Understanding anhedonia in schizophrenia through lexical analysis of natural speech

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Anhedonia is a negative prognostic indicator in schizophrenia. However, the underlying nature of this emotional deficit is unclear. Laboratory studies examining patients’ emotional reactions under controlled circumstances have failed to find evidence for a diminished hedonic response, instead finding that patients' reactions to laboratory stimuli are characterised by high levels of negative emotion. The present study employed lexical analysis of natural speech in 52 patients and 49 non-patient controls while they discussed separate neutral, pleasant and unpleasant autobiographical memories. Patients with clinically rated anhedonia, versus other patients and controls, showed a dramatic increase in negative emotion expression when discussing pleasurable memories, but they showed no corresponding decrease in positive emotion. These findings provide further evidence that “anhedonia” is more reflective of negative emotional states than the absence of positive ones. These findings also raise questions about how positive and negative emotions can be simultaneously co-activated in patients with schizophrenia.

Keywords: Schizophrenia; Affect; Emotion; Anhedonia; Speech; Negative; Deficit; Ambivalence.

INTRODUCTION

Anhedonia, defined as an inability to experience pleasure, has been postulated to be a stable personality trait that is a core feature of schizophrenia (e.g., Meehl, 1962). In support of the prominence of anhedonia in schizophrenia, research measuring trait positive emotionality...
has found that patients report having fewer and less intense pleasurable experiences compared to non-patients (Berenbaum & Fujita, 1994; Blanchard, Mueser, & Bellack, 1998; Chapman, Chapman, & Raulin, 1976; Cohen et al., 2005). Similarly, patients have been rated by trained clinicians as experiencing less pleasure than non-patient controls using symptom rating scales (e.g., Andreasen, 1984). In contrast to these findings, however, researchers using laboratory mood-induction procedures have found limited evidence for anhedonia in schizophrenia (e.g., Berenbaum & Oltmanns, 1992; Cohen & Docherty, 2004; Cohen, Docherty, Nienow, & Dinzeo, 2003; Kring, Kerr, Smith, & Neale, 1993; Kring & Neale, 1996). A recent meta-analysis of 25 mood-induction studies comparing patients and non-patient controls found that patients' hedonic reactions to pleasurable stimuli was qualitatively similar to controls (Cohen & Minor, 2008). However, when patients were asked to separately report their level of dysphoria to these same stimuli they reported experiencing relatively strong aversive reactions compared to controls (mean weighted effect size = .73 for “pleasant” stimuli, .70 for “neutral” stimuli and .27 for “unpleasant” stimuli). These findings raise questions about the nature of the affective deficits in schizophrenia, suggesting that anhedonia may actually be more reflective of negative emotional states than an inability to experience pleasurable emotions.

When attempting to resolve the seemingly inconsistent findings between laboratory studies and studies using self-report questionnaires or interviews, it is important to note that self-report questionnaires and symptom rating scales may inadvertently be measuring negative emotions. A common strategy for assessing anhedonia involves measuring attitudes (e.g., “Do you enjoy being around other people?”) or behaviours (e.g., “Do you often spend time with other people?”) with the implicit assumption that abnormal responses on these items reflect attenuated positive emotionality. Consider items from the Chapman Anhedonia Scales (Chapman, Chapman, & Raulin, 1976), which include questions like “I like to make long distance phone calls to friends and family” (keyed false) and “I have often enjoyed receiving a strong, warm handshake” (keyed false) as well as the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1982), which assesses phenomena such as “lack of recreational interests”, “lack of sexual interests and activity” and “relationships with friends and peers”. Neither of these instruments is designed to take into account the cause of the putative emotional deficit, so it is unclear to what degree elevated scores reflect attenuated positive or increased negative emotional states. Not surprisingly, prior research has demonstrated that both the Chapman anhedonia scores and SANS ratings correspond significantly to increasing levels of negative emotions (e.g., Blanchard et al., 1998; Cohen et al., 2005). In sum, it is possible that our understanding of anhedonia has been obscured by a lack of
precision in assessing positive versus negative emotions using questionnaire and symptom rating instruments.

