



Positive affect during social interactions predicts goal progress and social motivation in daily life for people with schizophrenia

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ABSTRACT

Experiences of positive and negative affect can impact social motivation, including desire and effort towards social connection. Although people with schizophrenia report lower social motivation and more negative affect in daily life than matched controls, they also experience pleasure from social interactions. In the current study, we were interested in examining the extent to which positive and negative affect related to recent social interactions predicted social goal progress and motivation in daily life. Within the context of a digital health intervention (Motivation and Skills Support, or MASS), 30 people with a schizophrenia spectrum disorder worked towards a social goal and completed ecological momentary assessments twice a day for 60 days on affect experienced from recent social interactions, progress on one's goal, and different facets of social motivation. Results showed that participants reported more positive than negative affect in response to social interactions. However, only positive (not negative) affect predicted greater social goal progress and social motivation towards one's goal across the intervention. These results suggest that facilitating positive affect experiences during social interactions, over and above reducing negative affect, may be important for improving social motivation in this population.

Impairments in social motivation, or reduced desire to seek out, engage in, and/or maintain social relationships, are one of the core negative symptoms of schizophrenia (Catalano and Green, 2023; Fulford et al., 2018). Social motivation is a multifaceted construct related to social cognition, social skills, effort-based decision-making, and affect (Bandura, 1986; Kring and Barch, 2014; Culbreth et al., 2018). Like motivation in general, social motivation not only relies on a desire to achieve a goal, but a calculation involving beliefs around one's ability to successfully seek out and persist towards that goal as well as the perceived value of that goal (i.e., is it worth the effort?) (Choi et al., 2010). Low social motivation predicts social deficits and poorer quality of life and may be a stronger predictor of real-world social impairments in schizophrenia than depression or social skills (Fervaha et al., 2015; Kalin et al., 2015; Moe et al., 2021; Robertson et al., 2014).

Social affective experiences, or the emotions experienced when anticipating, engaging in, and following social interactions, are important drivers of social motivation. While affect and motivation are separable constructs (Fulford et al., 2018; Gable and Dreisbach, 2021), people tend to be more motivated for social relationships when they

anticipate pleasant/positive feelings and less motivated when they expect unpleasant/negative feelings. People with schizophrenia report higher social anhedonia (i.e., diminished social pleasure) than people without schizophrenia on trait-based questionnaires (Blanchard et al., 1994, 2001), suggesting that the tendency to view such relationships as unpleasant contribute to reductions in social motivation in this population. However, these questionnaires are limited in their ability to directly assess social pleasure as they rely on retrospective reporting, the aggregation of affective experiences over time, and often assess non-affective aspects of social experiences, such as importance or meaning of social relationships or social effort (e.g., the items "I attach very little importance to having close friends" and "Making new friends isn't worth the energy it takes" from the Revised Social Anhedonia Scale; Mishlove and Chapman, 1985).

On the other hand, when directly asked the extent to which they feel a variety of positive and negative emotions in laboratory settings, people with schizophrenia show intact hedonic responding in the presence of positive social interactions (Aghevli et al., 2003; Martin et al., 2019). This suggests that once people with schizophrenia engage in a pleasant

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social interaction, they experience just as much positive emotion as people without schizophrenia. However, laboratory studies are unable to clarify whether people with schizophrenia experience social interactions in daily life as positive. Across ecological momentary assessment (EMA) studies that measure emotions felt during real-world social interactions, people with schizophrenia report more positive affect when they are interacting with others compared to being alone, and report equivalent positive affect during interactions when compared to people without schizophrenia in daily life (for review, see Mote and Fulford, 2020).

Nonetheless, people with schizophrenia report more trait negative affect (Horan et al., 2008) and more negative affect in daily life (across contexts) compared to people without schizophrenia (for review, see Cho et al., 2017). Specific to social interactions, again in EMA studies, people with schizophrenia report more social distress—such as a preference to be alone and disliking the company they are in—compared to people without schizophrenia (Mote and Fulford, 2020). This is in line with laboratory-based studies where, when positive and negative emotions are assessed separately, people with schizophrenia report equivalent positive emotions in response to putatively positive stimuli but also report more negative emotions compared to matched controls (Mote and Kring, 2019).

