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# Differential hedonic experience and behavioral activation in schizophrenia and bipolar disorder

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## ABSTRACT

The Kraepelinian distinction between schizophrenia (SZ) and bipolar disorder (BP) emphasizes affective and volitional impairment in the former, but data directly comparing the two disorders for hedonic experience are scarce. This study examined whether hedonic experience and behavioral activation may be useful phenotypes distinguishing SZ and BP. Participants were 39 SZ and 24 BP patients without current mood episode matched for demographics and negative affect, along with 36 healthy controls (HC). They completed the Chapman Physical and Social Anhedonia Scales, Temporal Experience of Pleasure Scale (TEPS), and Behavioral Activation Scale (BAS). SZ and BP showed equally elevated levels of self-report negative affect and trait anhedonia compared to HC. However, SZ reported significantly lower pleasure experience (TEPS) and behavioral activation (BAS) than BP, who did not differ from HC. SZ and BP showed differential patterns of relationships between the hedonic experience and behavioral activation measures. Overall, the results suggest that reduced hedonic experience and behavioral activation may be effective phenotypes distinguishing SZ from BP even when affective symptoms are minimal. However, hedonic experience differences between SZ and BP are sensitive to measurement strategy, calling for further research on the nature of anhedonia and its relation to motivation in these disorders.

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## 1. Introduction

Anhedonia – the diminished ability to experience pleasure – comprises one of the core negative symptoms of schizophrenia (SZ), closely related to amotivation and apathy, symptoms that severely interfere with daily functioning. Disturbances in hedonic experience are also observed in bipolar disorder (BP), evident by excessive pleasure-seeking during the manic state and reduced interest and pleasure during the depressive state. The Kraepelinian distinction between SZ and BP emphasizes affective and volitional impairment in the former (Kraepelin, 1921; Kendler, 1986), suggesting that emotional measures targeting hedonic experience, drive and motivation should differentiate the two diagnostic groups. However, emotional abnormalities, negative affect, and poor social adjustment characterize both SZ and BP (Blanchard et al., 1998; Elgie and Morselli, 2007; Gur et al., 2010; Rosa et al., 2010; Townsend and Altshuler, 2012; Kring and Elis, 2013; Michalak et al., 2013), which may reflect on assessments of hedonic capacity. This study sought to clarify whether hedonic

experience and behavioral activation may be distinguishing phenotypes for SZ and BP.

Individuals with SZ have consistently shown elevated levels of anhedonia compared with healthy controls as assessed by interview-based (e.g., Sayers et al., 1996; Blanchard and Cohen, 2006) and self-report measures (Berenbaum and Fujita, 1994; Horan et al., 2008). However, experimental and experience-sampling studies have suggested the opposite, such that SZ participants often report equal levels of pleasant emotions in response to positive stimuli in the laboratory (Kring and Moran, 2008; Cohen and Minor, 2010) and similar intensity (though reduced frequency) of positive emotions in daily life as compared with healthy controls (Myin-Germeys et al., 2000, 2001). A recent attempt to reconcile this “emotion paradox” in SZ distinguishes the ability to experience “in the moment” pleasure from the ability to anticipate pleasure. Using the Temporal Experience of Pleasure Scale (TEPS), individuals with SZ were shown to have intact consummatory pleasure along with deficits in anticipatory pleasure in one study (Gard et al., 2007), although others have reported the opposite finding (Strauss et al., 2011). Recent neuroimaging data have shown abnormal reward learning and anticipation in SZ (see Ziauddeen and Murray, 2010 for review), as well as the failure to use prefrontal cortical mechanisms involved in reflecting upon emotional experience (Ursu et al., 2011). Gold et al. (2008), Strauss and Gold (2012)

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and Strauss (2013) asserted that rather than reflecting a reduced capacity to experience pleasure, anhedonia in SZ reflects impaired reward representation and low-pleasure beliefs in recalling and forecasting hedonic experience. This view provides a plausible explanation as to why individuals with SZ are able to experience in-the-moment pleasure yet show difficulty with representation and goal-related computations about potentially rewarding experiences. In addition, in contrast to findings of increased self-report anhedonia, the lack of overall difference in self-report behavioral activation between SZ and healthy controls (Barch et al., 2008; Scholten et al., 2006; Strauss et al., 2011) suggests that how questions are framed can influence the results and warrants further investigation.

Clinically, bipolar affective disorder (BP) is set apart from schizophrenia by the absence of significant negative symptoms, or at least those associated with the Kraepelinian ‘deficit’ syndrome (Carpenter et al., 1999a, 1999b). However, BP patients exhibit significant mood dysregulation, including depression with anhedonia, although few studies have examined the phenomenon of anhedonia in BP. These findings have been mixed, likely due to varied clinical states of the patients and also sampling and measurement factors. As would be expected, anhedonia is prevalent among BP patients in the depressed phase (52%; Mazza et al., 2009), and while the rate is much lower among euthymic patients (12–20.5%), it is still significantly higher than healthy controls (Etain et al., 2007; Di Nicola et al., 2013). In mood induction studies, BP patients have shown sustained elevations of positive emotions across positive, neutral, and negative contexts compared with controls (Farmer et al., 2006; Gruber et al., 2008, 2011a). They have also been shown to be less able to regulate positive emotions with cognitive restructuring techniques such as reappraisal compared with healthy individuals (Johnson et al., 2008; Gruber et al., 2009, 2011b). Together with self-report (Meyer et al., 2001; Hayden et al., 2008), behavioral (Hayden et al., 2008; Pizzagalli et al., 2008), electrophysiological (Hayden et al., 2008), and neuroimaging findings (Abler et al., 2008), there is ample evidence suggesting that abnormalities in hedonic experience in BP lie in a dysregulated reward-related behavioral activation system (BAS) that leads to abnormal goal pursuit.