How is it that external stimuli could simultaneously activate both positive and negative emotional systems in patients with schizophrenia? Many traditional theories of emotion assert that positive and negative emotion valences reflect opposing ends of a continuum (e.g., circumplex model; Larsen & Diener, 1992). Although these models appear to adequately explain many common types of emotional experiences, they fail to account for stimuli with both positively and negatively valenced properties (e.g., approach–avoidance conflicts; Miller, 1951). Contemporary models of emotion suggest that the organisation of negative and positive emotions is orthogonal and that these emotions can be co-activated when processing certain stimuli (e.g., the “evaluative space model”; Cacioppo, Gardner, & Berntson, 1997). For example, tragic movies (Larsen, McGraw, & Cacioppo, 2001), “hot button” political topics (e.g., abortion; Priester & Petty, 1996, 2001), and situations providing both reward and punishment (Miller, 1951) each have been shown to arouse simultaneous positive and negative emotional states. In understanding affective abnormalities in schizophrenia, it could be the case that “anhedonia” actually reflects ambivalent emotions towards stimuli that individuals without the disorder find generally pleasant (or at least, not aversive).

Given the aforementioned imprecision in measuring anhedonia using traditional self-report questionnaires and clinical instruments, more sophisticated procedures that can parse positive and negative emotions may be needed to clarify the emotion-related symptoms of schizophrenia. This is a particularly complicated endeavour in schizophrenia because the illness is characterised by a number of maladies that limit individuals’ ability to clearly identify and articulate emotional states, e.g., alexithymia (Maggini & Raballo, 2004; van’t Wout, Aleman, Bermond, & Kahn, 2007), communication difficulties (Docherty, 1996), and low levels of insight (Mintz, Dobson, & Romney, 2003). In the present study, we employed lexical analysis of patients’ natural speech as they discuss memories from their lives. Lexical analysis has been used extensively outside of schizophrenia research (see Pennebaker, 2001, for a review), for example as an outcome measure for individuals engaged in psychotherapy (Pennebaker, Mehl, & Niederhoffer, 2003), and for the study of alexithymia (Kelley, Lumley, & Leisen, 1997; Tull, Medaglia, & Roemer, 2005), posttraumatic stress disorder (Bernard, Jackson, & Jones, 2006; Murray & Segal, 1994; Orsillo, Batten, Plumb, Luterek, & Roessner, 2004), depression and anxiety (Gortner, Rude, & Pennebaker, 2006; Lepore, 1997; Watson & Pennebaker, 1989), eating disorders (Lyons, Mehl, & Pennebaker, 2006) and bereavement (Pennebaker, Mayne, & Francis, 1997; Stroebel, Stroebel, Schut, Zech, & van den Bout, 2002). In support of using lexical analysis to understand emotional processes
in schizophrenia, several recent studies have reported that lexical expression is independent from other channels of emotional expression (e.g., facial expression), suggesting that it may be a valid indicator of emotional experience even when symptoms of blunt affect and alogia are prominent (Alpert, Shaw, Pouget, & Lim, 2002; Cohen, Alpert, Nienow, Dinzeo, & Docherty, in press; St-Hilaire, Cohen, & Docherty, 2008).

The present study aimed to better understand the emotional underpinnings of “anhedonia” by examining the lexical expression of schizophrenia patients with clinically rated anhedonia, patients without clinically rated anhedonia and non-patient controls as they discussed separate neutral, pleasant and unpleasant memories from their lives. We employ memory recall in our mood-induction procedure because the stimuli can be individually tailored (see Greasley, Sherrard, & Waterman, 2000). This circumvents limitations associated with standardised stimuli that produce variable reactions across individuals (e.g., showing pictures of adorable puppies to individuals grieving the loss of their pet). Moreover, analysis of patients’ natural speech offers ecological validity over methods used in prior mood-induction studies of schizophrenia because clinical ratings are often informed by patients’ verbal accounts of their experiences. Our general hypotheses were two-fold. First, we predicted that patients as a group would express more negative emotion, and similar (or more) positive emotion when discussing neutral and pleasant memories from their lives compared to controls. Second, we predicted that this pattern would be particularly pronounced in patients with anhedonia, as evidenced by more negative emotion, but similar (or more) positive emotion when discussing neutral and pleasant memories compared to other patients and controls.

