < 0.001$), reflecting increased willingness after the social interaction. The main effect of group and the group × time interaction were not significant (*p*s = 0.398 and 0.842, respectively).

3.2.4. Positive and negative affect

Regarding affect, as measured by the PANAS, there was a significant main effect of time on positive ($F(1, 53) = 31.12$, $p < 0.001$) but not negative affect ($p = 0.432$), indicating increases in positive affect only. Additionally, a main effect of group was significant for positive ($F(1, 53) = 6.17$, $p < 0.001$) and negative affect ($F(1, 53) = 13.13$, $p = 0.001$), demonstrating that the schizophrenia group had less positive and more negative affect than controls. The group × time interactions were not

[4] Participants interacted with one of two Caucasian female research partners. Independent *t*-tests indicated no significant difference in affiliation and affect ratings between the first and second half of participants within each participant group that interacted with either research partner (*p*s > 0.05).

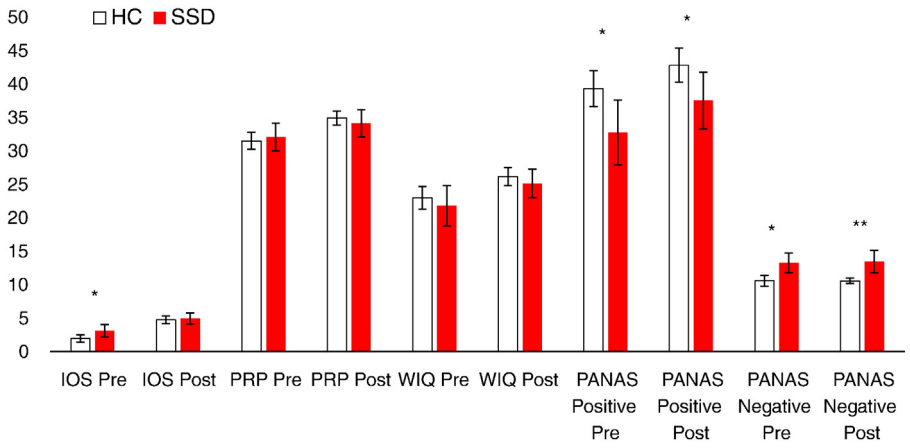

Fig. 1. Social affiliation and affect ratings by time and group. Self-reported social affiliation and affect ratings (means and confidence intervals) before (pre) and after (post) completing the Social Affiliation Enhancement Tasks with a research partner. HC = healthy control; SSD = schizophrenia spectrum disorder; IOS = Inclusion of the Other in the Self Scale; PRP = Positive Reactions to Partner Questionnaire; WIQ = Willingness to Interact Questionnaire; PANAS = Positive and Negative Affect Scale. * $p < 0.05$, **$p < 0.01$.

Table 2
Schizophrenia correlations: negative symptoms, functioning, social affiliation, affect.

Measure	1	2	3	4	5	6	7	8	9	10
1. CAINS_MAP	.									
2. CAINS_EXP	0.18	.								
3. SAS-B	0.69**	−0.23	.							
4. RFS family	−0.47*	−0.11	−0.37	.						
5. RFS extended	−0.82**	−0.23	−0.58**	0.35	.					
6. IOS	−0.50*	0.25	−0.57**	0.20	0.45*	.				
7. PRP	−0.37	0.29	−0.66**	0.01	0.36	0.73**	.			
8. WIQ	−0.49*	0.47*	−0.67**	0.23	0.45*	0.66**	0.83**	.		
9. PANAS positive	−0.41	0.35	−0.48*	0.09	0.38	0.67**	0.83**	0.88**	.	
10. PANAS negative	0.17	−0.10	0.58**	−0.20	−0.05	−0.26	−0.44	−0.28	−0.18	.

Correlations for the schizophrenia group between clinical measures and social affiliation and affect ratings *after* completing the Social Affiliation Enhancement Tasks.
CAINS = Clinical Assessment Interview for Negative Symptoms; MAP = Motivation and Pleasure; EXP = Expression; SAS-B = Social Anhedonia Scale – Brief; RFS = Role Functioning Scale; IOS = Inclusion of the Other in the Self; PRP = Positive Reactions to Partner Questionnaire; WIQ = Willingness to Interact Questionnaire; PANAS = Positive and Negative Affect Scale.
* $p < 0.05$.
** $p < 0.01$.

significant for positive or negative affect (*ps* = 0.408 and 0.165, respectively).

