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Ecological Momentary Assessment of social functioning in schizophrenia: Impact of performance appraisals and affect on social interactions

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ABSTRACT

Research concerning the complex interplay between factors that contribute to poor social functioning in schizophrenia has been hampered by limitations of traditional measures, most notably the ecological validity and accuracy of retrospective self-report and interview measures. Computerized Ecological Momentary Assessment (EMAc) permits the real-time assessment of relationships between daily life experiences, thoughts, feelings, and behaviors. In the current study, EMAc was used to record daily social interactions, subjective performance appraisals of these interactions (e.g., "I succeeded/failed"; "I was liked/rejected"), and affect in 145 individuals with schizophrenia or schizoaffective disorder. Participants completed electronic questionnaires on a personal digital assistant (PDA) four times per day for one week. Time-lagged multilevel modeling of the data revealed that more positive interaction appraisals at any point in a day were associated with greater positive affect which, in turn, was a strong predictor of more social interactions over subsequent hours. Social functioning, therefore, was linked to positive performance beliefs about social interactions that were associated with greater positive affect. The findings suggest a useful treatment target for cognitive behavioral therapy and other psychosocial interventions that can be used to challenge defeatist beliefs and increase positive affect to enhance social functioning in schizophrenia.

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1. Introduction

Social functioning impairments are observed during the prodromal stages of schizophrenia, often worsen immediately after the first episode, and persist into late life (Robinson et al., 2004). Deficits in social functioning are frequently described as being of primary concern to patients, families, and advocacy groups, and are important predictors of quality of life (Bellack et al., 2007). While current pharmacologic treatments can often reduce psychotic symptom severity, deficits in social functioning typically persist in this population (Robinson et al., 2004). A better understanding of the factors that contribute to deficits in social functioning is, therefore, needed to inform and improve interventions for this population (Bellack et al., 2007).

A variety of factors are associated with real-world functioning deficits in schizophrenia (Brekke et al., 2005; Harvey et al., 2006; Bowie et al., 2008). Neurocognitive deficits are associated with the severity of functional impairment (Green, 1996; Green et al., 2004), but several factors are likely to mediate the relationship between neurocognitive ability and daily life functioning. For example, Grant and Beck (2008) reported that dysfunctional performance beliefs (e.g., failure expectations) and social disinterest attitudes play an important role in determining real-world functioning outcomes. In a path analysis, they found that defeatist beliefs mediated the relationship between neurocognitive impairment and poor functioning in people with schizophrenia, and added significantly to the prediction of functioning above and beyond symptoms. Horan et al. (2010) also used structural equation modeling to identify a significant indirect pathway from functional capacity (which is strongly associated with neurocognition, see Bowie et al., 2006) to dysfunctional attitudes and real-world functioning. We (Granholm et al., 2009; Granholm et al., 2013) previously found that reduction in severity of defeatist performance beliefs and social disinterest attitudes in a cognitive-behavioral therapy intervention was associated with improved functioning in people with schizophrenia.

Social anhedonia and affect have also been linked to social functioning in schizophrenia (Horan et al., 2008). Blanchard et al. (1998), for example, found that greater social anhedonia, reduced positive affect, and increased negative affect were each associated with poor social functioning in people with schizophrenia, but the greatest unique association was found for low positive affect. Gard et al. (2007) also

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showed that people with schizophrenia who endorsed greater positive affect associated with anticipatory pleasure displayed greater social role functioning. Several researchers have suggested that people with schizophrenia may be less motivated to seek out social interaction experiences, because they do not anticipate that these experiences will be pleasurable (Kring and Caponigro, 2010; Cohen et al., 2011; Strauss and Gold, 2012). Positive affect that is linked to positive beliefs about social experiences, therefore, may be associated with better social functioning in people with schizophrenia.