METHODS

Participants. This study was part of a multi-faceted research project investigating language disorder in schizophrenia (see Docherty, Cohen, Nienow, Dinzeo, & Dangelmaier, 2003, for elaboration on methods). Exclusion criteria were: having a documented serious central nervous system disease (besides schizophrenia), having a primary language other than English, meeting criteria from the Diagnostic and Statistical Manual of Mental Disorders – 4th Edition (DSM-IV; American Psychiatric Association (APA), 1994) for substance dependence and having a history suggestive of mental retardation or head trauma requiring an overnight hospital stay. All participants received monetary compensation for participation in the present study. The participants’ demographic and descriptive information are presented in Table 1. This project was approved by the relevant Institutional Review Boards.
Patients with clinically rated anhedonia, those without and controls on descriptive, intellectual functioning (IQ), Global Assessment of Functioning (GAF) and clinical and medication data, with means and standard deviations ($M \pm SD$)

<table>
<thead>
<tr>
<th>Measure</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive variable</td>
<td>Anhedonia</td>
</tr>
<tr>
<td>Age</td>
<td>34.43 ± 7.66</td>
</tr>
<tr>
<td>Education</td>
<td>12.57 ± 1.51</td>
</tr>
<tr>
<td>IQ$^{1,2}$</td>
<td>90.77 ± 14.95</td>
</tr>
<tr>
<td>% male</td>
<td>64</td>
</tr>
<tr>
<td>% Caucasian</td>
<td>71</td>
</tr>
<tr>
<td>Average hospital stay (weeks)$^3$</td>
<td>50.87 ± 61.62</td>
</tr>
<tr>
<td>GAF$^{1,4}$</td>
<td>44.93 ± 12.24</td>
</tr>
<tr>
<td>Psychosis syndrome$^5$</td>
<td>13.78 ± 3.47</td>
</tr>
<tr>
<td>Anergia syndrome$^6$</td>
<td>9.64 ± 3.10</td>
</tr>
<tr>
<td>Mania/Excitement syndrome$^6$</td>
<td>9.28 ± 1.86</td>
</tr>
<tr>
<td>Depression/Anxiety syndrome$^5$</td>
<td>11.50 ± 3.41</td>
</tr>
</tbody>
</table>

Notes: $^1$Higher scores reflect better functioning. $^2$In standard scale format (mean = 100, standard deviation =15). $^3$Scores were log-transformed to correct for excessive skew before comparison. $^4$GAF = Global Assessment of Functioning (DSM-IV; American Psychiatric Association, 1994). $^5$Higher scores reflect more severe symptomatology.

Patients. The patient group consisted of 52 stable out-patients with DSM-IV schizophrenia (American Psychiatric Association, 1994). Diagnoses were made by a licensed clinical psychologist with diagnostic expertise (N. M. Docherty) based on information obtained using the Schedule for Affective Disorders and Schizophrenia – Lifetime Version (SADS-L; Endicott & Spitzer, 1978). Participants who had Global Assessment of Functioning (GAF, DSM-IV; American Psychiatric Association, 1994) scores below 30 were excluded from this study to provide some assurance that participants could comply with the study protocol. All participants were being treated by a multidisciplinary team and were considered to be “stable” at the time of testing. Nearly all patients in this study were being prescribed antipsychotic medication.

Controls. The control group consisted of 49 volunteers recruited from university support staff. These participants were matched to the patients on age and parents’ socioeconomic status using the Socioeconomic Index (SEI; Hauser & Warren, 1996). In addition to the aforementioned exclusion criteria, controls were excluded if they had any history of psychotic symptoms, or if they met criteria for an axis I substance abuse or mood disorder based on information obtained from a SADS-L interview.
Procedure

Symptom. Symptoms were measured using two instruments. First, clinically rated anhedonia was assessed using the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1982). The SANS is one of the most popular negative symptom measures used in schizophrenia research (see Blanchard & Cohen, 2006; Earnst & Kring, 1997). In the present study we used the SANS to differentiate individuals with clinical anhedonia from patients without. Patients were categorised as “anhedonic” if they had a rating of “2” (mild severity) or higher on the SANS global anhedonia scale. Fourteen of the patients in this study met criteria for the anhedonia group and the remaining 38 patients were included in the non-anhedonic group.

