+ model

ARTICLE IN PRESS

Available online at www.sciencedirect.com

SCIENCE DIRECT®

ELSEVIER

Psychiatry Research xx (2006) xxx–xxx

PSYCHIATRY RESEARCH

www.elsevier.com/locate/psychres

Episodic memory for emotional and non-emotional words in individuals with anhedonia

Jennifer R. Mathews *, Deanna M. Barch

Department of Psychology, Washington University, Campus Box 1125, St. Louis, MO 63130, USA

Received 21 April 2004; received in revised form 21 March 2005; accepted 13 July 2005

Abstract

Anhedonia is a symptom that plays a significant role in theories of illness such as depression and schizophrenia. Some previous research suggests that participants who report high levels of social/physical anhedonia also show deficits in both self-report and physiological measures of emotional processing, particularly for measures of emotional valence as compared with emotional arousal. Little is known about memory for emotionally valenced information or how this might be related to emotional processing in anhedonia. Participants were 391 undergraduate students participating for course credit. We administered an incidental encoding task that required participants to rate emotional words on both valence and arousal dimensions. We then administered surprise recall and recognition tasks to all participants. Results indicated that higher levels of physical and social anhedonia were associated with attenuated valence ratings of emotional words but did not influence arousal ratings or the memory pattern for emotionally valenced information. These findings suggest that there is some reduction in emotional experience in individuals with anhedonia, but that this reduction does not appear to produce a deficit in memory performance, perhaps due to the intact experience of arousal.

Keywords: Anhedonia; Emotion; Memory

1. Introduction

Anhedonia, the inability to experience pleasure, is a symptom that plays a significant role in many theories of illnesses such as depression and schizophrenia. For example, in Meehl's theory of schizotaxia, primary anhedonia is thought to play a crucial role in increasing susceptibility to developing psychosis (Meehl, 1962). According to Meehl, the ability to experience and anticipate pleasure serves as a buffer of sorts to the development of a psychotic disorder, potentially by protecting against the negative influences of stress. As a result of an inability to feel pleasure, Meehl contends that anhedonia leads to an "aversive drift" or the tendency to view events as negative or threatening (Meehl, 1962) given the absence of positive hedonic cues. Despite the prominent role of anhedonia in theories such as Meehl's, relatively little empirical work has focused on understanding the specific nature of emotional processing disturbances in individuals who self-report high levels of anhedonia. The goal of the current study is to address the following three questions: (1) What are the subjective emotional responses of individuals who report anhedonia to affect-eliciting stimuli? (2) Do individuals with anhedonia have differential deficits in the valence versus the arousal dimensions of emotion? and (3) Do individuals with anhedonia experience disturbances in memory for affective stimuli?

* Corresponding author. Tel.: +1 314 935 8459; fax: +1 314 935 8790.

E-mail address: jrlofton@artsci.wustl.edu (J.R. Mathews).

0165-1781/$ - see front matter © 2005 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.psychres.2005.07.030

Anhedonia is typically rated based on the individual's self-report of emotional experience, usually during a clinical interview or on a questionnaire. However, relatively little is known about how individuals who report being socially or physically anhedonic actually respond to emotion eliciting stimuli. A few studies have examined the relationship between self-reports of anhedonia and other aspects of emotional processing in individuals with manifest schizophrenia. For example, a study by Berenbaum and Oltmanns (1992) found that patients with schizophrenia did not differ from controls in their self-reports of emotion in response to emotional stimuli, despite the fact that the patients reported higher levels of social and physical anhedonia in a clinical interview. Blanchard et al. (1994) found that individuals with schizophrenia who reported higher levels of physical anhedonia also reported less positive affect when watching both positive and negative film clips. However, these reduced positive affect reports among patients may have simply reflected baseline reductions in positive affect, given that patients showed a clear increase in positive affect in response to the positive as compared to negative film clips and the reduced positive effect reports were present in all valence conditions. Recent research by Mathews and Barch (2004) found that individuals with schizophrenia had intact self-reports of emotional valence and arousal in response to affectively valenced words, despite again having higher clinical ratings of anhedonia than controls. Thus overall, the existing research on schizophrenia, anhedonia, and emotional processing suggests that although patients may report high levels of anhedonia, they appear to self-report experiencing the same levels of positive emotion in response to affect eliciting stimuli.