Taken together, people with schizophrenia report less social pleasure and more negative affect in response to social interactions on average, despite showing the capacity to experience social interactions as generally positive in-the-moment. They also report more negative affect in daily life, including in response to social interactions, than people without schizophrenia. What remains unknown is the extent to which momentary fluctuations in positive and negative affect in the context of real-world social interactions impact social motivation in daily life. Clarifying these associations can help identify whether promoting positive or reducing negative affect in response to social interactions (or both) would have the most direct impact on improving social motivation.

Thus, in the current study we were interested in identifying the extent to which positive and negative affective experiences from social interactions predict social motivation in people with schizophrenia. Previously, our team developed and tested an ecological momentary intervention to improve social functioning by targeting social motivation (the Motivation and Skills Support [MASS] application; Fulford et al., 2020; Fulford et al., 2021). In the current secondary data analysis, we assessed how affective experiences specific to social interactions in daily life related to various facets of social motivation in people with schizophrenia as they were actively working towards specific social goals (e.g., making a new friend).

Similar to previous studies, we predicted that people with schizophrenia would report more positive than negative affect in response to social interactions. Due to the lack of previous EMA research on positive and negative social affective experiences and social motivation, we aimed to explore whether positive or negative affect (or both) within the context of social interactions predicted progress towards goals in the intervention as well as 1) social goal motivation (i.e., motivation towards the specific goal participants were working towards) and 2) a composite variable assessing the value of a recent interaction, reflections and appraisals related to social motivation (Fulford et al., 2018). We also explored whether clinical symptoms and social functioning at baseline were related to positive or negative affect reported during daily social experiences.

1. Methods

1.1. Recruitment and procedure

Participants were part of the original Motivation and Skills Support (MASS) mobile health application pilot study, which took place at two sites (for full methods, see: Fulford et al., 2020; Fulford et al., 2021). The

MASS app was designed as a mobile health intervention to improve social motivation using principles from basic affective, cognitive, and motivational science with elements of cognitive behavioral therapy for psychosis and social skills training. Participants identified and then worked towards a specific social goal related to family, friends, or romantic relationships over the course of 60 days, with all content delivered via the MASS mobile app. In our open pilot intervention, participants showed reductions in positive symptoms and improvements in social functioning at treatment termination and improvements in appraisals and reflections of social interactions (“social value”) in daily life across the intervention (Fulford et al., 2021).

Participants were fluent in English, between the ages of 18 and 65 years old, and had a diagnosis of schizophrenia or schizoaffective disorder. They were receiving outpatient psychiatric and/or psychological treatment at the time of study participation and were able to provide informed consent. As part of the intervention, participants identified one social goal to work towards throughout the 60-day intervention. Potential participants were excluded if they met criteria for substance use disorder in the past six months, current suicidal ideation (via structured diagnostic interview), or self-reported diagnosis of a neurological disorder (e.g., history of epilepsy or stroke). Participants were screened via telephone and invited to an in-person meeting to complete informed consent procedures and in-depth screening for eligibility. Participants were provided with smartphones with Android OS that included the MASS app as well as prepaid data and call and text plans during the intervention period. Throughout the intervention, participants were prompted via smartphone notification twice a day to answer questions related to their social goal progress. Participants were also called by a research assistant once a week to help address technical difficulties.

1.2. Measures

1.2.1. Ecological momentary assessment (EMA)

In addition to the digital intervention content, a series of EMA surveys were delivered twice per day semi-randomly (once in the morning and once in the evening within blocks of 2.5 h), seven days a week, for 60 days. Participants were asked questions related to the affective experiences from previous social interactions as well as different aspects of social motivation: 1) social goal motivation, or motivation they felt towards the specific goal they reported working on during the EMA prompt related to their broader social goal (e.g., practicing conversation skills in support of their goal to make a new friend); and 2) social value, a three-item composite variable assessing the value of a recent social interaction, unrelated to their specific social goal (internal consistency $\alpha = 0.95$). See Table 1 for EMA items included in the current analysis.

