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Lexical Analysis of Emotional Responses to “Real-World” Experiences in Individuals with Schizophrenia

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Abstract

Abnormalities in emotion perception, expression, and experience are considered a core component of schizophrenia. Previous laboratory studies have demonstrated that while individuals with schizophrenia report levels of positive emotions comparable to healthy individuals in response to positive stimuli, they also report co-occurring negative emotions in response to such stimuli. However, it is unknown whether this response pattern extends to “real world” naturalistic environments. To examine this question, we employed an experience sampling method (ESM) approach using mobile electronic devices to collect information up to 10 times/day over a two-day period from 53 individuals with schizophrenia and 19 non-clinical controls. As part of each experience sample, participants completed brief open-ended responses and answered questions about their emotional responses to three recent events (neutral, positive, and negative). Additionally, participants completed diagnostic and clinical measures. Lexical analyses were used to analyze ESM-based word production and characterize emotion word use. Compared to non-clinical controls, individuals with schizophrenia reported similar levels of positive emotion, but significantly higher negative emotion, which was associated with increased negative symptoms. The schizophrenia group used more anxiety words in response to negative and neutral events, and more anger words in response to positive events. Increased use of anger words was linked with elevations in positive symptoms as well as symptoms of depression, while use of sadness words was linked with anhedonia. Our findings support the co-activation of negative emotion hypothesis

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Contributors

Author DK designed the study. Authors DK and JV managed the literature searches. Authors DK, JV, SK, RC, MH, and LA conducted the study, collected and managed the data, and contributed to the data analysis. Author JV wrote the first draft of the manuscript. Authors JJG and DK significantly revised the manuscript. All authors edited and approved the final version of the manuscript.

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Conflicts of Interest

No authors reported any conflicts of interest.

documented in laboratory settings and provide evidence of its ecological validity. Implications for functioning and future directions are discussed.

Keywords

Schizophrenia; psychosis; emotion; experience sampling; lexical analysis

1. Introduction

Difficulties with emotion perception, expression, and experience have been extensively documented in schizophrenia (SZ) and have been linked with impairments across multiple domains of functioning, including interpersonal and daily functioning (Fervaha et al., 2014), quality of life (Eack and Newhill, 2007), and employment (Ventura et al., 2015). These abnormalities are largely resistant to pharmacological and psychological intervention (Fusar-Poli et al., 2015; Kirkpatrick et al., 2006). An extensive research literature indicates that individuals with SZ display substantial difficulties with the identification, discrimination, and perception of facial expressions in others (Chan et al., 2010; Kohler et al., 2010; Kring and Elis, 2013). In contrast, investigations of emotion experience in individuals with SZ have yielded more equivocal findings. While studies using interview and self-report measures have documented a significant decrease in the ability to experience positive emotions (Andreasen, 1984; Berenbaum and Fujita, 1994; Blanchard et al., 1998) laboratory studies assessing in-the-moment subjective experiences using emotion induction techniques found minimal differences in the ability to experience positive emotions compared to non-clinical controls (NCC; Cohen and Docherty, 2004; Kring and Neale, 1996). Addressing this discrepancy, Horan et al. (2006) suggested that impairment in the ability to encode and retain positive emotional experiences might be responsible for the variable results, such that individuals with SZ are unable to accurately assess previous in-the-moment experiences of pleasure in self-report measures. Similarly, Kimhy and colleagues (2010; 2006) suggested that the use of retrospective self-report measures may hinder the ability of individuals with SZ to accurately document emotional experiences due to common impairments in episodic memory.

To clarify the nature and extent of abnormalities in emotional experience, Cohen and Minor (2010) conducted a meta-analysis that examined 26 laboratory studies assessing experiences of positive and negative emotions in individuals with SZ. They found that while people with SZ report experiencing positive emotions in response to positive and neutral stimuli to a similar degree as NCC, they also report significantly higher levels of co-occurring negative emotion in response to these stimuli. The authors concluded that impairments in the ability of individuals with SZ to inhibit negative emotions may not only be responsible for discrepancies reported in the literature but may also contribute to the clinical manifestation of anhedonia. However, the findings regarding co-occurring negative emotions have been investigated predominantly in laboratory studies using emotion-induction methods, often with participants asked to identify their emotional experience based on a pre-determined and often limited list of emotional responses (Kimhy et al., 2012). Thus, it is unknown whether the results generalize to naturalistic environments in which individuals with SZ would have

to independently generate emotional descriptions, a more difficult task, rather than identify them from a pre-determined list. This issue is critical as previous reports have indicated significant deficits in emotion awareness (i.e., alexithymia) among people with schizophrenia (Kimhy et al., 2012; Kimhy et al., 2014a; van 't Wout et al., 2007), as well as those at clinical high-risk for psychosis (Kimhy et al., 2016).