According to the social-functional approach to emotion, emotions serve to coordinate interactions that both form and maintain interpersonal relationships (Ekman, 1992; Frijda and Mesquita, 1994; Keltner and Kring, 1998). That is, emotions motivate behaviors in the interest of social bonding (e.g., Bowlby, 1969; Buss, 1992). Positive emotions, such as laughter and smiling, evoke tendencies toward social affiliation (Keltner and Bonanno, 1997). Most relevant to the current study, research has shown that emotions serve as incentives for interpersonal interaction (Keltner and Kring, 1998). That is, emotional experience provides an ongoing assessment of relationship status, with studies showing that current affect influences evaluations of overall relationship satisfaction (e.g., Keltner et al., 1993). The experience of positive affect, in particular, is associated with self-reported frequency and duration of social interactions and activities (Watson et al., 1992). Thus, it follows logically that disturbances in emotional experience would compromise an individual's perception of current relationships, thereby disrupting social functioning.

Although associations between dysfunctional attitudes, affect and social functioning in schizophrenia have been identified, previous cross-sectional studies do not allow us to draw conclusions about directional effects. In addition, participants in prior studies were typically asked to retrospectively recall and summarize recent activities and subjective states, which are a methodology that has been found to result in exaggerated reports of dysfunction and negative biases in both psychiatric and healthy populations (Stein and Corte, 2003; Ebner-Priemer et al., 2006; Ben-Zeev et al., 2012). Computerized Ecological Momentary Assessment (EMAc) is a powerful longitudinal methodology that avoids these measurement bias problems and provides information about directional effects. EMAc (Stone and Shiffman, 1994; Shiffman et al., 2008; Ben-Zeev, 2012) is an assessment strategy in which an electronic signaling device (e.g., smart phone or personalized digital assistant, or PDA) asks participants to complete self-report questionnaires in real-time, real-world environments multiple times per day. EMAc data are more ecologically valid than those collected in laboratory or artificial settings (Csikszentmihalyi and Larson, 1987) because the possibility for recall biases associated with delayed or aggregate self-reporting is greatly decreased (Scollon et al., 2003; Myin-Germeys et al., 2009). Data collected in EMAc studies reflect one's immediate state within the context and flow of daily experience (deVries, 1987). EMAc has been used in a number of studies of people with psychotic disorders (Oorschot et al., 2009), and has recently been shown to be a feasible and valid data collection strategy in community-dwelling people with schizophrenia (Granholm et al., 2008; Johnson et al., 2009).

The purpose of the current study was to use EMAc methods to examine relationships among social interaction appraisals, affect, and social functioning in the daily lives of people with schizophrenia or schizoaffective disorder. We used EMAc to sample social functioning (i.e., number of recent social interactions), social interaction appraisals (e.g., perceptions of the success of these interactions) and momentary affect (i.e., happiness, anxiety, sadness) four times per day for one week. Based on the literature discussed above and a model we proposed describing the risk factors associated with poor social functioning in schizophrenia (Granholm et al., 2009), we hypothesized that: (a) positive social interaction appraisals would be associated with positive affect, and (b) positive social interaction appraisals and positive affect would predict a greater number of social interactions in the future.

2. Methods

2.1. Participants

This study was approved by the Institutional Review Board for the University of California, San Diego. Participants in the current study were recruited from a larger study examining the effects of a psychosocial treatment for individuals with schizophrenia or schizoaffective disorder. The following inclusion/exclusion criteria from that parent trial were: Age 18 years or older, no social skills training or cognitive behavioral therapy interventions in the past 5 years, and level of care required does not interfere with outpatient group therapy participation (e.g., partial or inpatient hospitalization for psychiatric, acute substance use, or physical illness). One hundred eighty-three people with schizophrenia or schizoaffective disorder in the community participated in this study. Thirteen enrolled individuals did not complete the study due to mechanical problems with the devices (7%), and an additional 25 participants (13%) were excluded for not achieving minimum compliance in responding to questionnaires, defined as the equivalent of at least two days of ambulatory monitoring (8 questionnaires).

The final sample included 145 individuals with a mean age of 46.5 years (SD = 11.2) and 12.4 years of education (SD = 2.1). Participants were 61% male, 60% Caucasian, 15% African-American, 14% Hispanic, 11% other ethnicities, and 40% resided in assisted living facilities ("board and care"). Participants experienced moderate symptom severity (PANSS total score: M = 66.77, SD = 17.11; PANSS positive symptom score: M = 18.26, SD = 6.04; PANSS negative symptom score: M = 15.26, SD = 5.69).