We also used the Brief Psychiatric Rating Scale (BPRS; Lukoff, Nuechterlein, & Ventura, 1986) to measure patients’ general psychiatric symptomatology. BPRS scales were organised into separate “psychosis” (i.e., suspiciousness, unusual thought content, hallucination, disorientation, and bizarre behaviour items), “anergia” (i.e., emotional withdrawal, motor retardation, self-neglect, and blunted affect items), “manic/excitement” (i.e., motor hyperactivity, elevated mood, excitement, distractibility, hostility and grandiosity items), and “depression/anxiety” (i.e., guilt, depression, anxiety and suicidality items) scores based on the findings of a recent factor analysis of the BPRS (Overall & Gorham, 1988). Symptom ratings were made by graduate student researchers who had attained acceptable levels of interrater reliability (all intraclass correlations >.69, most > .90).

Mood-induction task. Participants provided separate affective-neutral, pleasant and unpleasant speech samples that were each 10 minutes in length. During the neutral condition, participants talked about affectively neutral topics (i.e., hobbies, daily routine, etc.). They recounted happy times during the “pleasant” condition and stressful/unhappy memories during the “unpleasant” condition. Participants were expected to do most of the talking; however, interviewers kept them on task as needed and elicited elaboration of condition-appropriate memories. The order of the pleasant and unpleasant speech samples was counterbalanced with the neutral sample always presented second. The narratives were transcribed by trained research assistants and carefully proofread to ensure accuracy.

The speech sample texts were then analysed using Pennebaker’s Linguistic Inquiry and Word Count program (LIWC; Pennebaker, 2001). The LIWC program processes text files one word at a time, attempting to match the base form of the word to a “dictionary” of over 2290 words stems. These word stems are organised into 83 different categories. LIWC analysis yields a frequency count of the total instances of target words from each category. These numbers are then divided by the total number of words in the text to
control for individual differences in verbosity. Thus, scores reflect a percentage of word matches in that category. LIWC contains separate positive and negative emotional categories, which are comprised of words related to emotional states (e.g., angry, happy, friendly). The LIWC software has been used extensively in non-psychotic patients (see Pennebaker, 2001, for validity and reliability data) and has been used in prior work by our lab (Cohen et al., in press; St-Hilaire et al., 2008). All speech samples contained at least 100 words, the minimum suggested by Pennebaker (2001) for LIWC analysis.

**IQ.** Intellectual functioning was estimated based on total scores from the Shipley Institute for Living test (Zachary, Paulson, & Gorsuch, 1985). The Shipley includes separate measures of verbal and abstraction abilities and has shown high convergence with scores from more thorough IQ tests. IQ data was missing for two subjects.

**Analyses**

Analyses were conducted in three phases. First, we computed and compared descriptive and clinical variables between patients with anhedonia, patients without and controls. These analyses were meant to examine the role of individual difference variables (e.g., age, gender, ethnicity) that could potentially confound the other analyses. Second, we used mixed ANOVA design to compare positive emotion expression in the neutral, pleasant and unpleasant conditions between patients and controls. A separate mixed ANOVA was computed to compare patients and controls in their negative emotion expression across the three conditions. We predicted that patients would express more negative emotion and similar or more positive emotion across the neutral and pleasant conditions. Third, we used a similar strategy to compare patients with clinically rated anhedonia, those without and non-patient controls on positive and negative emotion expression across the three conditions. We expected that anhedonia patients would express more negative emotion and similar or more positive emotion compared to the other groups. The unpleasant conditions were included in these analyses for exploratory purposes, although we did not have a priori predictions about their relations to the lexical variables. The results of a recent meta-analysis (Cohen & Minor, 2008) suggest that patients and controls experience similar levels of both positive and negative emotion as controls while processing negative stimuli. All significance tests are two-tailed and all variables are normally distributed (skew values < 1.5) unless otherwise noted.
RESULTS

