

Anhedonia in schizophrenia: Distinctions between anticipatory and consummatory pleasure [☆]

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Abstract

Research on anhedonia in schizophrenia has revealed mixed results, with patients reporting greater anhedonia than healthy controls on self-report measures and semi-structured interviews, but also reporting comparable experiences of positive emotions in response to pleasurable stimuli. Basic science points to the importance of distinguishing between anticipatory and consummatory (or in-the-moment) pleasure experiences, and this distinction may help to reconcile the mixed findings on anhedonia in schizophrenia. In two studies, we tested the hypothesis that anhedonia in schizophrenia reflects a deficit in anticipatory pleasure but not consummatory pleasure. In Study 1, we used experience sampling methodology to assess reported experiences of consummatory and anticipated pleasure among schizophrenia patients and controls. In Study 2, schizophrenia patients and controls completed a self-report trait measure of anticipatory and consummatory pleasure and interviews that assessed negative symptoms, including anhedonia, and community functioning. In both studies, we found evidence for an anticipatory but not a consummatory pleasure deficit in schizophrenia. In addition, anticipatory pleasure was related to clinical ratings of anhedonia and functional outcome. Clinical and research implications of these findings are discussed.

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1. Introduction

Although anhedonia, defined as an inability to experience pleasure, has long been considered a core feature of schizophrenia, recent research raises fundamental questions about the nature of this emotional disturbance. On the one hand, patients report experiencing lower levels of pleasure than controls on self-report trait measures and in semi-structured interviews (see Horan et al., 2006b for a review). On the other hand, patients report experiencing as much pleasant

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emotion as controls in response to emotionally evocative stimuli (e.g., Berenbaum and Oltmanns, 1992; Kring and Earnst, 1999; Kring and Neale, 1996).

In an effort to reconcile these findings, we have proposed that the nature of the anhedonia deficit in schizophrenia is more circumscribed (Germans and Kring, 2000; Kring, 1999). Drawing on neurobehavioral models that distinguish between components of hedonic experience (e.g., Berridge and Robinson, 2003; Depue and Collins, 1999; Gard et al., 2006; Knutson et al., 2001), we proposed that schizophrenia patients experience normal levels of pleasure when directly engaged in an enjoyable activity, or *consummatory* pleasure, but experience disturbances in the experience of pleasure related to future activities, or *anticipatory* pleasure. These aspects of hedonic experience have distinguishable neural circuitry, neurotransmitter involvement, and behavioral sequelae. Anticipatory pleasure appears to rely heavily, though not exclusively, on dopamine and the mesolimbic pathway whereas serotonergic and opioid systems appear to be more centrally involved in consummatory pleasure (Berridge and Robinson, 1998; Schultz, 2002; Wise, 2002). Anticipatory pleasure can be further parsed into two components: (1) predicting the future experience of pleasure, and (2) the concurrent experience of pleasure knowing that a future activity is going to occur — that is, the pleasure experienced *in anticipation* of things to come. In addition, anticipatory pleasure is linked to motivational processes that promote goal-directed behaviors aimed at achieving desired rewards (Carver, 2001; Dickinson and Balleine, 1995; Schultz, 2002). Thus, to the extent that schizophrenia patients exhibit deficits in anticipatory pleasure, we would expect this to be linked to a decrement in goal-directed behavior.

In the current studies, we used convergent methods to evaluate the hypothesis that schizophrenia patients have an anticipatory but not consummatory pleasure deficit. In Study 1, we examined daily reports of anticipatory and consummatory pleasure in schizophrenia patients and healthy controls over the course of one week. Using the experience sampling method, we assessed participants' ability to predict future pleasure from both goal-directed and non-goal-directed activities. In Study 2, we administered a battery of self-report and interview-based measures, including a trait measure of anticipatory and consummatory pleasure, to schizophrenia patients and healthy controls. The trait measure used in Study 2 assesses the experience of pleasure in anticipation of future events. To further establish the validity of this pleasure distinction in schizophrenia, we examined the correlates of anticipatory and consummatory pleasure in schizophrenia patients, including other measures

of anhedonia, approach motivation, and functional outcome.