2.2. Procedures

Following informed consent, researchers assessed participants using the Structured Clinical Interview for DSM-IV (SCID-I/P, version 2.0; First et al., 1995) to verify diagnoses of schizophrenia or schizoaffective disorder. Following this interview, participants completed an extensive baseline battery of laboratory-based measures, including the Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987) and Beck Depression Inventory — II (BDI-II; Beck et al., 1996), as well as other measures not relevant to this report. Assessors received training using videotape and practice interviews and did not complete assessments until achieving at least .80 inter-rater reliability. Inter-rater reliability (interclass correlation) was .88 for PANSS total. Researchers then provided 45-minutes of training in the use of a PDA to answer questionnaires and participants completed questionnaires with guidance until they could do so without assistance. The question content and format, as well as the ambulatory sampling schedules, were validated in a subsample ($n = 56$) of current participants (Granholm et al., 2008). Researchers also provided written information about sampling procedures and battery charging, a carrying pack, and a pager number to call in case of questions or to troubleshoot technical problems. Participants were paid $35 when they returned the PDA.

The PDAs were programmed to administer four electronic interviews per day for seven days. A modified version of the Purdue Momentary Assessment Tool version 2.1.2 (Weiss et al., 2004) was used in the PDA programming. This tool provides time stamps for all data entries and permits responses only within a 15-minute period following an alarm signal. Alarm signals occurred within each of the following time periods: 9:00 am to 12:00 pm; 12:00 pm to 3:00 pm; 3:00 pm to 6:00 pm; and 6:00 pm to 9:00 pm. The assessment times were fixed for each participant but randomized across participants. Participants reported no changes in their usual activities due to PDA use during pilot testing, and there was no correlation between missing data or variable frequency or intensity with time in the study (Swendsen et al., 2011). For the current analyses, seven items were selected from a larger EMAc questionnaire

Table 1
EMAc questionnaire items.

SOCIAL FUNCTIONING	RESPONSES (BOX CHECK)
Since the last questionnaire, about how many times did you talk or communicate with someone else?	☐ 0 (you had no interactions) ☐ 1 interaction ☐ 2 or 3 interactions ☐ 4 or more interactions
SOCIAL INTERACTION APPRAISALS	**RESPONSES (VISUAL ANALOG)**
The following questions concern these interactions you had with other people	
To what degree do you think these interactions were worth the effort it took to have them?	1 ⟷ 7 Too hard; not worth trying ⟷ Well worth the Effort
How well do you think you communicated?	1 ⟷ 7 Made mistakes and failed ⟷ I did well and succeeded
What do you think other people thought of you?	1 ⟷ 7 Unlikable, stupid or weird ⟷ Likable, smart, interesting
AFFECT	**RESPONSES (VISUAL ANALOG)**
How happy do you feel right now?	1 ⟷ 7 Not at all happy ⟷ Extremely happy
How sad do you feel right now?	1 ⟷ 7 Not at all sad ⟷ Extremely sad
How anxious do you feel right now?	1 ⟷ 7 No at all anxious ⟷ Extremely anxious

Table 2
Means and distribution of EMAc variables.

EMAc variable	Mean	SD	Min	Max
Number of social interactions[a]	1.66	1.01	0.00	3.00
Worthwhile interaction	5.05	1.61	1.00	7.00
Successful interaction	4.97	1.64	1.00	7.00
Likable interaction	4.82	1.69	1.00	7.00
Average of 3 cognitions	4.94	1.45	1.00	7.00
Happy	4.56	1.67	1.00	7.00
Sad	2.55	1.64	1.00	7.00
Anxious	2.69	1.70	1.00	7.00

[a] Mean number since the last alarm coded as 0 (no interactions), 1 (one interaction only), 2 (two or three interactions), 3 (four or more interactions).

(see Granholm et al., 2008). These items included questions assessing the number of social interactions since the last alarm, and appraisals of these interactions, which were based on items from the Defeatist Performance Attitude Subscale of the Dysfunctional Attitude Scale (Cane et al., 1986), and current affect (see Table 1). Participants were not asked for appraisals of social interactions if they did not have any since the last alarm.