Demographic and descriptive variables. Means and standard deviations of the descriptive, clinical and functioning variables were separately computed for the anhedonia, non-anhedonia and control groups. These data are presented in Table 1. Group-wise comparisons, using a series of ANOVA and chi-square analyses suggested that the patient and control groups were similar in age, gender and ethnicity. Controls had significantly more education, higher IQ scores, and better overall functioning than both patient groups (all \( p \) values < .05). \( T \)-tests suggested that the anhedonia and non-anhedonia groups were similar in age, education, IQ, gender and ethnic composition, average hospital stay and severity of mania/excitement symptoms (all \( p \) values > .05), but patients with anhedonia showed more severe psychosis, anergia, depression/anxiety and poorer overall functioning (all \( p \) values < .05). These results suggest there were no obvious differences in sample composition between the patient groups worth controlling for in the following analyses.

The mean number of total words spoken during the neutral, pleasant and unpleasant memory recall conditions for the patients with anhedonia \((936.36 \pm 480.93, 979.07 \pm 499.82\) and \(962.71 \pm 447.39\), respectively), patients without anhedonia \((1229.26 \pm 351.34, 1064.42 \pm 395.80\) and \(1113.24 \pm 376.99\), respectively) and controls \((1515.87 \pm 377.17, 1651.40 \pm 428.67\) and \(1613.34 \pm 418.87\), respectively) was computed. A repeated-measures ANOVA revealed that, across all groups, the total word count did not significantly differ across conditions, \(F(1, 96) = 0.01\), ns. The groups significantly differed in overall word count, \(F(2, 96) = 25.19\), \(p < .001\), and the Group \(\times\) Condition interaction was significant, \(F(2, 96) = 4.38\), \(p < .05\). Scheffé post hoc comparisons suggested that the patient groups used significantly fewer words than controls, but were not significantly different from each other. The interaction effect reflected a net increase in the number of words between the neutral and other conditions for the anhedonia and control groups and a net decrease by non-anhedonia patients from the neutral to other conditions.

To better understand the variability in emotion word expression across subjects, we examined how descriptive and clinical variables were related to positive and negative emotion word expression. Control males used more negative emotion words during the unpleasant condition compared to control females, \(t(39) = 2.31\), \(p < .05\), but otherwise there were no demonstrable differences between males and females or between ethnic groups in any of the lexical variables examined in this study (when patients and controls were examined separately or as a group). Age, education, GAF scores, Shipley IQ and BPRS factor scores were generally not related to any of the lexical variables examined here in either patients or controls.
(examined separately or together). Worse functioning (measured with the GAF), increasing depression/anxiety scores and psychosis scores were each associated with increased use of negatively valenced words in the pleasant condition, $r(52) = -.36$, $p < .05$, $r(52) = .46$, $p < .001$ and $r(52) = .31$, $p < .05$, respectively, and increased IQ scores were associated with increased use of positively valenced words in the neutral condition, $r(50) = .30$, $p < .05$, within the patient group. Interestingly, increasing mania scores corresponded to increased use of positive words in the neutral condition, $r(52) = .36$. In all, individual differences in emotion expression did not seem to be a function of demographic, intellectual functioning or global functioning although symptom clusters showed some selective associations.

Expression of emotion: Patients vs. controls. Means and standard deviations of positive emotion expression scores were separately computed from the neutral, pleasant and unpleasant conditions for patient as a whole group (1.99 ± 0.67, 3.58 ± 1.18 and 1.48 ± 0.82, respectively) and controls (1.61 ± 0.64, 3.52 ± 0.85 and 1.29 ± 0.47, respectively). Examination using repeated-measures ANOVA revealed that expression of positive emotion significantly changed across conditions, $F(1, 99) = 25.93$, $p < .001$. Neither the between-subjects main effect, $F(2, 99) = 3.28$, ns, nor the interaction, $F(2, 99) = 1.41$, ns, terms were significant. The within-group effect reflected significant differences between each of the conditions, with the most emotion expressed occurring during the pleasant condition and the least expressed during the unpleasant condition (all $p$ values $<$ .001).