For every time point, participants were asked about the number of interactions they had since their last survey (0, 1, 2, or 3 or more interactions), past progress they had made on their social goal since their last survey, and specific motivation related to their social goal. When participants reported at least one previous social interaction, they were also prompted to respond to positive affect, negative affect, and social value items pertaining to those social interactions. Affect, past goal progress, and social goal motivation were rated on 5-point scales (e.g., 0 = not at all to 4 = extremely), while the items for social value were rated on 4-point scales (e.g., 0 = I did not communicate well at all to 3 = I communicated very well).

1.2.2. Clinical measures

In the current study, to explore the relationship between positive and negative affect with symptoms and functioning, we assessed positive symptoms (the positive symptoms subscale of the Brief Psychiatric Rating Scale, or BPRS; Overall and Gorham, 2016), negative symptoms (the motivation and pleasure subscale of the Clinical Assessment Interview for Negative Symptoms, or CAINS-MAP; Kring et al., 2013), and social functioning (from both the Social Functioning Scale, or SFS; Birchwood et al., 1990; and the Quality of Life Scale – Interpersonal

Table 1

Ecological momentary assessment (EMA) constructs and items.

Construct	EMA Item	When Prompted
Number of Interactions	"How many conversations did you have in person, by phone/text, or online, since the last time you filled out a survey?"	Every time point
Positive Affect	"How happy did you feel about those conversations?" "How excited did you feel about those conversations?" "How calm did you feel about those conversations?"	Only when interactions were reported
Negative Affect	"How sad did you feel about those conversations?" "How anxious did you feel about those conversations?" "How angry did you feel about those conversations?"	Only when interactions were reported
Past Goal Progress	"How much progress did you make towards the following steps towards your goal since the last time you worked on it?"	Every time point
Social Goal Motivation	"How motivated are you to work on this step?"	Every time point
Social Value	"How well did you communicate in your past conversations?" "What did you think other people thought of you in those conversations?" "To what extent were those interactions worth the effort?"	Only when interactions were reported

Relations, or QLS-IR; Heinrichs et al., 1984) from baseline.

1.3. Analytic procedures

We computed means for the three positive emotion and three negative emotion items and created composite positive affect (PA) and negative affect (NA) experienced from social interactions. PA and NA were compared using paired-samples *t*-tests. We computed Pearson correlations to examine relationships between positive and negative affect items with the other EMA-reported variables (Past Goal Progress, Social Goal Motivation, Social Value) and clinical measures.

Given the nested structure of EMA data (responses nested within participants) and to account for the longitudinal nature of our data, we conducted multilevel analyses using Hierarchical Linear Modeling (HLM) Version 7.03 (Raudenbus et al., 2013). Participants were required to respond to a minimum of 10% EMA prompts to the affect items to be included in analysis. Parameters were estimated with full-information maximum likelihood and intercepts were allowed to vary across participants. EMA responses were treated as repeated measures (Level 1) that were nested within persons (Level 2). PA and NA were included within the same model when included as Level 1 predictors. In all models we tested contemporaneous associations, within the same time point (i.e., we did not examine lagged relationships); thus, causality cannot be determined between predictors and outcomes. Standard errors are reported for all multilevel results.

2. Results

2.1. EMA Adherence, demographics, and clinical characteristics

Thirty-two participants completed the baseline clinical assessments and the intervention portion of the study. Two participants completed less than 10% of the EMA surveys and were excluded from further

analyses.¹ Approximately half of the remaining participants had a schizophrenia diagnosis, identified as male, and identified as a race other than non-Hispanic White. See Table 2 for demographics and clinical characteristics for the 30 participants included in analyses. EMA adherence ranged from 12 to 89% ($M = 0.48$, $SD = 0.25$).

Participants chose a variety of social goals. Fifteen (50%) participants chose a goal related to friendship, including attempting to make a new friend (eight participants), improving communication or increasing activities with an existing friend (five participants), and reconnecting with an old friend (two participants). Eleven (37%) participants chose goals related to improving their relationship with a family member. Four (13%) participants chose a goal related to romantic relationships, including attempting to find a dating partner through a dating website (three participants) or pursuing a romantic relationship with someone they already knew (one participant).