2.3. Analyses

Cross-sectional and prospective within-day associations among affect, social interactions, and social interaction appraisals were analyzed using Hierarchical Linear and Nonlinear Models 6.03 (Raudenbush et al., 2005). The EMAc data were also time-lagged so that affect or appraisals at any given assessment (T0) predicted the frequency or intensity of outcome variables at the subsequent assessment on the same day (T1). Lagged data were then analyzed using intercepts-and-means-as-outcome models where the γ coefficients represent the pooled within-person associations between a predictor (e.g., affect) and the later-occurring outcome (e.g., number of social interactions).

3. Results

Over the week-long assessment period, participants responded on average to 72.1% (SD = 19.1%) of all programmed electronic interviews, thereby generating 2737 observations of daily life experiences. Table 2 presents the means, standard deviation and ranges for the EMAc variables. The frequency of social interactions experienced during the week did not vary by age ($\gamma = 0.003$, SE = 0.005, $t = 0.622$, $p > .05$), or by sex ($\gamma = -0.139$, SE = 0.100, $t = -1.390$, $p > .05$). Similarly, age and sex were not associated with the average intensity of happy, sad or anxious affect, and they were not associated with any of the appraisals of social interactions.

3.1. Cross-sectional associations

As shown in Table 3, strong associations were observed between the different appraisals of social interactions and affect when assessed during the same questionnaire time point. These cross-sectional associations were strongest for happiness (positive affect), with greater happiness associated with recent social interactions appraised as more worthwhile and successful and being perceived by others as likable, smart and interesting. Sadness was uniformly negatively associated with each of these social interaction appraisals, while somewhat more attenuated negative associations were observed for anxiety. Two-level interactions were also examined for these significant associations by age and sex. No significant effects were found involving age. Only two significant effects were observed involving sex whereby men demonstrated stronger positive associations than women between appraisals of being well perceived and happiness ($\gamma = 0.166$, SE = 0.063, $t = 2.645$, $p < .01$), as well as stronger negative associations between appraisals that social interactions were worthwhile and anxiety ($\gamma = -0.121$, SE = 0.061, $t = -1.983$, $p < .05$).

3.2. Prospective associations

The primary question we sought to answer in this study was whether social interaction appraisals and affect at one time point predicted the presence of social interactions at the next time point. Thus, the capacity of affect or appraisals of recent social interactions at one time point (T0) to predict new social interactions at a time point later in the day (T1) was examined through lagged analyses (i.e., across two consecutive electronic assessments, each separated by an average delay of 3 h). Among all EMAc variables examined, only happiness significantly predicted the number of social interactions experienced at the next interview (see Table 4). This effect remained significant when controlling for previous (T0) social interactions, and there were no significant effects of age, sex, or baseline symptoms of depression. Current level of socialization (T0) also

Table 3
Cross-sectional associations of social interaction appraisals and affect.

Appraisals of social interaction	Happy				Sad				Anxious			
	Coeff	SE	t-Ratio	p	Coeff	SE	t-Ratio	p	Coeff	SE	t-Ratio	p
Worthwhile interaction	0.338	0.031	10.762	0.000	−0.169	0.038	−4.468	0.000	−0.069	0.031	−2.266	0.023
Successful interaction	0.272	0.035	7.691	0.000	−0.135	0.032	−4.151	0.000	−0.120	0.031	−3.842	0.000
Well perceived in interaction	0.385	0.035	10.982	0.000	−0.172	0.039	−4.447	0.000	−0.038	0.040	−0.966	0.335
Average of 3 appraisals	0.540	0.039	13.872	0.000	−0.262	0.050	−5.256	0.000	−0.121	0.046	−2.644	0.009

Table 4
Prospective associations of T0 affect and social interaction appraisals with T1 social interactions.