3.3. Correlations with negative symptoms

Within individuals with schizophrenia, we explored how negative symptoms and social functioning (RFS), correlated with affiliation and affect following the social interaction (Table 2; Fig. 2).[5,6]

3.3.1. Social closeness

Less social closeness was significantly related to more motivation and pleasure deficits, as measured by the CAINS MAP subscale ($r = -0.50$, $p = 0.026$). Consistent with the findings from the clinical interview motivation and pleasure ratings, less social closeness was also significantly correlated with more severe self-reported social anhedonia on the SAS-B ($r = -0.57$, $p = 0.009$). Expressive negative symptoms, as measured by the CAINS EXP subscale, were not significantly correlated with social closeness ($r = 0.25$, $p = 0.290$).

3.3.2. Positive reactions to partner

Reduced positive reactions to the partner were significantly associated with more social anhedonia on the SAS-B ($r = -0.66$, $p = 0.002$), but not the CAINS MAP ($r = -0.37$, $p = 0.113$) or CAINS EXP ($r = 0.29$, $p = 0.222$).

3.3.3. Willingness to interact

Diminished willingness to interact was significantly correlated with more severe CAINS MAP negative symptoms ($r = -0.49$, $p = 0.028$) and self-reported social anhedonia ($r = -0.67$, $p = 0.001$). Unexpectedly, more severe expressive negative symptoms were significantly correlated with *increased* willingness to interact with the partner in the future ($r = 0.47$, $p = 0.036$).

3.3.4. Positive and negative affect

Less positive affect, but more negative affect on the PANAS, was significantly associated with greater social anhedonia ($r = -0.48$, $p = 0.031$) ($r = 0.58$, $p = 0.008$). However, neither CAINS MAP or EXP subscale significantly correlated with affect (positive: MAP $r = -0.41$, $p = 0.071$, EXP $r = 0.35$, $p = 0.135$; negative: MAP $r = 0.17$, $p = 0.476$, EXP $r = -0.10$, $p = 0.666$).

3.3.5. Social functioning

Better functioning in family social networks was negatively correlated with fewer CAINS MAP negative symptoms ($r = -0.47$, $p = 0.036$),

[5] The affiliation and affect ratings completed after the three Social Affiliation Enhancement Tasks were included in these correlations to best reflect the quality of the participants' relationship with their affiliative partner once they established this relationship, as was done in the video social affiliation task (Blanchard et al., 2015).

[6] Within the schizophrenia group, correlations for affiliation and affect ratings before the Social Affiliation Enhancement Tasks, as well as change scores (post-pre), are included in Supplemental Tables 1 and 2.