2.2. Positive and negative affect

See Table 3 for means for specific emotions and internal consistency for PA and NA related to social interactions (responses ranged from 0 to 4). As predicted, participants reported more PA overall in response to social interactions ($M = 2.10$, $SD = 0.88$) than NA ($M = 0.62$, $SD = 0.61$), $t(29) = 6.71$, $p < 0.001$, Cohen's $d = 1.20$.

2.3. Affect, social motivation and behavior, and clinical outcomes

See Table 4 for overall means for EMA items. Participants on average reported less than two interactions per EMA response with moderate social goal motivation and social interaction value.

PA was not significantly correlated with NA, $r = -0.27$, $p = 0.15$. Neither PA nor NA were correlated with the number of social interactions reported at each time point ($r_s = 0.02$, and 0.09 , respectively, $p_s > 0.63$). PA from social experiences was positively correlated with past goal progress ($r = 0.41$, $p = 0.03$), social goal motivation ($r = 0.43$, $p = 0.02$), and social value ($r = 0.59$, $p < 0.001$). In contrast, NA was not significantly correlated with past goal progress ($r = -0.07$, $p = 0.73$), social goal motivation ($r = -0.16$, $p = 0.40$), or social value ($r = -0.32$, $p = 0.08$).

Table 2

Demographics and clinical characteristics.

Demographics	N = 30
Male / Female / Other (n, %)	15 (50%) / 14 (47%) / 1 (3%)
Schizophrenia / Schizoaffective Disorder (n, %)	16 (53%) / 14 (47%)
Non-Hispanic White (n, %)	13 (43%)
Black (n, %)	5 (17%)
Asian (n, %)	8 (27%)
Multiple/Other (n, %) ¹	1 (3%)
Hispanic (n, %) ¹	2 (7%)
Age (M, SD; Range)	46.90 (10.64; 22–65)
% Goal Category ²	15 (50%) Friendship / 11 (37%) Family / 4 (13%) Romantic
Baseline BPRS Positive Symptoms (M, SD)	2.47 (0.68)
Baseline CAINS-MAP (M, SD)	1.60 (0.69)
Baseline QLS-IR (M, SD)	2.68 (1.34)
Baseline SFS Scaled Score (M, SD)	107.51 (7.73)

¹ Not mutually exclusive with other race/ethnicity categories.

² See Fulford et al., 2021 for description of specific goals within each category.

¹ One participant included in these analyses was excluded from the sample reported in Fulford et al., 2021 because they did not complete any follow-up assessment procedures.

Table 3
Internal consistency of emotion items (between-subjects).

Affect	Emotion Items	<i>M</i> (<i>SD</i>)	Cronbach's Alpha
Positive Affect	Happy	2.20 (0.85)	0.88
	Excited	1.84 (1.04)	
	Calm	2.25 (1.06)	
Negative Affect	Sad	0.66 (0.67)	0.94
	Anxious	0.73 (0.70)	
	Angry	0.47 (0.57)	

Table 4
Overall means for EMA items.

EMA Items	<i>M</i> (<i>SD</i>) [Response Range]
Number of Interactions	1.79 (0.76) [0–3]
Past Goal Progress	1.73 (0.93) [0–4]
Social Goal Motivation	2.44 (0.84) [0–4]
Social Value	2.08 (0.59) [0–3]

In examining correlations between momentary affect related to social interactions and clinical measures at baseline, PA was not significantly correlated with positive symptoms ($r = -0.32$, $p = 0.09$), negative symptoms ($r = 0.10$, $p = 0.61$), or social functioning (QLS-IR: $r = 0.14$, $p = 0.46$; SFS Scaled Score: $r = 0.21$, $p = 0.26$). NA showed a moderate (marginally significant), positive association with positive symptoms ($r = 0.36$, $p = 0.05$) but was unrelated to negative symptoms ($r = 0.05$, $p = 0.80$) or social functioning (QLS-IR: $r = 0.04$, $p = 0.86$; SFS Scaled Score: $r = -0.25$, $p = 0.19$).