T0 affect and appraisals of social interaction	New social interactions T1			
	Coeff	SE	t-Ratio	p
Happy[a]	0.057	0.020	2.872	0.005
Sad	−0.000	0.017	−0.005	0.996
Anxious	0.021	0.022	0.952	0.342
Worthwhile interaction	0.015	0.023	0.621	0.534
Successful interaction	−0.024	0.023	−1.049	0.295
Well perceived in interaction	0.035	0.022	1.590	0.112
Average of 3 appraisals	0.013	0.028	0.450	0.652

[a] This effect remained significant when controlling for previous (T0) social interactions.

was not significantly associated with future positive affect (T1), $\gamma = -0.062$, SE = 0.069, $t = -0.901$, $p = 0.368$, so positive affect predicted future socialization but socialization did not predict future positive affect. Number of social interactions also did not differ significantly between participants in assisted (M = 1.677, SD = 0.575) and non-assisted (M = 1.688, SD = 0.675) housing, $\gamma = 0.056$, SE = 0.117, $t = 0.477$, $p = 0.634$ (model controlled for age and sex).

4. Discussion

Impaired social functioning is a key characteristic of schizophrenia. Factors related to social cognition (e.g., defeatist performance beliefs), negative symptoms (e.g., social anhedonia) and affect may contribute to social functioning deficits in schizophrenia (Blanchard et al., 1998; Grant and Beck, 2008; Horan et al., 2008, 2010; Kring and Caponigro, 2010; Strauss and Gold, 2012). In the current study, we examined daily social interactions, subjective appraisals of these interactions, and affect in individuals with schizophrenia or schizoaffective disorder using EMAc. Findings revealed that positive social interaction appraisals at a given time of day were concurrently associated with significantly greater positive, and less negative, affect. Time-lagged multilevel modeling of the EMAc questionnaire data revealed that positive affect (i.e., happiness) at a given time of day predicted the number of social interactions later in the day.

The associations found between positive affect, but not negative affect, and social functioning are consistent with findings of previous studies (e.g., Blanchard et al., 1998; Brown et al., 2007; Gard et al., 2007). Although social interaction appraisals were strongly related to affect at a given time point, contrary to our predictions, we did not find a direct relationship between social interaction appraisals and future social interactions. That is, positive affect was the sole predictor of future social interactions when these relationships were modeled prospectively. This pattern of results suggests that the impact of appraisals on social functioning is indirect and mediated by their strong association with affect. One possible explanation for this pattern of results is that positive performance beliefs about the success of recent social interactions result in the subjective experience of positive affect, which reinforces interactions and motivates engagement in future interactions. That is, cognitive appraisals of social interactions are insufficient in and of themselves to motivate engagement in future interactions, but can contribute to the emergence of subjective affective experiences that play a more essential role in motivating real-world social functioning in individuals with schizophrenia. Negative social appraisals and defeatist performance beliefs may preclude the experience of positive affect and, thus, provide no reward for social engagement.

This interpretation is consistent with research showing that emotions can serve as incentives for interpersonal interaction (Ekman, 1992; Frijda and Mesquita, 1994; Keltner and Kring, 1998). The experience of positive affect, in particular, is associated with self-reported frequency and duration of social interactions and activities (Watson et al., 1992). Other researchers have also suggested that negative appraisals about future social experiences may reduce positive emotions and motivation to seek out new social experiences (Kring and Caponigro, 2010; Strauss and Gold, 2012). Research on affect in schizophrenia has shown that this population does indeed experience affect at similar levels as healthy controls, though they may lack the experience of *anticipatory* affect (Kring and Moran, 2008; Kring and Caponigro, 2010; Cohen et al., 2011; Strauss and Gold, 2012; Oorschot et al., 2013). That is, consumers with schizophrenia report less positive affect in anticipation of rewarding experiences, even though they experience similar levels of affect while experiencing pleasure in the moment (*consummatory* affect). Although anticipatory affect was not measured in the current study per se, we found that consummatory affect associated with negative appraisals about recent interactions was predictive of future social functioning.