There has been a growing body of literature attempting to assess emotions in response to daily experiences through experience sampling and narrative analysis (Buck and Penn, 2015; Buck et al., 2015; Cohen et al., 2009a; Gruber and Kring, 2008; Hong et al., 2012; Myin-Germeys et al., 2001; Painter and Kring, 2015; Sanchez et al., 2014). The current study aimed to expand on this work by combining methodologies to examine whether co-occurrence of negative emotions in response to positive and/or neutral events occur during “real-world” daily functioning among individuals with SZ and NCC. Employing an experience sampling method paradigm (ESM; Granholm et al., 2012; Granholm et al., 2008; Kimhy and Corcoran, 2008; Kimhy et al., 2010; Kimhy et al., 2014b; Kimhy et al., 2017), we sampled emotion word production in response to positive, neutral, and negative events as they occur during the course of daily functioning. We then employed lexical analysis to characterize emotion word production during descriptions of these experiences, with emotion data gathered using both open-ended questions and a pre-determined list of emotions. We also examined associations between emotional word production and several clinical variables, including negative symptoms, quality of life, social functioning, and emotion regulation, as some strategies to regulate emotions (expressive suppression, cognitive reappraisal) may impact the degree to which negative emotions are experienced or expressed (Moran et al., 2018).

Thus, the goals of the present study were: 1) To characterize and compare emotion word production among individuals with SZ and NCC in response to positive, negative, and neutral events during daily functioning; and 2) To examine within the SZ group the associations among emotional word production, cognitive reappraisal, emotion suppression, negative symptoms, and social functioning. We hypothesized that individuals with SZ would use more negative emotional words in response to positive and neutral events as compared to NCC. Among individuals with SZ, we expected that greater negative emotional word use across experience types would correlate significantly with increased negative symptoms, including anhedonia, poorer social functioning, and increased use of expressive suppression.

2. Method

2.1 Participants

Fifty-three individuals with SZ and 19 non-clinical control participants (NCC) were recruited at the New York State Psychiatric Institute (NYSPI) at Columbia University Medical Center. Individuals with SZ were recruited from patients treated at the NYSPI or affiliated community mental health clinics. NCC were recruited via advertisements. The inclusion and exclusion criteria for all participants were age 18–55, English speaking, with no diagnosis of intellectual disability. For the SZ group, the inclusion criteria also included a DSM-IV diagnosis of SZ spectrum disorder, and a capacity to give informed consent. For the control group, exclusion criteria included a history of psychosis, a diagnosis of any

DSM-IV Axis-II Cluster A personality disorder, a first-degree family member with history of psychosis, and being adopted. The study was approved by the NYSPI's Institutional Review Board and all participants provided written informed consent.

2.2 Procedure

After signing the informed consent form, participants completed research assessments and the experience sampling protocol within 2–4 weeks of entering the study.

2.3 Measures

Diagnoses were established using the Diagnostic Interview for Genetic Studies (DIGS; Nurnberger et al., 1994), a semi-structured diagnostic interview and medical records review. All participants completed the Wechsler Test of Adult Reading (WTAR; Wechsler, 2001) to assess intellectual functioning. Symptoms assessed included positive and negative symptoms (Scales for the Assessment of Positive and Negative Symptoms; SAPS/SANS; Andreasen, 1983, 1984), depression (Beck Depression Inventory, BDI; Beck et al., 1996) and anxiety (Beck Anxiety Inventory, BAI; Beck and Steer, 1993). Social functioning was indexed by the Provision of Social Relations Scale (PSRS; Turner et al., 1983) and the Quality of Life scale (QOL-16; Burckhardt and Anderson, 2003). The DIGS and SANS/SAPS were administered by clinical research interviewers at Masters' level or above.