2. Study 1

2.1. Method

2.1.1. Participants

Outpatients with either schizophrenia ($n=10$) or schizoaffective disorder ($n=5$) participated. Diagnoses were confirmed using the Structured Clinical Interview for DSM-IV (First et al., 1994). Individuals were excluded from the study if they reported current alcohol or drug abuse, a history of head trauma or loss of consciousness, poor fluency in English, or an active mood episode. All patients were taking medication, either typical ($n=10$) or atypical ($n=5$) antipsychotics.¹ Healthy controls ($n=12$) were recruited via flyers in the community and were screened with a phone interview. Controls were excluded if they reported a personal or family history of mental illness or psychiatric hospitalization, past head trauma or loss of consciousness, current substance abuse or dependence, English fluency problems, or prescription medication that might have affected mood. All participants were paid \$50.00 for their participation. This study received IRB approval for all procedures, and all participants gave written informed consent to participate.

Patients and controls did not significantly differ in age $t(25)=1.81$, ns, education $t(25)=.12$, ns, gender $\chi^2(1, N=27)=1.69$, ns, ethnicity $\chi^2(3, N=27)=2.13$, ns, marital status $\chi^2(3, N=27)=6.63$, ns, or employment status $\chi^2(2, N=27)=4.33$, ns (see Table 1).

2.1.2. Measures and procedure

We followed typical experience sampling study procedures by using pagers and booklets for participants to enter information regarding their daily experience. Participants were paged seven times a day for seven days (49 observations per participant). The times of the pages were pseudo-random between 8 a.m. and 10 p.m. such that no two pages occurred within 45 min of each other and that pages occurred at least once every 3 h. Once paged, participants wrote down what they were doing and rated the amount of enjoyment they were experiencing (i.e., their consummatory pleasure) using a 5 point Likert scale (0 = not at all to 5 = very much). Participants rated anticipatory pleasure by indicating what they were

¹ Given the small number of patients taking atypical neuroleptics in Study 1, we felt it imprudent to examine patients' responses based on medication type or dosage. Indeed, the most optimal test for medication effects is to test the same patients both on and off medication (Blanchard and Neale, 1992).

Table 1
Demographic and clinical characteristics

	Study 1		Study 2	
	Patient	Control	Patient	Control
	N=15	N=12	N=51	N=50
	M (SD)	M (SD)	M (SD)	M (SD)
Age	42.67 (8.33)	36.33 (9.85)	48.06 (9.61)	46.62 (10.27)
Education (years)	12.5 (1.96)	12.42 (1.68)	13.14 (2.00)	13.35 (1.02)
Gender	N	N	N	N
Male	10	5	33	25
Female	5	7	18	25
Ethnicity				
African American	5	4	19	17
Asian American	1	1	3	1
Latino	1	3	5	3
White/Caucasian	8	4	23	26
Other	0	0	1	3
Marital status				
Never married	12	5	25	28
Married	0	3	6	10
Divorced	3	3	19	12
Widowed	0	1	0	0
Diagnosis				
Schizoaffective	5	N/A	1	N/A
Schizophrenia	10		50	
Medication status				
Typical antipsychotics	10	N/A	8	N/A
Atypical antipsychotics	5		31	
Both typical and atypical	0		8	
No medication	0		2	

looking forward to doing (no time frame was indicated) and the amount of enjoyment they anticipated they would get out of that activity using the same Likert scale. For current and ‘looked forward to’ activities, participants chose from a list of activities that included “nothing.” Responses made more than 15 min after a page (less than 2% for each group) were not included in the final analyses given the evidence that such responses are less reliable than earlier responses (e.g., deVries, 1992).

Two undergraduate research assistants coded the reported activities into ‘goal-directed’ and ‘non-goal-directed’ categories, and agreement was nearly 100%. Goal-directed activities were part of pursuing a goal (making dinner, doing an errand, en route somewhere, working or studying). Non-goal-directed activities were not directly related to going after a larger goal (eating dinner, watching TV, smoking, sleeping).