This study had several limitations and alternative explanations for the above findings should be mentioned. It is possible, for example, that a lack of positive affect may simply be a proxy for depression, and thus those who were more depressed at baseline would be less likely to both report positive affect and interact with others. We tested this possibility by controlling for baseline self-reported depressive symptoms (BDI-II) in the statistical models. The addition of depressive symptoms did not appreciably change the findings. We also found that happiness, but not sadness, was a significant predictor of future social interactions. Another limitation of the study was that the EMA self-reports of emotional experiences required emotional awareness. A substantial proportion of consumers with schizophrenia have poor emotional awareness, which has been linked to social dysfunction (Kimhy et al., 2012). Future EMA research examining emotional experiences in schizophrenia should include a measure of emotional awareness. We also did not collect information about the extent of social networks, so we could not examine whether the pattern of results was related to greater opportunities for socializing afforded by larger social networks. Finally, it may have been difficult for participants to make appraisals if participants had multiple interactions since the last alarm (e.g., one interaction might have been more successful than others), but this did not occur often, as the average number of interactions being rated was less than 2 (M = 1.66). One way to avoid this in future research is to only ask for appraisals of interactions in the moment (occurring now), rather than over the past few hours, although this approach will not capture all interactions. Related to this, future research might ask for expectations about possible future interactions when participants are alone. This would be a way of examining the impact of failure expectancies and anticipatory anhedonia on the probability of future interactions.

Despite these limitations, findings from the current study suggest a useful treatment target for cognitive behavioral therapy and other psychosocial interventions that can be used to challenge defeatist beliefs and increase positive affect to enhance social functioning in schizophrenia. Interventions should use cognitive-behavioral strategies to challenge inaccurate defeatist attitudes and social disinterest and perhaps emphasize behavioral assignments that connect meaningful rewards with socialization. For example, skills training could be used to help the individual pay more attention to, or even solicit, these rewards from others (e.g., positive feedback) and thereby increase the likelihood of socializing in the future.

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Contributors
E. Granholm obtained funding for the study, supervised study procedures, and contributed to study design and manuscript preparation. J. Swendsen contributed to study design, data analysis, and manuscript preparation. D. Ben-Zeev and D. Fulford contributed to manuscript preparation. All authors have approved the final manuscript.

Conflict of interest

The authors report no conflict of interest.

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References

Beck, A.T., Steer, R.A., Brown, G.K., 1996. Manual for Beck Depression Inventory II (BDI-II). Psychology Corporation, San Antonio.

Bellack, A.S., Green, M.F., Cook, J.A., Fenton, W., Harvey, P.D., Heaton, R.K., et al., 2007. Assessment of community functioning in people with schizophrenia and other severe mental illnesses: a white paper based on an NIMH-sponsored workshop. Schizophr. Bull. 33 (3), 805–822.

Ben-Zeev, D., 2012. Mobile technologies in the study, assessment, and treatment of schizophrenia. Schizophr. Bull. 38 (3), 384–385.

Ben-Zeev, D., McHugo, G., Xie, H., Dobbins, K., Young, M.A., 2012. Comparing retrospective reports to real-time/real-place mobile assessments in individuals with schizophrenia and a nonclinical comparison group. Schizophr. Bull. 38 (3), 396–404.

Blanchard, J.J., Mueser, K.T., Bellack, A.S., 1998. Anhedonia, positive and negative affect, and social functioning in schizophrenia. Schizophr. Bull. 24 (3), 413–424.

Bowie, C.R., Reichenberg, A., Patterson, T.L., Heaton, R.K., Harvey, P.D., 2006. Determinants of real-world functional performance in schizophrenia subjects: correlations with cognition, functional capacity, and symptoms. Am. J. Psychiatry 163 (3), 418–425.

Bowie, C.R., Leung, W.W., Reichenberg, A., McClure, M.M., Patterson, T.L., Heaton, R.K., Harvey, P.D., 2008. Predicting schizophrenia patients' real-world behavior with specific neuropsychological and functional capacity measures. Biol. Psychiatry 63, 505–511.

Bowlby, J., 1969. Attachment. Basic Books, New York.

Brekke, J., Kay, D.D., Lee, K.S., Green, M.F., 2005. Biosocial pathways to functional outcome in schizophrenia. Schizophr. Res. 80 (2–3), 213–225.

Brown, L.H., Silvia, P.J., Myin-Germeys, I., Kwapil, T.R., 2007. When the need to belong goes wrong: the expression of social anhedonia and social anxiety in daily life. Psychol. Sci. 18 (9), 778–782.

Buss, D., 1992. Male preference mechanisms: consequences for partner choice and intrasexual competition. In: Barkow, J.H., Cosmides, L., Tooby, J. (Eds.), The Adapted Mind. Oxford University Press, New York, pp. 267–288.