Expression of negative emotion showed a different pattern across conditions ($M \pm SD$ of neutral, pleasant and unpleasant conditions for patient as a whole group (0.83 ± 0.31, 0.72 ± 0.36 and 1.63 ± 0.31, respectively) and controls (0.61 ± 0.24, 0.68 ± 0.23 and 1.41 ± 0.23, respectively). A repeated-measures ANOVA suggested that expression of negative emotion changed significantly across conditions, $F(1, 99) = 276.19$, $p < .001$, that patients had higher overall expression of negative emotion than controls, $F(2, 99) = 21.87$, $p < .001$, and that the Group × Condition interaction, $F(2, 99) = 3.23$, $p < .05$, was significant. Follow-up analyses suggested that expression of negative emotion was significantly higher in the unpleasant condition compared to the pleasant and neutral conditions (all $p$ values $<$ .001) and patients expressed significantly more negative emotion compared to controls during the neutral and unpleasant conditions (all $p$ values $<$ .05). The interaction term reflects patients showing a slight decrease in expression between the neutral and pleasant conditions compared to controls who showed a slight increase during these conditions. In sum, patients did not express less positive emotion compared to controls in any of the conditions, and they expressed more negative emotion in the neutral and unpleasant conditions.
Expression of emotion: Patients with vs. without anhedonia vs. controls. Means and standard deviations of the positive emotion scores were separately computed from the neutral, pleasant and unpleasant conditions for the anhedonia (1.84 ± 0.79, 3.35 ± 1.59 and 1.20 ± 0.77, respectively), non-anhedonia (2.05 ± 0.62, 3.67 ± 1.00 and 1.58 ± 0.82, respectively) and control (1.61 ± 0.64, 3.52 ± 0.85 and 1.29 ± 0.47, respectively) groups. These values are presented in Figure 1. A repeated-measures ANOVA suggested that expression of positive emotion significantly changed across conditions, \( F(1, 99) = 206.01, p < .001 \), although neither the between subjects, \( F(2, 99) = 3.10, ns \), nor the interaction, \( F(2, 99) = 0.90, ns \), terms reached statistical significance. As seen above, the within-group effect reflected the pleasant condition eliciting the most emotional expression for all groups, the neutral condition eliciting the next most, and the unpleasant condition eliciting the least of the three (all \( p \) values < .001). As hypothesised, patients with anhedonia did not show significantly less positive word expression compared to the other groups.

Means and standard deviations of the negative emotion scores were then separately computed from the neutral, pleasant and unpleasant condition for the anhedonia (0.63 ± 0.47, 1.02 ± 1.34 and 2.90 ± 1.28, respectively), non-anhedonia (0.83 ± 0.57, 0.52 ± 0.39 and 2.68 ± 0.97, respectively) and control (0.43 ± 0.31, 0.51 ± 0.30 and 2.02 ± 0.95, respectively) groups. These values are presented in Figure 2. The negative emotion variable from the pleasant condition was excessively skewed, so we square-root transformed (skew of transformed values < 1.5) the scores from each condition to make them uniform for analysis. The within-group, \( F(1, 99) = 224.32, p < .001 \), and
between-group, $F(2, 99) = 11.29, p < .001$, main effects and the interaction, $F(2, 99) = 3.78, p < .01$, terms were each significant. As seen above, the within-group effect reflected higher negative emotion expression in the unpleasant condition compared to the pleasant and neutral conditions (all $p$ values $< .001$). For the pleasant and unpleasant conditions, the three groups were statistically different from each other (all $p$ values $< .05$) with anhedonia patients expressing the most negative emotion and controls expressing the least. For the neutral condition, patients without anhedonia expressed significantly more negative emotion than controls ($p < .001$), but neither group significantly differed from the anhedonia group. The interaction effect reflected a dramatic increase in the proportion of negative emotion words used by the anhedonia patients from neutral to pleasant condition and a net decrease by non-anhedonia patients from the neutral to pleasant memory recall conditions. In sum, anhedonia patients evidenced higher negative emotion expression than the other groups, and this was particularly pronounced when recounting pleasurable memories from their lives.