2.2. Results and discussion

Data were analyzed using hierarchical linear modeling (HLM; e.g., Bryk and Raudenbush, 1992; Schwartz and

Stone, 1998). HLM treats the multiple observations gathered for each participant (enjoyment ratings or reported activities) as ‘Level 1’ data (within subjects) that are nested within individuals at ‘Level 2’ (between subjects variable of group: patient or control). Separate models were estimated for current and ‘looking forward to’ activities, consummatory pleasure, and anticipatory pleasure.

Patients and controls did not significantly differ with respect to the number of pages they responded to, with patients responding to 89.4% (SD=6.6), and controls responding to 86.4% (SD=9.0) of pages. Patients and healthy controls did not significantly differ in the amount of time spent engaging in or looking forward to non-goal-directed activities t 's (25)=1.45 and 0.46, ns. However, patients (17%) were engaged in goal-directed activities less often than controls (35.7%) t (25)=3.12, $p<.01$, and patients reported looking forward to goal-directed activities less often than controls (4.8% versus 15.1%) t (25)=2.71, $p<.01$. As predicted and shown in Fig. 1, patients did not significantly differ from controls in their reported consummatory pleasure. This was true for both non-goal-directed, t (25)=0.74, ns, and goal-directed activities, t (25)=1.45, ns. Hence, compared with healthy controls the patients reported similar levels of pleasure from goal-directed activities, but did them less often.

Also shown in Fig. 1 the expected finding is that patients reported anticipating less pleasure from future activities compared to controls t (25)=1.95, $p=.06$. Moreover, patients reported significantly less anticipatory pleasure for goal-directed activities than controls t (25)=3.92, $p<.01$, suggesting a link between anticipatory pleasure of motivated behavior. Patients did not differ from controls in their anticipatory pleasure for non-goal-directed activities.

Consistent with our hypothesis, schizophrenia patients exhibited a deficit in anticipatory pleasure, particularly for goal-directed activities, but did not exhibit a deficit in consummatory pleasure. Furthermore, schizophrenia patients reported engaging in and looking forward to fewer goal-directed activities in daily life than controls. Despite the large number of observations per participant, the small sample size limits our ability to make stronger conclusions based on these data. In Study 2, we include more patients and controls to increase the generalizability of the findings.

3. Study 2

In Study 2, participants completed the Temporal Experience of Pleasure Scale (TEPS), a trait measure of pleasure in anticipation and consummatory pleasure (Gard et al., 2006), which measures pleasure experienced

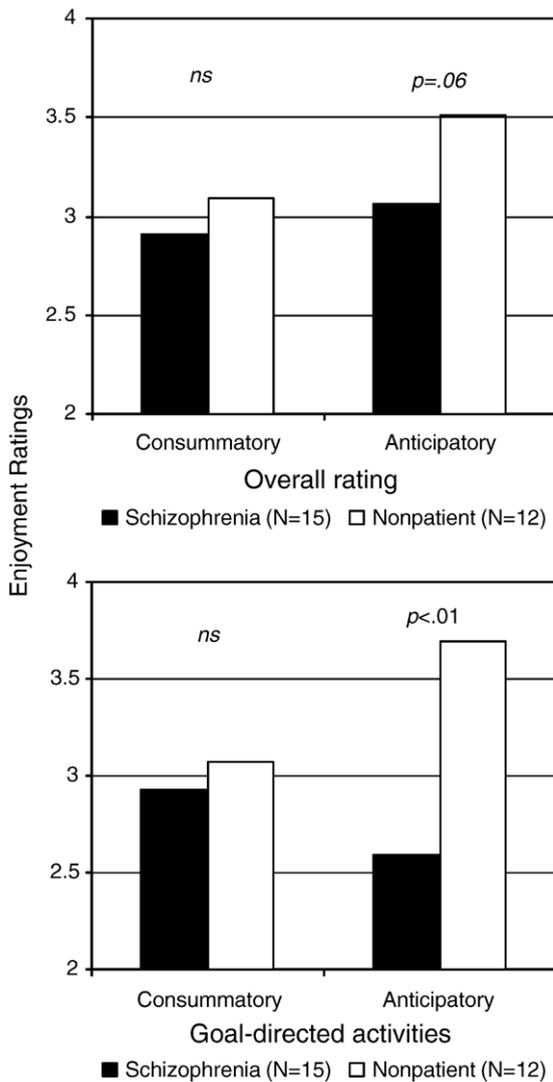


Fig. 1. Ratings of anticipatory and consummatory pleasure for schizophrenia patient and healthy control participants for Study 1.