Emotion awareness was assessed using the 20-item Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994) and the use of specific emotion regulation strategies (reappraisal, suppression) was assessed using the Emotion Regulation Questionnaire (ERQ; Gross and John, 2003.) To assess momentary experiences of emotions, samples of emotion word production were collected over a two-day period using ESM with mobile devices. The use of this methodology has been described extensively elsewhere (Kimhy and Corcoran, 2008; Kimhy et al., 2010; Kimhy et al., 2006). Briefly, participants were provided with a mobile device (Palm Tungsten T3 computer with the iESP software) to present questions and collect responses. Responses were to be provided manually by typing using the mobile keyboard. Mobile devices were preprogrammed to beep randomly 10 times/day (10am→10pm) to elicit 20 experience samples over the two-day assessment period. Upon hearing the beeps, participants were instructed first to report their current experience using an open-ended response ("When the beep went off, I was thinking about?"; neutral experience prompt), followed by questions using a visual analog scale (VAS; range 0–100) asking participants to rate the degree to which they currently experienced the emotions of happiness, anxiety, anger, and sadness. Next, participants were asked about a recent negative experience ("*Now think about the time when you felt the WORST or MOST NEGATIVE since the last beep. Please describe this negative experience.*") This open-ended assessment was followed-up by VAS questions about experiencing happiness, anxiety, anger, and sadness at the time of the negative experience. Finally, participants were asked about a recent positive experience ("*Now try to remember the time when you felt the MOST POSITIVE since the last beep. Please describe this positive experience.*") Similarly, this open-ended query was followed up by VAS questions about experiencing happiness, anxiety, anger, and sadness at the time of the positive experience. Consistent with previous SZ ESM studies, participants had to complete at least 30% of the experience samples for their data to be included in the analysis.

Three participants from the clinical group were excluded from analysis due to insufficient responses.

Lexical analyses of emotion word production were conducted using the Linguistic Inquiry & Word Count 2007 (LIWC; Pennebaker et al., 2007), a computerized text-analysis software that uses a dictionary to match written speech to specific word categories. LIWC has been validated as a measure of verbal expression of emotion (Kahn et al., 2007) and has previously been used in SZ (Cohen et al., 2009b; St-Hilaire et al., 2008).

2.4 Data Reduction

Lexical analyses were used to analyze ESM-based word production as it occurred during daily functioning. As individual responses were relatively brief, and suggested length for LIWC analysis is a minimum of 25 words (Pennebaker et al., 2015), word production samples collected via ESM were collapsed by event type for each individual participant. The samples were then thoroughly proofread and cleaned by two separate raters according to the LIWC Operator's Manual. Cleaning consisted of adjusting for misspellings and inappropriate word use (its vs. it's, their vs. there, etc.), as well as reviewing abbreviations, contractions, end of sentence markers, hyphens, and commonly used words in written and spoken language (e.g. w/, 'cause, gotta, and/or) that would need to be adjusted in order for LIWC dictionaries to recognize them and analysis to be completed accurately. In cases of raters' disagreement, a consensus was reached by consulting a third rater. Each document was then analyzed using LIWC, which processes the whole text file, comparing one word at a time to a dictionary of over 4,500 words and word stems. LIWC then calculates the percentage of words based on total word use that match a specific category, such as *Total Negative Emotion*, *Total Positive Emotion*, as well as words associated with *anxiety*, *anger*, and *sadness*.

2.5 Statistical Analyses

Statistical analyses were conducted using IBM SPSS Version 22 for macOS. Significance levels were set at $p < .05$. A 2 (group) x 3 (experience type) mixed model ANOVA with age as a covariate was conducted to examine group differences in percentage scores calculated by LIWC in categories associated with emotion word production, followed by post-hoc analyses assessing significant between- and within-group interactions. Welch's t-Test was used to account for unequal sample size between groups. The Holm's Sequential Bonferroni procedure was used to reduce type I error for follow-up pairwise comparisons. Pearson correlations were used to examine the relationship between total negative emotion word production and clinical assessments, as well as associations between emotion expressed through VAS and open-ended prompts.

3. Results

3.1 Sample Characteristics and Compliance

Demographic and clinical characteristics are presented in Table 1. There were no significant differences between the SZ and NCC groups in sex, ethnicity, race, and reading ability. However, the NCC group was significantly younger.