Cane, D.B., Olinger, L.J., Gotlib, I.H., Kuiper, N.A., 1986. Factor structure of the dysfunctional attitude scale in a student population. J. Clin. Psychol. 42 (2), 307–309.

Cohen, A.S., Najolia, G.M., Brown, L.A., Minor, K.S., 2011. The state-trait disjunction of anhedonia in schizophrenia: potential affective, cognitive and social-based mechanisms. Clin. Psychol. Rev. 31 (3), 440–448.

Csikszentmihalyi, M., Larson, R., 1987. Validity and reliability of the experience-sampling method. J. Nerv. Ment. Dis. 175 (9), 526–536.

deVries, M.W., 1987. Investigating mental disorders in their natural settings. J. Nerv. Ment. Dis. 175 (9), 509–513.

Ebner-Priemer, U.W., Kuo, J., Welch, S.S., Thielgen, T., Witte, S., Bohus, M., et al., 2006. A valence-dependent group-specific recall bias of retrospective self-reports: a study of borderline personality disorder in everyday life. J. Nerv. Ment. Dis. 194 (10), 774–779.

Ekman, P., 1992. An argument for basic emotions. Cogn. Emot. 6, 169–200.

First, M.B., Spitzer, R.L., Gibbon, M., Williams, J.B.W., 1995. Structured Clinical Interview for DSM-IV Axis I Disorders—Patient Edition (SCID-I/P), Version 2.0. Biometrics Research, New York.

Frijda, N.H., Mesquita, B., 1994. The social roles and functions of emotions. In: Kitayama, S., Marcus, H. (Eds.), Emotion and Culture: Empirical Studies of Mutual Influenced. American Psychological Association, Washington, DC, pp. 51–87.

Gard, D.E., Kring, A.M., Gard, M.G., Horan, W.P., Green, M.F., 2007. Anhedonia inschizophrenia: distinctions between anticipatory and consummatory pleasure. Schizophr. Res. 93 (1–3), 253–260.

Granholm, E., Loh, C., Swendsen, J., 2008. Feasibility and validity of computerized and ecological momentary assessment in schizophrenia. Schizophr. Bull. 34 (3), 507–514.

Granholm, E., Ben-Zeev, D., Link, P.C., 2009. Social disinterest attitudes and group cognitive-behavioral social skills training for functional disability in schizophrenia. Schizophr. Bull. 35 (5), 874–883.

Granholm, E., Holden, J., Link, P.C., McQuaid, J.R., Jeste, D.V., 2013. Randomized controlled trial of cognitive behavioral social skills training for older consumers with schizophrenia: defeatist performance attitudes and functional outcome. Am. J. Geriatr. Psychiatry 21, 251–262.

Grant, P.M., Beck, A.T., 2008. Defeatist beliefs as a mediator of cognitive impairment, negative symptoms, and functioning in schizophrenia. Schizophr. Bull. 35 (4), 798–806.

Green, M.F., 1996. What are the functional consequences of neurocognitive deficits in schizophrenia? Am. J. Psychiatry 153, 321–330.

Green, M.F., Kern, R.S., Heaton, R.K., 2004. Longitudinal studies of cognition and functional outcome in schizophrenia: implications for MATRICS. Schizophr. Res. 72 (1), 41–51.

Harvey, P.D., Koren, D., Reichenberg, A., Bowie, C.R., 2006. Negative symptoms and cognitive deficits: what is the nature of their relationship? Schizophr. Bull. 32 (2), 250–258.

Horan, W.P., Blanchard, J.J., Clark, L.A., Green, M.F., 2008. Affective traits in schizophrenia and schizotypy. Schizophr. Bull. 34 (5), 856–874.

Horan, W.P., Rassovsky, Y., Kern, R.S., Lee, J., Wynn, J.K., Green, M.F., 2010. Further support for the role of dysfunctional attitudes in models of real-world functioning in schizophrenia. J. Psychiatr. Res. 44 (8), 499–505.