Several additional studies have examined anhedonia in individuals without a clinical diagnosis of any form of psychopathology. These studies have typically examined individuals who score highly on scales such as the Chapman social and physical anhedonia scales (Chapman et al., 1980). These individuals are of interest to psychopathology researchers, given the theorists who have argued that high levels of anhedonia constitute a vulnerability for psychosis (Meehl, 1962; Rado, 1962). Further, studies by Chapmanet al. have shown that individuals who score more than two standard deviation above the mean are at an increased risk for the later development of psychotic disorders (Kwapil et al., 1997). A number of these studies examined the relationships between self-reports of anhedonia on questionnaires and self-reports of emotion in response to affect eliciting stimuli. Many of these studies have found that participants with high levels of anhedonia report and rate stimuli as less positive or less interesting than controls (Ferguson and Katkin, 1996; Fiorito and Simons, 1994; Fitzgibbons and Simons, 1992; Gooding et al., 2002; Putnam, 1997; Simons et al., 1982), though one study reported no difference between high anhedonic individuals and controls (Berenbaum et al., 1987). Several studies have also examined facial expressiveness in individuals with high ratings of anhedonia, with mixed results (Berenbaum et al., 1987; Putnam, 1997; Ferguson and Katkin, 1996; Fitzgibbons and Simons, 1992).

A number of previous studies have also examined heart rate while participants viewed emotional stimuli and have consistently found that when processing emotional and neutral stimuli, individuals who report high anhedonia show reduced changes in their heart rate response when processing emotional stimuli as compared to controls (Ferguson and Katkin, 1996; Fitzgibbons and Simons, 1992; Fiorito and Simons, 1994; Simons et al., 1982). In contrast, a number of the previous studies have also looked at skin conductance in individuals rated highly on anhedonia scales and have not found skin conductance differences between individuals who self-report high versus low anhedonia (Ferguson and Katkin, 1996; Fitzgibbons and Simons, 1992; Fiorito and Simons, 1994; Putnam, 1997). In addition, two studies looked at emotion modulated startle responses in anhedonics and concluded that high and low anhedonic individuals demonstrated similar changes in startle as a function of exposure to emotional stimuli (Putnam, 1997; Gooding et al., 2002).

In summary, the studies examining the relationships between self-reports of anhedonia on questionnaires and various indices of emotional responding to affect-eliciting stimuli among individuals without clinically diagnosed psychopathology suggest a mixed, but potentially informative picture. Many theories of emotional processing (Russell, 1980; Larsen and Diener, 1992) distinguish between valence (positive versus negative) and arousal (high versus low) aspects of subjective emotional responses, as research suggests that these may be partially independent aspects of emotional processing that are mediated by different neural systems (Bradley, 2000). Further, the literature on physiological indices of emotional processing in individuals reporting high levels of anhedonia suggests that there may be an important dissociation between the processing of valence versus arousal aspects of emotional responding. Previous work has suggested that heart rate tends to track the valence of emotional stimuli (e.g., positive versus negative), while skin conductance tends to track arousal irrespective of valence (e.g., high versus low arousal for both negative and positive stimuli) (Bradley et al., 1992). The literature reviewed above suggests that individuals reporting high levels of anhedonia show deficits in physiological indices linked to emotional valence (e.g., heart rate), but not emotional arousal (e.g., skin conductance). Whether this same dissociation exists in self-reports of emotional experience in anhedonia is unclear, as many of the studies reviewed above did not make this distinction. However, two studies (Fitzgibbons and Simons, 1992; Fiorito and Simons, 1994) distinguished between arousal and valence dimensions of emotion in their self-rating tasks in anhedonia individuals. The Fitzgibbons and Simons (1992) studies found deficits only in valence reports and not arousal reports. However, Fiorito and Simons (1994) found that both the valence and arousal self-report ratings were impaired. In sum, the literature on emotional processing in high anhedonia individuals suggests consistent evidence for deficits in the processing of valence, but mixed evidence for the processing of arousal.