in the moment and in anticipation of future activities. We hypothesized that patients would score lower than controls on the anticipatory scale but not the consummatory scale. In addition, we investigated the correlates of anticipatory and consummatory pleasure. We hypothesized that anticipatory pleasure, but not consummatory pleasure would be related to other interview and self-report measures of anhedonia. We expected that decrements in anticipatory pleasure would be linked to decrements in motivational processes. In addition, we examined the relationship between anticipatory and consummatory pleasure and functional outcome in schizophrenia, predicting that a deficit in anticipatory pleasure may have important functional consequences for patients with schizophrenia.

3.1. Method

3.1.1. Participants

Participants were recruited from UC Berkeley and the Greater Los Angeles VA. Patients from UC Berkeley were diagnosed with either schizophrenia ($n=21$) or schizoaffective disorder ($n=1$) and did not have current alcohol or drug abuse, a history of head trauma or loss of consciousness, poor fluency in English, or an active mood episode. Patients from the VA were diagnosed with schizophrenia ($n=29$) and did not have current alcohol or drug abuse, identifiable neurological disorder, mental retardation, or seizure disorder. (For additional details on participant selection at the Greater Los Angeles VA, see Horan et al., 2006a). At both sites, diagnoses were confirmed using the SCID-IV. Two patients were not taking antipsychotic medication, 8 were taking typical, 31 atypical, and 8 a combination of typical and atypical antipsychotics. Medication information was unavailable for two patients. Healthy controls from UC Berkeley ($n=19$) were recruited from the community using the same criteria as in Study 1. Controls from the VA ($n=31$) were recruited from the community through notices placed in newspapers, flyers, and websites and were screened with the SCID and SCID-II (First et al., 1996). Controls were excluded if they had a first-degree relative with a psychotic disorder, were currently abusing drugs or alcohol, had a neurological or seizure disorder, mental retardation, mood disorder, borderline, avoidant, or any Cluster A personality disorder. There were no differences between the Berkeley and VA samples for either patients or controls in terms of age, years of education, ethnicity, marital status, patient medication status (i.e., number of patients taking typical or atypical antipsychotics), or gender, except that there were more women controls in the Berkeley sample than the VA sample. This study received IRB approval at both institutions for all procedures, and all participants gave written informed consent to participate.

As shown in Table 1, patients and controls did not significantly differ with respect to age $t(98)=0.72$, ns, education $t(98)=0.66$, ns, gender $\chi^2(2.23, N=101)=1.69$, ns, ethnicity $\chi^2(4, N=101)=2.79$, ns, or marital status $\chi^2(2, N=100)=2.75$, ns.

3.2. Measures and procedure

All participants completed the *Temporal Experience of Pleasure Scale* (Gard et al., 2006), an 18-item self-report measure of trait anticipatory and consummatory pleasure. The TEPS has good internal consistency, test-retest reliability, and convergent and discriminant

validity (Gard et al., 2006). All participants also completed the *Behavioral Inhibition and Behavioral Activation Scales* (BIS/BAS; Carver and White, 1994), a 24-item self-report scale that measures trait approach and avoidance motivation. The BIS scale measures sensitivity to punishment and non-reward. The BAS scale measures sensitivity to reward and goal-directed pursuits and contains three subscales: drive, fun-seeking, and reward responsiveness.

A subset of patients from the VA ($n=31$) completed the *Revised Physical Anhedonia Scale* (PAS; Chapman et al., 1976), a 61-item scale of physical pleasure deficits, and the *Revised Social Anhedonia Scale* (SAS; Eckblad et al., 1982), a 40-item scale of social pleasure deficits. Both scales have been used extensively in schizophrenia studies (Horan et al., 2006b). These patients were also rated for negative symptoms using the *Schedule for the Assessment of Negative Symptoms* (SANS; Andreasen, 1983) and for functioning in the areas of work productivity, independent living and self-care, immediate family networks, and extended social networks using the *Role Functioning Scales* (RFS; Goodman et al., 1993).