Johnson, E.I., Grondin, O., Barrault, M., Faytout, M., Helbig, S., Husky, M., et al., 2009. Computerized ambulatory monitoring in psychiatry: a multi-site collaborative study of acceptability, compliance, and reactivity. Int. J. Methods Psychiatr. Res. 18 (1), 48–57.

Kay, S.R., Fiszbein, A., Opler, L.A., 1987. The positive and negative syndrome scale (PANSS) for schizophrenia. Schizophr. Bull. 13 (2), 261–276.

Keltner, D., Bonanno, G.A., 1997. A study of laughter and dissociation: the distinct correlates of laughter and smiling during bereavement. J. Pers. Soc. Psychol. 73, 687–702.

Keltner, D., Kring, A.M., 1998. Emotion, social function, and psychopathology. Rev. Gen. Psychol. 2 (3), 320–342.

Keltner, D., Locke, K.D., Audrain, P.C., 1993. The influence of attributions on the relevance of negative emotions to personal satisfaction. Pers. Soc. Psychol. Bull. 19, 21–29.

Kimhy, D., Vakhrusheva, J., Jobson-Ahmed, L., Tarrier, N., Malaspina, D., Gross, J., 2012. Emotion awareness and regulation in individuals with schizophrenia: implications for social functioning. Psychiatry Res. 200 (2–3), 193–201.

Kring, A.M., Caponigro, J.M., 2010. Emotions in schizophrenia: where feeling meets thinking. Curr. Dir. Psychol. Sci. 19 (4), 255–259.

Kring, A.M., Moran, E.K., 2008. Emotional response deficits in schizophrenia: insights from affective science. Schizophr. Bull. 34 (5), 819–834.

Myin-Germeys, I., Oorschot, M., Collip, D., Lataster, J., Delespaul, P., van Os, J., 2009. Experience sampling research in psychopathology: opening the black box of daily life. Psychol. Med. 39 (9), 1533–1547.

Oorschot, M., Kwapil, T., Delespaul, P., Myin-Germeys, I., 2009. Momentary assessment research in psychosis. Psychol. Assess. 21 (4), 498–505.

Oorschot, M., Lataster, T., Thewissen, V., Lardinois, M., Wichers, M., van Os, J., et al., 2013. Emotional experience in negative symptoms of schizophrenia—no evidence for a generalized hedonic deficit. Schizophr. Bull. 39 (1), 217–225.

Raudenbush, S., Bryk, A., Congdon, R., 2005. HLM for Windows, Version 6.03. Scientific Software International, Chicago.

Robinson, D.G., Woerner, M.G., McMeniman, M., Mendelowitz, A., Bilder, R.M., 2004. Symptomatic and functional recovery from a first episode of schizophrenia or schizoaffective disorder. Am. J. Psychiatry 161 (3), 473–479.

Scollon, C.N., Kim-Prieto, C., Diener, E., 2003. Experience sampling: promises and pitfalls, strengths and weaknesses. J. Happiness Stud. 4 (1), 5–34.

Shiffman, S., Stone, A.A., Hufford, M.R., 2008. Ecological momentary assessment. Annu. Rev. Clin. Psychol. 4, 1–32.

Stein, K.F., Corte, C.M., 2003. Ecologic momentary assessment of eating-disordered behaviors. Int. J. Eat. Disord. 34 (3), 349–360.

Stone, A.A., Shiffman, S., 1994. Ecological momentary assessment (EMA) in behavioral medicine. Ann. Behav. Med. 16 (3), 199–202.

Strauss, G., Gold, J., 2012. A new perspective on anhedonia in schizophrenia. Am. J. Psychiatry 169 (4), 364–373.

Swendsen, J., Ben-Zeev, D., Granholm, E., 2011. Real-time electronic ambulatory monitoring of substance use and symptom expression in schizophrenia. Am. J. Psychiatry 168 (2), 202–209.

Watson, D., Clark, L.A., Mclntyre, C.W., Hamaker, S., 1992. Affect, personality, and social activity. J. Pers. Soc. Psychol. 63, 1011–1025.

Weiss, H.M., Beal, D.J., Lucy, S.L., MacDermid, S.M., 2004. Constructing EMA Studies with PMAT: The Purdue Momentary Assessment Tool User's Manual.