2.4. Momentary associations between affect and social motivation and behavior

All person-level intraclass correlations (ICC) for each model were > 0.10 , indicating sufficient interdependence of responses to necessitate multilevel analyses. Approximately 52% of the observations were missing (1882 out of a possible 3600).

First, we examined whether PA or NA (as outcomes in separate models) changed across the intervention using time point (of a possible 120 EMA signals across 60 days) as the within-subjects Level 1 predictor. Neither PA ($b = -0.0017$, $SE = 0.00099$, $p = 0.10$) nor NA ($b = -0.00024$, $SE = 0.0012$, $p = 0.84$) significantly changed over the course of the intervention. For all subsequent analyses, time point was included as a covariate at Level 1 (results not reported).

We examined three separate models with different outcomes (past goal progress, social goal motivation, and social value). Level 1 predictors included time point and positive and negative affect in each model. Between-subjects (grand-mean centered) and within-subjects (group-mean centered) results are reported for each model. See Table 5 for results for between-subjects effects and Table 6 for within-subjects effects for each model.

Between- and within-subjects effects were similar to one another and similar to across-participant correlations reported earlier. Overall, PA was associated with greater past goal progress, social goal motivation, and social value. In other words, the more PA participants in general and individuals reported from recent social interactions, the more progress

Table 5
Between-subjects multilevel model results for PA and NA predicting past goal progress, social goal motivation, and social value.

Outcome	Positive Affect		Negative Affect	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
Past Goal Progress	0.40*	0.068	-0.13	0.077
Social Goal Motivation	0.26*	0.056	0.06	0.038
Social Value	0.22*	0.028	-0.21*	0.038

Note. * $p < 0.001$.

Table 6
Within-subjects multilevel model results for PA and NA predicting past goal progress, social goal motivation, and social value.

Outcome	Positive Affect		Negative Affect	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
Past Goal Progress	0.38*	0.066	-0.14	0.085
Social Goal Motivation	0.20*	0.039	0.04	0.026
Social Value	0.22*	0.027	-0.20*	0.036

Note. * $p < 0.001$.

they reported making on their social goal, the more social motivation they reported towards their goal, and the more social value they reported from prior social interactions. NA was associated with lower social value; in other words, the more NA people in general and individuals experienced from recent social interactions, the less social value they reported on recent social interactions. NA did not significantly predict past goal progress or social goal motivation when PA was included in the model (p values > 0.10).

3. Discussion

This is the first study to examine associations between affect related to social interactions and social goal progress and motivation in daily life in schizophrenia. Participants in general reported more PA than NA related to recent social interactions. These results are in line with previous research showing that people with schizophrenia report an increase in PA during social interactions in daily life (Mote and Fulford, 2020). PA and NA related to social interactions predicted social value across and within participants, facets of social motivation that improved significantly during the MASS intervention (Fulford et al., 2021). This suggests that both PA and NA in response to social interactions are crucial in understanding the value one assigns to these interactions in terms of social performance and worthwhileness. Clearly assessing the beliefs one has regarding their ability to make and maintain social connections as well as the emotions related to those beliefs may be necessary for clinicians to understand which specific emotions from social experiences are critical to address for specific patients in specific contexts. For example, there may be patients who believe they communicate poorly with others who need initial help addressing negative emotions (such as anger and sadness) before they can pursue future social interactions, while other patients with similar beliefs may benefit more from attempting to capitalize on existing positive emotions (such as hope) in pursuit of their social goals.

In our results, only PA (not NA) predicted social goal progress and motivation towards the specific goal that participants were working towards within the context of the intervention. For example, for every one unit increase in positive affect an individual experienced from a recent social interaction, there was a 0.20-unit increase in motivation towards a specific social goal. While PA and NA may be related to aspects of social motivation such as social value, PA experienced from social interactions may have a more direct impact on specific behaviors towards and/or in-the-moment experiences of motivation for specific goals. PA may be part of an important feedback loop for people with schizophrenia in terms of social experiences and motivation: The more PA one experiences from social interactions, the more they will make progress towards their social goals, resulting potentially in more positive interactions in the future. Therapeutic strategies such as helping people with schizophrenia reappraise social interactions as more positive, savor past and present positive experiences with others, and/or focus on what they are looking forward to in relation to completing their social goals could increase PA specific to social experiences in this population. These strategies could further help people with schizophrenia seek out more opportunities to experience PA in response to future social interactions, simultaneously allowing them more opportunities to improve their appraisals of social performance and beliefs around the utility of social

interactions altogether.