Additionally, the NCC group had significantly higher overall response rate to ESM prompts. Out of the 20 possible prompts, the mean response rate in the NCC group was 17.57 ± 2.67 (range: 11–20; mean words per prompt (MWP): 8.49 ± 3.08) to negative experience prompts, 17.84 ± 2.50 (range: 12–20; MWP: 6.35 ± 2.62) to neutral experience prompts, and 17.68 ± 2.60 (range: 11–20; MWP: 7.90 ± 2.71) to positive experience prompts.

In the SZ group, the response rate to negative experience prompts was 14.41 ± 4.12 (range: 5–20; $p < .001$) and MWP was 8.06 ± 3.81 ($p = \text{n.s.}$), to neutral experience prompts was 14.94 ± 3.91 (range: 5–20; $p = .001$) and MWP was 5.93 ± 3.58 ($p = \text{n.s.}$), and to positive experience prompts was 14.77 ± 3.81 (range: 6–20; $p < .01$) and MWP was 7.28 ± 3.64 ($p = \text{n.s.}$).

3.2 Comparisons of Positive and Negative Emotion Word Production Across Experience Types

Our first aim was to compare the production of positive and negative emotion words across experience types. These results are presented in Table 2. Analysis of variance revealed a significant effect of group on expression of negative emotion across experience types, $F(1,69) = 10.25$, $p = .002$. The SZ group produced significantly higher proportions of negative emotion words across all types of experience, with the highest differences observed when describing positive ($p = .003$) and neutral events ($p = .009$). In contrast, there were no group differences in the expression of positive emotions $F(1,69) = .08$, $p > .05$. There was also no main effect associated with age on either positive or negative emotion expression across experience types. Next, we examined the production of specific negative emotion words between SZ and NCC groups. Results indicated that the former produced significantly more anxiety words in response to negative events ($p = .007$; see Figure 1.). Similarly, when responding to neutral events, the SZ group used significantly more anxiety words ($p = .027$) and sadness words ($p = .005$), with a trend relationship anger words. Finally, when responding to positive events, the SZ group used significantly more anger words ($p = .035$), with a trend relationship for sadness words ($p = .10$).

3.3 Association of Negative Emotions with Clinical and Psychosocial Variables in Schizophrenia

Our second aim was to examine within the SZ group the associations between total negative emotional word production, clinical symptoms, emotion regulation strategies, and social functioning. Pearson correlations are presented in Table 3. Higher overall negative word production correlated significantly with increased negative symptoms ($r = .28$, $p < .05$) and with reduced quality of life at a trend level ($p = .065$.) Examining specific negative emotions, use of anxiety words correlated significantly with decreased social functioning ($r = .35$, $p < .05$), anger words correlated significantly with increased positive symptoms ($r = .37$, $p < .01$), depression ($r = .28$, $p < .05$), and negative symptoms at a trend level ($p = .08$.), and sadness words correlated significantly with anhedonia as measured by the SANS ($r = .33$, $p < .05$.)

3.4 Association of Negative Emotions Expressed in VAS and Open-Ended Prompts Following Neutral Experiences in Schizophrenia

Finally, we explored the associations between reports of emotions via VAS versus open-ended responses. These results are presented in Table 4. After controlling for alexithymia, there was a significant correlation between use of anger words during open-ended and endorsement of feeling angry ($p < .01$), anxious ($p < .01$), and sad ($p < .05$) using VAS questions. Similarly, there was a significant correlation between use of sadness words and endorsement of feeling sad ($p < .05$) and anxious ($p < .05$). There were no significant correlations between use of anxiety words and the degree to which any specific negative emotions were endorsed.

4. Discussion

To the best of our knowledge, the present study is the first to employ lexical analysis to examine emotion responses to positive, neutral, and negative events as they occur during daily functioning. Our primary finding is that individuals with SZ expressed significantly more negative emotion in response to negative, neutral, and positive events compared to non-clinical individuals. This was particularly apparent in response to neutral and positive events. In contrast, the SZ group expressed comparable positive emotion word production in response to the three types of events. These findings are consistent with Cohen and Minor's (2010) meta-analysis and suggest that while individuals with SZ may experience comparable levels of positive emotions, they may experience a co-activation of negative emotion in response to positive and neutral events. Thus, our results extend findings from laboratory studies by indicating that such phenomena can also occur within the course of "real world" daily functioning. In addition, the results are consistent with findings from studies assessing emotion functioning in this population using ESM (Gard et al., 2007; Sanchez et al., 2014). In contrast, our results diverged from a meta-analysis of ESM studies by Cho and colleagues (2017) that found that individuals with SZ reported significantly fewer positive and more negative emotions in daily life. Such discrepancies may reflect methodological differences. Compared to traditional retrospective self-report measures, ESM minimizes potential biases related to cognitive impairment. However, as a type of self-report measure, ESM may continue to be limited by subjectivity and social desirability bias. Using lexical analysis to process data obtained through ESM may improve accuracy (Minor et al., 2015), as recent literature has suggested that lexical analysis may be a more objective, behavior-based tool to assess some emotional experiences (Ablanalp et al., 2017).