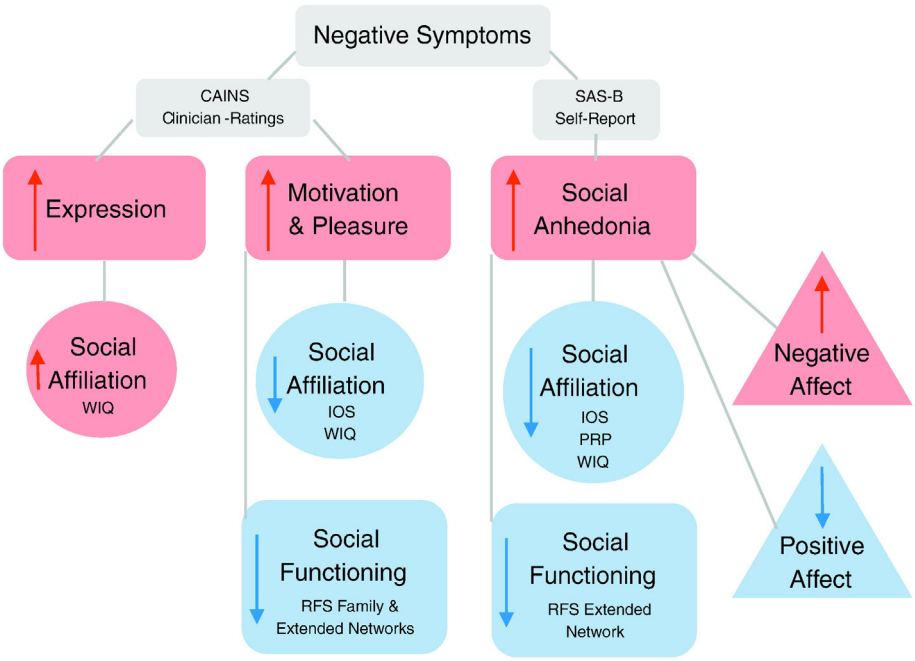

Fig. 2. Relationships between negative symptoms, social affiliation, affect, and social functioning in the SSD group. A schematic of the primary correlation results between negative symptoms (red rectangles), social affiliation (circles), affect (triangles), and social functioning (blue rectangles). Red arrows reflect increased variable levels, blue arrows reflect reduced variable levels, and gray lines indicate significant correlations ($p < 0.05$) between negative symptoms and social affiliation, affect, and social functioning. SSD = schizophrenia spectrum disorder; CAINS = Clinical Assessment Interview for Negative Symptoms; SAS-B = Social Anhedonia Scale – Brief; IOS = Inclusion of the Other in the Self; PRP = Positive Reactions to Partner Questionnaire; WIQ = Willingness to Interact Questionnaire.

but not social anhedonia ($r = -0.37$, $p = 0.111$) or CAINS EXP negative symptom severity ($r = -0.112$, $p = 0.640$).

However, better functioning in extended social networks, had a significant relationship with less severe CAINS MAP negative symptoms ($r = -0.82$, $p < 0.001$) and less social anhedonia ($r = -0.58$, $p = 0.008$), whereas expressive negative symptoms were unrelated to either index of social functioning ($r = -0.23$, $p = 0.334$).

3.3.6. Social functioning with social affiliation and affect

Finally, we examined the relationship between self-report social affiliation measures in the laboratory and community functioning. Better functioning in extended social networks was associated with greater social closeness ($r = 0.45$, $p = 0.049$) and willingness to interact ($r = 0.45$, $p = 0.046$) but not positive reactions to the partner ($r = 0.36$, $p = 0.122$) or affect (positive $r = 0.38$, $p = 0.100$; negative $r = -0.05$, $p = 0.848$). Family network functioning was not significantly correlated with affiliation ratings (IOS $r = 0.20$, $p = 0.409$; PRP $r = 0.01$, $p = 0.959$; WIQ $r = 0.23$, $p = 0.332$) or affect (positive $r = 0.09$, $p = 0.711$; negative $r = -0.20$, $p = 0.402$).

4. Discussion

The present study used a novel experimental paradigm to address limitations in the literature regarding the formation of social affiliation in schizophrenia and to understand the contribution of negative symptoms to the appraisals of a social partner. Across groups, participants demonstrated increases in social affiliation and positive affect following the Social Affiliation Enhancement Tasks, supporting our first hypothesis that these tasks would induce feelings consistent with the formation of a social bond. Our results align with prior work showing the ability to increase positive affect in individuals with schizophrenia after a video social affiliation interaction task (Blanchard et al., 2015) and when in the presence of others versus being alone in experience sampling research (Oorschot et al., 2013). Our findings indicate, at the group level, the ability of individuals with schizophrenia to experience positive social affiliation. The dynamic and positive nature of our tasks appear to have facilitated normative levels of affiliation that, one could speculate, may be less likely in evaluative laboratory role plays or interactions beyond the laboratory that are subject to stigma of mental illness and associated with social avoidance (Yanos et al., 2008).

Though both groups reported similar positive reactions to and willingness to interact with their partners, individuals with schizophrenia experienced more social closeness at baseline (prior to the interaction) than controls. However, this difference was not present following the social interaction as both groups demonstrated an increase in social closeness following the interactions. The reasons for this unexpected group difference in baseline social closeness are unclear, and there were no similar group differences in other baseline self-report social affiliation measures (positive reactions and willingness to interact). Speculatively, the social isolation experienced by individuals with schizophrenia diagnoses may have contributed to a greater inclination to report social closeness toward an anticipated social partner. However, this conjecture does not fit clearly with the lack of group differences in willingness to interact or positive appraisals of the interaction partner. Caution is warranted in interpreting this unexpected finding, and future research will need to determine the replicability of this group difference.

On the other hand, individuals with schizophrenia reported generally less positive affect and more negative affect than controls. Many studies typically report similar ratings between schizophrenia and control groups using evocative stimuli for valence of positive and negative pictures (Heerey and Gold, 2007; Lui et al., 2016; Volz et al., 2003), affective responding to video affiliation tasks (Blanchard et al., 2015), and meta-analyses of emotional experience (Cohen and Minor, 2010). Nonetheless, individuals with schizophrenia have reported less positive affect (Curtis et al., 1999; Lee et al., 2006; Myin-Germeys et al., 2000) and more negative affect (Earnst and Kring, 1999; Horan et al., 2006; Myin-Germeys et al., 2000) compared to controls (Kring and Elis, 2013; Kring and Moran, 2008), which can vary depending on the context (Gard and Kring, 2009). These mixed findings may reflect differences in sample characteristics or experimental paradigms.