It is also important to determine whether individual differences in anhedonia are related to the influence of emotion on other aspects of cognitive processing, as this may shed light on the ways that anhedonia could influence life function and risk for the development of psychosis. As described above, Meehl suggested that anhedonia contributes to susceptibility for developing a psychotic disorder by a reduced ability to buffer against stress and increased adverse drift. However, the mechanisms by which these effects may occur are not clear. One possibility is that anhedonia changes memory for emotional information, such that memories of positive stimuli are harder to retrieve (and thus less available to buffer against stressful or negative experiences), but memories for negative stimuli are easier to retrieve.

Research in healthy individuals suggests that the emotional valence and arousal of both verbal and non-verbal stimuli can influence subsequent memory for those stimuli. It has been shown that emotional experiences, as compared with non-emotional experiences, are remembered better (Christianson, 1992) and that people show better declarative memory for emotionally salient parts of a story than for neutral parts of that story (Adolphs et al., 1997; Cahill et al., 1995). In addition, recent research suggests that in addition to valence, arousal characteristics of emotional stimuli have a strong influence on subsequent memory for those stimuli. For example, research by Bradley et al. (1992) has found that college students who viewed emotional pictures recalled positive, highly arousing pictures better after a short delay. However, at both short and long delays, highly arousing stimuli were remembered better than low arousal stimuli. In fact, at both time periods, arousal had a bigger influence than valence on whether a picture was remembered. Research on emotional memory in schizophrenia has been limited, although one study by Koh et al. (1981) found that individuals with schizophrenia did not show the differential effect of memory for positive words that was found in controls. They suggest that this is evidence for the Pollyanna effect in controls and the effect of anhedonia in individuals with schizophrenia. Recent research by Mathews and Barch (2004) found that individuals with schizophrenia (whether or not they reported high anhedonia) demonstrated the same influence of both positive and negative emotional valence on memory as controls, with both groups demonstrating enhanced memory for high arousal over low arousal words and emotional over neutral words. Recently, Gooding and Tallent (2003) demonstrated that individuals with high social anhedonia performed more poorly than controls on a delayed match to sample task for affective stimuli. However, these same individuals also performed more poorly than controls on a spatial working memory task without affective stimuli. In addition, a study by Kerns and Berenbaum (2000) examined affective priming in social anhedonics and found that individuals with high levels of social anhedonia exhibited an effect of target valence related to priming. They suggest this is due to the tendency of social anhedonics to process affective information semantically, but refrain from processing the information affectively.

In the current study, we examined the influence of emotion on memory in individuals that self-report high levels of either or both physical and social anhedonia on the Chapman Psychosis Proneness Scales. To do so, we asked participants to rate a series of words on both arousal and valence, without telling them that they would receive a subsequent memory test (we refer to this as the *incidental encoding task*). The participants were later given surprise recall and recognition tasks. We predicted that if individuals with high levels of anhedonia had reduced subjective responses to emotionally valenced words (at least, according to Meehl, positive words) for both valence and arousal ratings, then they should also show a reduced influence of emotion on subsequent memory. This would be especially true for positive words if Meehl's theory of hypoactive appetitive responses were related to rating and memory for positive words. However, we predicted that if high anhedonia individuals experience disturbances in the processing of valence but not arousal, they would show an intact influence of emotional valence on subsequent memory. Such a result would be predicted based on research that suggested that ratings of arousal are at least as strong a predictor as ratings of valence of subsequent memory. Further, such a result would be consistent with a study by Putnam (1997) suggesting that high anhedonic individuals self-report feeling less hedonic experience to emotional stimuli, despite demonstrating the same physiological responses (another potential indicator of “arousal”) to emotional stimuli as healthy controls.