PA may be a more modifiable treatment target for people with schizophrenia compared to NA, particularly related to social experiences. As previously discussed, people with schizophrenia report more trait NA, more NA in daily life, and more NA than what would be expected in the presence of putatively positive experiences (Cho et al., 2017; Horan et al., 2008; Mote and Kring, 2019), suggesting the stability of NA for people with schizophrenia. Rather than focus on reducing NA, which may be particularly intractable for the majority of this population, clinicians may get “more bang for their buck” by amplifying the positives in helping people with schizophrenia both improve their ability to accomplish their social goals as well as improve broad and specific aspects of social motivation.

One limitation in the current study is that we did not compare social with nonsocial affective experiences (emotions experienced outside of the context of social interactions). It is possible that our findings were not specific to social interactions but instead reflected broader affective experiences in our sample. Future studies should compare social with nonsocial affective experiences in daily life to compare differences in these experiences in people with schizophrenia and their potentially independent relationships with social motivation. We also asked participants to report on emotions experienced from social interactions that occurred in the previous few hours (versus at the time of responding to EMA prompts); thus, there may have been some retrospective reporting bias on affective experiences in participant responses. Additionally, while we made attempts to incorporate positive and negative emotions that varied in arousal/activation in our composite affect measures, it is possible that there are specific negative emotions that may be more strongly related to social goal progress and motivation than the ones we included (anxiety, anger, sadness). For example, boredom and loneliness were two negative emotions we did not assess in our study that are elevated in people with schizophrenia and related to motivational and functional impairment (Fulford and Holt, 2023; Gerritsen et al., 2015; Todman, 2003). Future studies should include these and other emotions, both positive and negative, to better understand which specific affective experiences may be particularly relevant for improving social motivation in this population.

Participants in our study volunteered for an intervention intended to improve social functioning; thus, they were likely more socially motivated at baseline compared to participants who were uninterested in improving their social lives. Additionally, due to the unique nature of data collection occurring within the context of an intervention designed to improve social functioning, these results may not replicate in a non-intervention context. While participants could choose a social goal in the intervention that did not necessitate already having social relationships (e.g., making a new friend or dating), it is still possible that participants in this study had more opportunities for positive social interactions in their daily life compared to other outpatients with schizophrenia. Thus, these results may not be applicable to people with schizophrenia with more severe social functioning or social motivation deficits. Future researchers may wish to assess participants who meet a specific threshold around low social motivation and/or other social functioning impairments. As with any EMA study, participants may have responded to prompts in a non-random fashion (e.g., when they felt more motivated and/or experienced more positive social interactions). Additionally, reporting more PA in response to recent social interactions may have reflected a general positivity bias for some participants, making it more likely for them to also report more progress on their social goal and more motivation for that goal during the same response window. Experimentally manipulating PA and NA in response to social interactions would help better understand the direct effects these different experiences have on one's social lives.

In the context of a mobile health intervention intended to improve social functioning in schizophrenia, PA and NA in response to social interactions were differentially related to different aspects of social motivation. PA specifically was related to both broad and specific

aspects of social motivation as well as social goal progress. Future studies can focus on other social emotional experiences to better understand specific emotions that may be helpful (or detrimental) to social motivation and contexts when the promotion of PA may be a useful treatment target for improving the social lives of people with schizophrenia.

CRediT authorship contribution statement

Jasmine Mote: Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **David E. Gard:** Writing – review & editing, Supervision, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Kim T. Mueser:** Writing – review & editing, Supervision, Methodology, Conceptualization. **Daniel Fulford:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

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Declaration of competing interest

Dr. Fulford serves as a subject matter expert for Click Therapeutics and Boehringer-Ingelheim.

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