**DISCUSSION**

Anhedonia’s importance in understanding the dysfunctions associated with schizophrenia are well documented, although the underlying construct of anhedonia is unclear. This is due in large part to findings from laboratory mood-induction studies failing to find attenuated emotional reactions in patients with schizophrenia compared to non-patient controls. Recent
findings have suggested that patients actually experience increased aversive emotions when processing stimuli that others report to be pleasant or neutral in valance (Cohen & Minor, 2008). The present study extended this work by examining patients’ lexical expression as they recounted memories from their lives. Patients with or without clinically rated anhedonia expressed similar levels of positive emotion as controls regardless of whether they were talking about neutral, pleasant or unpleasant memories from their lives. On the other hand, patients expressed more negative emotion in general. This was most notable for patients with clinically rated anhedonia during the pleasant recall condition. These findings suggest that anhedonia, at least as measured using clinical symptom rating scales, is more reflective of exacerbated negative emotions than attenuated positive emotions.

One intriguing explanation for the apparent co-activation of positive and negative emotion in “anhedonia” is that it reflects ambivalence. Stimuli that produce ambivalent tensions because of simultaneous attraction and repulsion are well documented in psychology, and have been studied in fields as diverse as basic emotion (e.g., Cacioppo et al., 1997; Ito, Cacioppo, & Lang, 1998), cognitive (e.g., Cunningham, Johnson, Gatenby, Gore, & Banaji, 2003), industrial-organisational (e.g., Hoggett, 2006), eating disorders (e.g., Urland & Ito, 2005), substance abuse (e.g., Armitage, Povey, & Arden, 2003), and borderline personality disorder (Hopwood & Morey, 2007) domains to name a few. The role of ambivalence in schizophrenia has been noted by many early theorists, particularly with regard to interpersonal functioning (e.g., Bleuler, 1950; Meehl, 1962; Sullivan, 1962). For example, the term “ambivalence” is originally credited to Bleuler (Rycroft, 1968), who proposed that it was one of four core symptoms of schizophrenia. Likewise, Meehl proposed that ambivalence reflected defective mutual inhibitory mechanisms in the positive and negative emotion sectors of the limbic system (Meehl, 1962). It is also worth noting that a questionnaire-based measure of ambivalence has shown convergence with psychotic spectrum symptomatology in adult college student samples (see Kwapił, Mann, & Raulin, 2002; Kwapił, Raulin, & Midtun, 2000). More recently, researchers have proposed that increased state negative affect in schizophrenia reflects dysfunction in emotion regulation systems (Horan, Green, Kring, & Nuechterlein, 2006). To date, however, ambivalence in schizophrenia has received limited empirical attention.

The finding that the “anhedonic” patients were more severe in overall illness raises some interesting alternate explanations of why their performance was qualitatively different from other patients during the pleasant memory recall condition. Insofar as more severe illness was associated with cognitive deficits, one possibility is that information processing impairments were responsible. Anhedonic patients have shown selective biases in recalling negative words over positive and neutral words in several studies (Calev &
Edelist, 1993; Koh, Grinker, Marusarz, & Forman, 1981) suggesting that subjects’ pleasurable experiences may have been recalled with an overly negativistic tone. Similarly, recent work by Herbener and colleagues (Herbener, Rosen, Khine, & Sweeney, 2007) indicated that patients as a group show impairment in encoding positive, but not negative, stimuli. Although it is not clear whether this impairment is more pronounced in “anhedonic” patients, encoding deficits for pleasant memories may also have played a role. Alternatively, increased negative emotionality during the pleasant condition may have reflected patients having a dearth of pleasurable memories to draw from, presumably because the severity of their illness limited their involvement in pleasurable activities. Finally, these more severe patients may have experienced frustration when attempting to construct coherent narratives about life events due to severe levels of thought disorder. Disentangling these issues is beyond the scope of the present data, so a more fine-grained examination aimed at addressing these alternate explanations is warranted.