3.3. Results and discussion

Consistent with Study 1 and shown in Fig. 2, patients did not significantly differ from controls on the TEPS consummatory scale, $t(99)=1.46$, ns. However, patients reported significantly less anticipatory pleasure than controls $t(99)=2.97$, $p<.01$.

In order to indirectly examine medication influences, we examined TEPS scores based on the types of medications patients were taking. There were no differences in reports of anticipatory or consummatory pleasure between patients taking only typical antipsychotics and those taking only atypical antipsychotics, t 's (37)=0.79 and 1.17, ns. Although this is not an optimal test of medication effects (cf. Blanchard and Neale, 1992), there were no marked differences among patients taking different types of medications.

The correlates of anticipatory and consummatory pleasure were examined among schizophrenia patients by computing correlations between the TEPS scales and the measures of motivation, anhedonia, and functional outcome (see Table 2). Trait motivational avoidance (BIS) was not significantly related to anticipatory or consummatory pleasure, consistent with previous research (Gard et al., 2006). As predicted, anticipatory pleasure (but not consummatory pleasure) was significantly positively correlated with scores on the BAS total scale as well as the drive and reward seeking

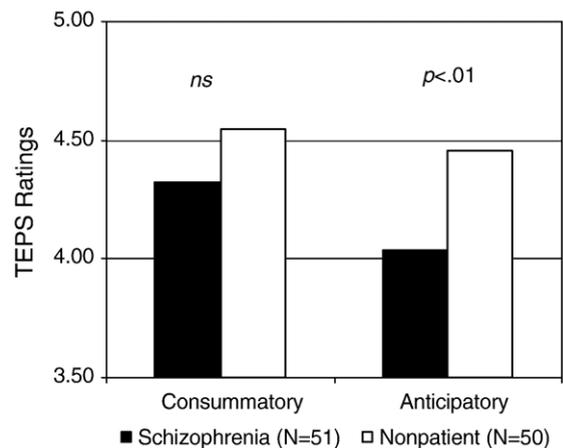


Fig. 2. Ratings of anticipatory and consummatory pleasure on the Temporal Experience of Pleasure Scale for schizophrenia patient and healthy control participants for Study 2.

subscales of the BAS, indicating that anticipatory pleasure was related to key aspects of approach motivation system sensitivity.

Patients' reports of anticipatory pleasure were also significantly correlated with physical and social anhedonia. In contrast, consummatory pleasure was significantly correlated with physical anhedonia, but not social anhedonia. Since both TEPS scales assess physical pleasure, it is not surprising that physical anhedonia was related with both TEPS subscales.

As predicted, SANS ratings of anhedonia were significantly correlated with patients' reports of anticipatory pleasure, but not consummatory pleasure. Although the SANS asociality/anhedonia scale does not include an anticipatory pleasure rating, these ratings were nonetheless more sensitive to patients' reports of anticipatory pleasure. Schizophrenia patients' reports of anticipatory pleasure were also significantly correlated with ratings of family functioning and extended social networks, while reports of consummatory pleasure were unrelated to all four RFS subscales. Thus, anticipatory pleasure was selectively related to how well patients were functioning in their daily lives.

4. General discussion

Across two studies using complementary methods, schizophrenia patients reported as much pleasure in the moment as controls in their daily lives and on a measure of trait consummatory pleasure. However, schizophrenia patients predicted that future daily life events would be less pleasurable, and they reported experiencing less pleasure in anticipation of future events compared to

Table 2
Correlates of anticipatory and consummatory pleasure in schizophrenia

Measure	TEPS anticipatory	TEPS consummatory
BIS	.17	.05
BAS total	.42**	.23
Fun-seeking	.19	.09
Reward responsiveness	.41**	.18
Drive	.29*	.23
SANS anhedonia	-.38**	-.17
RFS		
Social	.51**	.21
Family	.50**	.21
Independent living	.19	.11
Work	.08	.33
Physical Anhedonia Scale	-.48**	-.62**
Social Anhedonia Scale	-.43**	-.08