Our hypothesis regarding negative symptoms and affiliation was also largely supported in that lower motivation and pleasure, as measured by the CAINS MAP subscore, and social anhedonia were associated with diminished self-reported social closeness and less willingness to interact with the social partner in the schizophrenia group. Additionally, more social anhedonia was related to less positive appraisals of the interaction partner and positive affect but more negative affect. These results replicate and extend our prior findings that more MAP negative symptoms and social anhedonia were related to less positive appraisals using a video prompt to simulate affiliative social interactions (Blanchard et al., 2015). Surprisingly, expressive negative symptoms were associated with *increased* willingness to interact with the partner. Given null correlations between expressive deficits and social affiliation or trust in prior studies (Blanchard et al., 2015; Campellone et al., 2016), more work is needed to understand this relationship.

Importantly, the present association of diminished social affiliation with greater MAP negative symptoms and social anhedonia occurred even in a context where the interaction partner and nature of the interactions were designed to yield social bonding. This builds on prior findings that these negative symptoms are related to placing less trust in trustworthy partners (Campellone et al., 2016). Although diminished anticipation of future pleasure (Engel et al., 2016; Gard et al., 2007) may in part contribute to deficits in social motivation, the current findings suggest that, at least within face-to-face social interactions, MAP negative symptoms and social anhedonia are also related to diminished feelings of social closeness and that social anhedonia is related to diminished positive appraisals of an interaction partner.

We also hypothesized that diminished self-reported affiliation in the laboratory would be associated with poorer clinical ratings of social functioning in the community in the schizophrenia group. Our data supports this hypothesis in extended but not family social networks, a pattern that also emerged between role functioning and trust in others (Campellone et al., 2016). The association between self-reported affiliation and interview-rated community functioning also demonstrates external validity of the social affiliation laboratory tasks. Though affect was unrelated to social functioning in the present sample, prior research suggests that more positive affect is related to better social functioning (Blanchard et al., 1998). Our findings illustrate the dissociable nature of negative symptom and social functioning domains, highlighting the need to individualize treatment targets.

4.1. Limitations

The current study has several limitations. All participants with schizophrenia were taking medication. Because medication doses are clinically determined, we were unable to disentangle the dose effects from symptom severity itself (Green et al., 2015). Participants were also primarily middle-aged African-American men, and the lack of gender and ethnic diversity is another limitation of the study. To maintain consistency of opposite gender participants and partners, reduce variability, and align with prior studies on which the larger project was based (Coan et al., 2006), we recruited men as a first step with the goal of eventually studying our paradigm in women. It is possible that men may have given more affiliative ratings to their female partners compared to potential male partners, because men and women on average display greater liking and preference for women (Eagly et al., 1994; Rudman and Goodwin, 2004). Additionally, the primarily African American sample is reflective of the communities that our recruitment sites served, and it could be that ethnically matched dyads could have produced more positive affiliation ratings than the dyads in the present study. Thus, care must be taken when generalizing these findings to other genders, races, and age groups, as affective responding in schizophrenia may involve gender differences (Mote et al., 2014). Future research should examine different combinations of demographic variables across participants and research staff. Additionally, the current study presents cross-sectional data, and future research may benefit from longitudinal assessments of social affiliation changes over time or course of illness (first-episode vs. chronic psychosis). Finally, given the small sample size and multiple analyses, our results should be interpreted with caution, as they require further replication and extension.

4.2. Conclusions

This study provides some of the first data investigating how to actively build social affiliation in the laboratory in individuals with schizophrenia. Developing social affiliation is achievable in a controlled research setting within ~30 min with robust relationships with experiential negative symptoms and functioning in extended social networks. The results provide support for using the social affiliation enhancement paradigm to evaluate individual differences in developing social bonds. In sum, the present study contributes to the line of work that seeks to explore and improve how people with schizophrenia experience and engage in social affiliation.

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Contributors

JMM and JJB were responsible for study design/development and drafting of the manuscript. JMM completed data collection, literature search, and conducted analyses. KRB, LTC, CPG, and AM were responsible for data collection/management and assisted with manuscript preparation. MEB oversaw data collection and assisted with manuscript preparation. All authors contributed to and have approved the final manuscript.

Conflict of interest

JJB has consulted with and served on a scientific advisory board for Genentech/Roche. All other authors declare that they have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.schres.2017.07.034.

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