Understanding increased negative emotionality in schizophrenia is particularly interesting in light of evidence that higher levels of insight are associated with increased dysphoria (see Brune, 2005; Lysaker, Davis, Warman, Strasburger, & Beattie, 2007; Mintz et al., 2003). Findings from this literature suggest that a lack of insight may, at least in terms of subjective suffering, be protective in some manner. With regard to the present sample, it could be that clinically rated “anhedonia” denoted patients with more accurate self-reflective abilities and more insight into their illness. The decreased negative emotion in the “non-anhedonic” group could reflect a lack of awareness about negative emotions associated with their memories. Tentative support for this is reflected in the finding that non-anhedonic patients produced significantly less speech when discussing emotionally valenced topics compared to the anhedonic and control subjects. However, the overall severity of illness observed in the anhedonic group may argue against this, as it seems unlikely that these individuals had both improved insight and more severe psychotic symptoms. Nonetheless, the protective role of insight is a promising area for future laboratory-based studies of emotion.

It is important to interpret the present findings in light of another prominent theory of anhedonia in schizophrenia. In explaining the apparent discrepancy in findings between studies employing questionnaire/interview instruments and laboratory mood-induction procedures, Kring and colleagues (Kring, 1998) have proposed that patients are impaired in their ability to anticipate pleasurable experiences but their ability to experience pleasure in the moment is intact. We conceptualise the memory recall task used in this study as a mood-induction task that taps experiential emotion processes because participants were being asked to recount their experiences in the
moment. The finding that patients and controls did not differ in their expression of positive emotion offers potential support for Kring’s (1998) hypotheses. With respect to advancing this theory in light of the present findings, it would be important to clarify why “consummatory” pleasure is characterised by elevated negative emotional states.

In contrast to our hypothesis, patients as a group did not express more negative emotion during the pleasant condition. This finding highlights the pitfalls of conceptualising the emotional dysfunctions in schizophrenia as isomorphic in nature. Patients with the deficit syndrome are defined, in part, by a diminished capacity to experience both pleasurable and aversive emotions (Kirkpatrick, Buchanan, Ross, & Carpenter, 2001), so one might hypothesise that deficit syndrome patients would show emotion abnormalities not seen in other patients. It has been demonstrated that they, compared to other patients, have abnormally low levels of negative emotions using a variety of instruments (Kirkpatrick et al., 2001) and during laboratory mood-induction procedures (Cohen et al., 2003). It would appear that negative emotions might be helpful in differentiating primary and secondary negative symptoms in some regard, and ultimately may be helpful for identifying pathophysiologically distinct manifestations of schizophrenia.

Limitations of this study are important to note. First, the participants in this study were medicated. Although there is evidence to suggest that first- and second-generation medications have little effect on anhedonia symptoms (Tollefson & Sanger, 1997), it is unclear how medications may have affected the findings of this study. Second, while lexical analysis has a rich history within psychology research more generally (Pennebaker et al., 2003) and preliminary studies suggest that lexical analysis can be informative in understanding schizophrenia processes (Alpert, Rosenberg, Pouget, & Shaw, 2000; Cohen et al., in press; St-Hilaire et al., 2008), lexical analysis of patients’ natural speech is a relatively novel procedure for understanding emotion in schizophrenia. Moreover, given that our content analysis exclusively considered semantic meaning at the word level, it is not clear the degree to which topics recalled by the anhedonic patients were actually pleasant in valence. A topical examination of these memories would require a different type of content analysis, one that would be problematic given the difficulty in objectifying emotional events without understanding the deeper contextual meaning of the event for the individual. Another limitation concerns the possibility that the anhedonia patients, who also showed high levels of psychosis more generally, were more disorganised in their linguistic expression and this contributed to abnormal lexical analytic results. Finally, we lacked clinical and questionnaire-based instruments of positive emotion that would have been helpful for understanding the relative contributions that positive- versus negative-based emotion assessments make to clinical ratings of anhedonia.
In summary, the present findings raise questions about whether anhedonia, defined as a diminished capacity to experience pleasure, is a meaningful construct in schizophrenia. Clinically rated anhedonia was associated with relatively normal expression of positive emotion and abnormally high expression of negative emotions. Given the crucial role that emotional dysfunctions play in schizophrenia, it is important to further explicate the phenomenological and neurobiological correlates of these emotional abnormalities.

REFERENCES