Examination of specific negative emotion responses to each type of event indicated that, compared to NCC, individuals with SZ used significantly more anxiety and sadness-associated words during neutral events, more anxiety-associated words during negative events, and more anger-associated words during positive events. The prevalence of anxiety across events is consistent with previous reports (Delespaul, 1995; Myin-Germeys et al., 2000). Furthermore, the prevalence of anger-associated words in response to positive events is an important observation, as increased verbal expression of anger in response to positive stimuli has been linked with greater symptom severity and lower functioning (Minor et al., 2015). In this vein, we examined the links between emotion word use and symptoms and

functioning. Consistent with Minor and colleagues, increased verbal expression of anger was strongly associated with more positive symptoms and increased depression in our sample. In previous reports, anger has also been associated with increased paranoia, self-harm, impaired psychosocial functioning, and decreased experience of hope in people with SZ (Bonfils et al., 2016; Fassino et al., 2009; Pinkham et al., 2011).

Taken together, our results have potential implications for treatment targets in SZ. For instance, frequently-used techniques in cognitive-behavioral therapy for psychosis (CBTp), including examining beliefs, cognitive restructuring, and behavioral experiments, generally focus on how thoughts and behaviors may impact emotions and implicitly assume a functioning emotional apparatus that is able to shift as thoughts and behaviors change in response to dysregulating experiences. However, our findings suggest that while individuals with schizophrenia were able to largely shift negative emotion word use appropriately across experience types, negative emotionality persisted to some degree even outside of distressing experiences, as evidenced by the presence of greater negative emotion in response to neutral and positive events compared to controls, and may benefit from being addressed more explicitly in treatment. One method of addressing this and potentially enhancing the effectiveness of established evidence-based treatments is by directly targeting emotion identification, regulation, and processing skills to improve management of negative feelings, particularly in response to neutral or positive events where they may not be as expected. Pilot research examining the use of compassion, acceptance, and mindfulness techniques in early psychosis intervention has shown promise (Khouri et al., 2015), and highlighted the need for increased direct assessment of emotion functioning and regulation in ongoing psychotherapy trials.

In addition, the use of lexical expression as an indicator of emotional experience has previously been explored in the literature, with studies demonstrating lexical accuracy in individuals with blunted affect (Alpert et al., 2000) and an ability to accurately distinguish between clinical and NCC groups based on levels of emotion expressed in verbal output (Hong et al., 2015). In light of these findings and the potential impact of emotional awareness deficits on lexical accuracy, we assessed the degree to which individuals' subjective emotional experiences were related to lexical emotional expression. For individuals with SZ, lexical expression of anger and sadness in response to neutral prompts was linked with greater subjective reports of anger and sadness. This was not the case for anxiety, with lexical expression of anxiety more likely to be associated with subjective experiences of anger and sadness. These findings partially support lexical accuracy in SZ and are also consistent with a previous study by our group documenting that granularity of negative emotions, or the ability to distinguish between specific negative emotions, is predominantly intact in individuals with SZ, even as the overall ability to distinguish between emotions is significantly lower compared to NCC (Kimhy et al., 2014a). The lack of correlation between lexical expression of anxiety and subjective anxiety is complicated further by the observation that individuals with schizophrenia reported relatively lower anxiety on the BAI than NCC, while there were significant group differences in anxiety words in response to negative and neutral events. It is possible that, as demonstrated by Bantum and Owen (2009) in their validity assessments, LIWC over-identified expression of anxiety in individuals with schizophrenia, though the authors found large effects for

convergent and discriminant validity between LIWC's identification of anxiety and those of human raters. As such, it would be interesting to compare assessments of anxiety completed by clinical raters vs. self-report measures in their correlations with lexical expression of anxiety.