Few studies have directly compared SZ and BP for hedonic experience. They have generally found that SZ has higher levels of anhedonia compared with BP. For example, Blanchard et al. (1994) found higher levels of physical and social anhedonia (as measured with the traditional Chapman scales) in SZ compared with a small sample of BP patients in manic or mixed state. Schürhoff et al. (2003) and Etain et al. (2007) also observed higher physical anhedonia in euthymic SZ compared to euthymic or recently manic BP. However, duration of illness and affective symptoms of the two clinical groups were often not well matched, calling for replications with samples better matched for these variables. Further, these studies assessed only trait anhedonia as measured with the Chapman scales; it remains unclear whether the two clinical groups also differ in other aspects of reward-related experience, such as consummatory vs. anticipatory pleasure and behavioral activation. Disorder-specific patterns of different aspects of reward-related experience would provide further understanding of the disease nature of SZ and BP.

In this study, we examined hedonic experience and behavioral activation in a sample of patients with stable SZ and BP matched for age, sex, parental education, illness duration, cognitive and social functioning, and negative affect symptoms. We compared the two clinical groups, with respect to a sample of healthy controls, using the Chapman Physical and Social Anhedonia Scales (Chapman and Chapman, 1976; Eckblad et al., 1982), Temporal Experience of Pleasure Scales (TEPS; Gard et al., 2006), and the Behavioral Activation Scale (BAS; Carver and White, 1994).

We hypothesized that SZ would report higher trait anhedonia as measured with the Chapman scales, equal consummatory pleasure but lower anticipatory pleasure on the TEPS, and lower behavioral activation as measured with the BAS when compared with BP and HC. We predicted that BP would report higher trait anhedonia (Chapman scales), but equal consummatory and anticipatory pleasure (TEPS) as well as behavioral activation (BAS) when compared with HC.

## 2. Methods

### 2.1. Participants

Forty-three patients with stable schizophrenia ( $n=33$ ) or schizoaffective disorder ( $n=10$ ) (SZ), 27 patients with bipolar disorder I ( $n=24$ ) or II ( $n=3$ ) (BP), and 36 healthy controls (HC) completed the study. Participant eligibility was determined using a screening checklist followed by the Structured Clinical Interview for the DSM-IV (SCID-I; First et al., 1995). Patients were recruited from local community mental health facilities and a university mental health clinic. Comorbid Axis I disorders were allowed, but those who were on a court-ordered treatment plan were excluded. Healthy controls were recruited via postings in the community and excluded if they had a history of mental, neurological, or serious physical illness that could affect brain functions, or a history of substance abuse/dependence in the past six months. All participants were between the ages of 18–70, and provided written informed consent after full explanation of the study was given. The study was approved by the University of Michigan Institutional Review Board and conducted in accordance with the sixth revision of the Declaration of Helsinki. Thirty-seven of the SZ sample and 30 of the HC also completed a battery of self-report psychological measures that are outside the scope of this paper and reported elsewhere (Tso et al., 2012).

### 2.2. Assessments

#### 2.2.1. Clinical ratings

Clinical syndromes were further assessed using the Brief Psychiatric Rating Scale (BPRS; Overall and Gorham, 1962) and the Scale for the Assessment of Negative Symptoms (SANS; Andreasen, 1983). The BPRS items of Hallucinatory Behavior, Unusual Thought Content, Suspiciousness, and Conceptual Disorganization were summed to form the positive symptoms subscore; Emotional Withdrawal, Motor Retardation, and Flat Affect were summed for the negative symptoms subscore. The total score of the SANS was obtained by summing the global scores on the Flat Affect, Alogia, Avolition, and Anhedonia subscales. Level of current depression was assessed using the Calgary Depression Scale (CDS; Addington et al., 1993). All of these were assessed by a trained Master's level clinical research associate prior to participants' completion of the self-report measures described below.

#### 2.2.2. Affective symptoms

Participants completed self-report measures of negative affect: the Beck Depression Inventory (BDI; Beck et al., 1996), the Spielberger State-Trait Anxiety Inventory (STAI; Spielberger et al., 1970), and the Psychological Stress Index (PSI-18; Tso et al., 2012). These measures showed good internal consistency as indicated by Cronbach's alphas, ranged from 0.85 to 0.93 (see Table 1).

**Table 1**

Internal consistency (Cronbach's alpha) of self-report measures of negative affect and hedonic experiences.

Variables	Number of items	SZ ( $n=39$ )	BP ( $n=24$ )	HC ( $n=36$ )
BDI	21	0.84	0.92	0.88
STAI	20	0.89	0.92	0.90
PSI	18	0.84	0.84	0.89
Chapman physical	61	0.87	0.85	0.77
Chapman social	40	0.80	0.90	0.86
TEPS anticipatory	10	0.75	0.76	0.39
TEPS consummatory	8	0.80	0.82	0.66
BAS reward responsiveness	5	0.81	0.86	0.71
BAS drive	4	0.80	0.81	0.89
BAS fun seeking	4	0.66	0.67	0.84

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