Note: BIS = Behavioral Inhibition Scale; BAS = Behavioral Activation Scale; SANS = Schedule for the Assessment of Negative Symptoms; RFS = Role Functioning Scale. **Indicates $p < .01$; *indicates $p < .05$.

healthy controls. Further supporting the distinction between anticipatory and consummatory pleasure, clinical ratings of anhedonia were related to anticipatory, but not consummatory pleasure. In addition, ratings of functional outcome spanning family and social functioning were related to patients' reports of anticipatory, but not consummatory pleasure.

These findings help provide clarity to the discrepancy between experimental studies of emotion and schizophrenia (where no clear pleasure deficits have been found) and self-report and interview studies (where pleasure deficits have been found). Schizophrenia patients may have a deficit in anticipating that things will be pleasurable, but once an enjoyable stimulus is before them, they can and do experience pleasure. This distinction may help uncover some of the mechanisms behind social and emotional functioning deficits in schizophrenia, and it may also lead to more targeted treatments of anhedonia. In Study 2, we found evidence for a linkage between the experience of anticipatory pleasure and family and social network functional outcomes. A deficit in the ability to experience anticipatory pleasure may contribute to interpersonal or social isolation, limited social engagement, and other impoverished environments, though such causal suggestions are clearly beyond the data presented here. Future studies should look more specifically to social anticipatory pleasure to clarify these relationships.

Given the connection between dopamine and anticipatory pleasure, it is possible that the observed anticipatory pleasure deficit in schizophrenia reflects a consequence of medication more than an aspect of the illness. However, other investigations have observed anhedonia among unmedicated patients, using both self-report measures (e.g., Arnfred and Chen, 2004; Gruzelier and Davis, 1995)

and clinical ratings (Zhang et al., 2001), and among first episode patients, many of whom were not taking medication (e.g., Malla et al., 2002). A recent fMRI investigation (Juckel et al., 2006b) also found evidence for an anticipatory deficit among unmedicated patients as indexed by less activation than healthy controls in brain regions associated with reward anticipation (ventral striatum, including nucleus accumbens; cf Knutson et al., 2001) during presentation of reward cues. Furthermore, this reduced activation was associated with more severe negative symptoms, including anhedonia. In a second study using the same reward anticipation task, reduced activation in ventral striatum was found only among patients taking typical neuroleptics (Juckel et al., 2006a). Most of the patients in Study 2 were taking atypical antipsychotics. In future studies it would be useful to study at risk groups or unmedicated individuals in the schizophrenia spectrum.

Although schizophrenia patients represent emotion in the same two-dimensional structure (valence, arousal) as healthy controls (e.g., Kring et al., 2003), demand characteristics may have influenced reports of pleasure. However, there is no reason to believe that demand characteristics would operate more strongly for consummatory pleasure than anticipatory pleasure, or for patients more than controls. Nonetheless, it will be important for future studies to assess anticipatory and consummatory pleasure with additional behavioral and physiological measures.

The anticipatory/consummatory pleasure distinction has been discussed in the depression literature (e.g., Klein, 1984), and cognitive therapy for depression has targeted anticipatory pleasure (e.g., Burns, 1999). Though it remains to be seen if this type of intervention would be beneficial in schizophrenia, such investigations are now underway (e.g., Beck and Rector, 2005; Turkington et al., 2004).

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6. Contributors

Study 1 was designed by Ann Kring and David Gard, and data were collected at UC Berkeley with Ann Kring, David Gard, and Marja Germans Gard. Study 2 was designed by all authors, and data were collected at UC Berkeley with Ann Kring, David Gard and Marja Germans Gard, and at VA with William Horan and Michael Green. David Gard wrote the first draft of the manuscript, undertook the statistical analyses, and coordinated the feedback and input of the

other authors. All authors contributed to and have approved the final manuscript.

7. Conflict of interest

All authors declare that they have no conflicts of interest.

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