The present study has several unique strengths, including ecologically valid assessment of emotions experienced throughout the day and the use of lexical analysis to provide a potentially objective measure of emotional expression in response to personal experiences. However, several limitations should be acknowledged. Given that our NCC group was significantly younger, we examined the impact of age on several variables of interest. Overall, younger (< 22 years) participants expressed fewer positive emotions during negative events, more anger during negative events, and more negative emotions during positive events. This is in line with literature documenting more intense emotional experiences and greater difficulty regulating emotions in adolescents compared to adults (Silvers et al., 2012). This suggests that having a significantly younger control group may have somewhat diminished observed group differences. Additionally, since our clinical sample was relatively small, it was not possible to conduct further analysis within and between groups. Larger samples would allow not only for within-group examination based on additional variables of interest (e.g. demographics, symptom severity), but also a more robust comparison between groups using additional lexical variables, such as social constructs, pronoun-use, cognitive processes, and environmental context. Recently, Fineberg and colleagues (2015) have documented that compared to individuals with mood disorders, individuals with SZ tend to use language differently, with speech containing increased plural third person pronouns, decreased first person singular pronouns, and increased negative affect. Extending these findings, and in line with our hypothesis, our results indicated that verbal expression of negative affect was associated with overall negative symptoms in general, and sadness-related words were associated with anhedonia in particular.

Methodological limitations of the study included a single-item measure of anhedonia, four-item list of predetermined emotions on the VAS assessments, as well as relatively brief responses to queries, as the assessments were administered on mobile devices, which may have limited participants' abilities to fully express themselves. We attempted to address this limitation by analyzing samples with no fewer than 25 words and a minimum of 6 assessments completed, however, future studies may want to replicate our findings using more extensive speech samples from a larger sample. This would also allow greater opportunity to test variance in emotional expression over time.

In conclusion, our findings extend the current literature in important ways by replicating laboratory findings and showing that individuals with SZ experience comparable positive emotion and a co-occurring negative emotion in response to neutral and positive events in their daily lives. We also highlight the importance of continuing to improve data collection and accuracy in assessment by introducing a novel methodological technique, namely combining ESM and lexical analysis of short text communications, to address the ongoing need for objective measures of verbal emotional expression in the field.

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Figure 1.
Comparison of Negative Emotion Word Production in response to Negative, Neutral, and Positive Events in Individuals with Schizophrenia vs. Non-Clinical Controls

Table 1.

Demographic, Clinical, and Socioemotional Functioning Characteristics of Individuals with Schizophrenia and Non-Clinical Controls

	Schizophrenia (n=53)	Controls (n=19)	t/ χ^2	p
Age (years)	32.00 $\pm$ 8.30	22.63 $\pm$ 3.37	6.79	< .001
Sex (% female)	40	63	3.12	.08
Ethnicity (% Hispanic)	38	16	3.66	.16
Race (%)			5.79	.21
White	53	37		
Black	15	11		
Asian	11	26		
Native American	0	5		
More than one race	21	21		
Diagnosis (%)				
Schizophrenia	75	--	--	--
Schizoaffective Disorder	15	--	--	--
Schizophreniform	4	--	--	--
Psychosis NOS	6	--	--	--
Reading Ability (WTAR)	39.68 $\pm$ 8.38	40.89 $\pm$ 9.33	.51	.61
Positive Symptoms (SAPS)	28.69 $\pm$ 18.68	--	--	--
Negative Symptoms (SANS)	35.84 $\pm$ 16.09	--	--	--
Anhedonia (SANS Item 22)	2.63 $\pm$ 1.43	--	--	--
Depression (BDI)	14.71 $\pm$ 11.20	5.36 $\pm$ 5.91	4.55	< .001
Anxiety (BAI)	11.81 $\pm$ 8.67	15.94 $\pm$ 8.68	1.78	.08
Emotion Awareness (TAS-20) *	50.54 $\pm$ 14.90	37.63 $\pm$ 11.31	3.43	.001
Quality of Life (QOL-16) *	52.35 $\pm$ 20.99	35.42 $\pm$ 11.64	4.31	< .001
Perceived Social Support (PSRS) *	36.92 $\pm$ 12.22	22.36 $\pm$ 4.99	7.16	< .001

Note: Values are M $\pm$ SD; WTAR - Wechsler Test of Adult Reading; SAPS - Scale for the Assessment of Positive Symptoms; SANS - Scale for the Assessment of Negative Symptoms; SANS Anhedonia (item #22); BDI - Beck Depression Inventory; BAI - Beck Anxiety Inventory; TAS-20 - Toronto Alexithymia Scale; QOL-16 - Quality of Life Scale; PSRS - Provisions of Social Relations Scale.

* Higher scores indicate lower level of functioning.

Table 2.

A Comparison of Emotion Lexical Content in Response to Neutral, Negative, and Positive Experiences in Individuals with Schizophrenia and Non-Clinical Controls

	Schizophrenia	Controls	ANOVA		Effect Size	
			<i>F</i>	<i>p</i>	Hedges' <i>g</i>	95% CI
% Positive Emotion	4.02 ± .27 1.96	4.11 ± .49 2.14	.02	.885	.04	[−.51, .42]
% Negative Emotion	2.87 ± .20 1.45	1.49 ± .35 1.52	10.25	.002	.93	[.59, 1.27]
Welch's t-Test						
			<i>t</i>	<i>p</i>	Hedges' <i>g</i>	95% CI
Negative Experience						
Total Word Count	113.13 ± 8.45	149.47 ± 13.53	2.11	.030	.59	[−14.65, 13.47]
% Positive Emotion	1.47 ± .20	1.31 ± .29				
% Negative Emotion	5.59 ± .43	3.72 ± .45	−2.44	.005	.64	[.00, 1.31]
Neutral Experience						
Total Word Count	86.60 ± 7.70	114.11 ± 12.65	1.84	.073	.49	[−13.38, 12.41]
% Positive Emotion	3.11 ± .50	2.71 ± .34				
% Negative Emotion	1.94 ± .36	.73 ± .27	−2.68	.009	.51	[−.03, 1.05]
Positive Experience						
Total Word Count	107.30 ± 8.35	142.05 ± 12.11	2.21	.024	.58	[−14.17, 13.00]
% Positive Emotion	7.51 ± .58	8.27 ± .65				
% Negative Emotion	.99 ± .18	.32 ± .11	−2.13	.003	.57	[.31, .84]

Note: Values are $M \pm SE$. Word Count values represent total words used in reply to the prompt. Positive and Negative Emotion values reflect percentage of total words used in reply to prompt. Welch's t-Test was used to account for unequal sample size between groups. Hedges' *g* provides a measure of effect size weighted by the relative size of each sample (small = .20, medium = .50, large = .80).

Table 3.

Pearson Correlations Between Negative Emotion Word Production Across Events and Clinical and Psychosocial Variables in Individuals with Schizophrenia

	Total Negative Emotion	Anxiety	Anger	Sadness
Positive Symptoms (SAPS)	.150	-.014	.370^{**}	-.055
Negative Symptoms (SANS)	.282[*]	-.111	.245	.256
Anhedonia (SANS)	.074	.116	.006	.327[*]
Depression (BDI)	.170	.029	.281[*]	.214
Anxiety (BAI)	.089	-.057	.175	-.065
Cognitive Reappraisal (ERQ)	-.006	-.134	-.023	-.087
Expressive Suppression (ERQ)	.206	.185	.058	.032
Quality of Life (QoL) [†]	.266	.138	.178	.232
Social Functioning (PSRS) [†]	.219	.350[*]	.021	.163

[†] Higher scores on these measures indicate lower level of functioning.

^{*} $p < .05$

^{**} $p < .01$

Table 4.

Pearson Correlations Between Visual Analogue and Open-Ended Negative Emotion Responses Following Neutral Events in Individuals with Schizophrenia

		Visual Analogue Prompts			Open-Ended Prompts		
		Anxiety	Anger	Sadness	Anxiety	Anger	Sadness
Visual Analogue Prompts	Anxiety	--	.733 **	.878 **	.063	.306 *	.263
	Anger	.683 **	--	.633 **	.204	.303 *	.253
	Sadness	.827 **	.631 **	--	.196	.256	.306 *
Open-Ended Prompts	Anxiety	.008	.095	-.128	--	.086	.033
	Anger	.311 *	.289 *	.242	.059	--	.376 *
	Sadness	.305	.261	.341 *	.024	.375 *	--

Note: Zero-order correlations are presented above the diagonal. Partial correlations (controlling for the effects of alexithymia) are presented shaded below the diagonal.

*
 $p < .05$

**
 $p < .01$