2. Methods

2.1. Participants

Participants were college students at Washington University in St. Louis who received psychology course credit for their participation. Four hundred and two participants were screened in several group-testing situations during which they filled out questionnaires that included the Chapman Psychosis Proneness Scales. All participants were required to be able to read and understand English; however, English was not required to be the participant's first language. In addition, reading disorders were not excluded (such as dyslexia), but enough time was allowed for everyone to be able to complete the ratings so that reading disorders need not be an exclusion for participating. For the correlational analyses presented below, we used all participants who had complete data ($N=391$). For categorical analyses using the behavioral high-risk approach, we classified individuals as either high or low anhedonia based on the following criteria (Blanchard et al., 2000; Chapman et al., 1980; Meehl, 1962; Meyer and Keller, 2001): individuals classified as high anhedonic were required to have either physical or social anhedonia cutoff scores at least 1.96 standard deviations above the mean for the entire sample for their gender. Physical anhedonic participants ($n=18$, 9 males and 9 females) were identified based on elevated scores on the Revised Physical Anhedonia Scale, and social anhedonic participants ($n=21$, 7 male and 14 females) were identified based on elevated scores on the Revised Social Anhedonia Scale (Chapman et al., 1995; Eckblad et al., 1982). Control participants were required to have physical and social anhedonia cutoff scores no higher than 0.5 standard deviations above the mean for their gender. Low anhedonia control participants comprised 64 males and 97 females. Both of these scales had excellent internal reliability in this sample, with alphas of 0.89 for the Physical Anhedonia Scale and 0.85 for the Social Anhedonia Scale. Additionally, participants were required to complete the Beck Depression Inventory (Beck and Steer, 1987) to examine the potential influence of depression on the results. This scale also had excellent internal consistency in this sample, with an alpha of 0.92. All participants signed informed consent forms in accordance with the Human Studies Committee at Washington University. Means and standard deviations for scores on the Social and Physical Anhedonia Scales for the high and low anhedonia groups, as well as Beck scores and demographic information, are shown in Table 1.

2.2. Materials and tasks

2.2.1. Incidental encoding

Each participant was asked to rate 50 words using the Self-Assessment Manikin (SAM) (Lang, 1980). The SAM system consists of two dimensions, the positive/negative scale and the arousal/calm scale. Both dimensions range on a 5-point scale, with 1 being either the most positive or the most aroused, 5 being the most negative or the most calm, and 3 being neutral for both dimensions. Specific instructions for the task are included in Appendix A. To select the words for this task, we used previously acquired valence and arousal ratings from 50 undergraduates on a set of 420 words. These words were obtained from a variety of sources, primarily from previously published studies on memory and emotion. From the initial 420 words, 50 words were chosen based on these undergraduate ratings of

Table 1
Physical Anhedonia, Social Anhedonia, and BDI descriptives (categorical and continuous)

Variable	High physical anhedonia		High social anhedonia		Low physical and social anhedonia		Total sample	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Physical Anhedonia Scale	28.56	3.36	19.35	9.58	6.94	3.45	10.47	6.96
Social Anhedonia Scale	13.56	7.01	20.14	2.97	4.34	2.77	7.04	5.14
Beck Depression Inventory	11.83	8.94	17.95	8.65	6.29	6.55	9.01	8.44
Gender	9 Male	9 Female	7 Male	14 Female	64 Male	97 Female	161 Male	230 Female

valence and arousal (see the Appendix A). Ten words from each of five categories were included: Neutral (NEU), Positive-High Arousal (PHA), Positive-Low Arousal (PLA), Negative-High Arousal (NHA), and Negative-Low Arousal (NLA) words. The words from each of the five categories were chosen to be similar on a number of dimensions that could have an influence on memory. Specifically, categories did not differ significantly in word length ($F(445)=0.03$, $P>0.95$) or word frequency ($F(445)=0.66$, $P>0.60$) based on the Kucera–Francis norms (Francis and Kucera, 1982). In addition, all of the words in the PHA, PLA, NHA, and NLA categories were abstract. Thus, all of the words chosen for the NEU category were also abstract. The words were presented in different random orders for the different testing groups. These were the same stimuli as used in a previous study by Mathews and Barch (2004). All participants were required to complete the ratings before the whole group could continue to the memory tasks.

2.2.2. Free recall

Immediately following completion of the incidental encoding task (word ratings), each participant was asked to recall as many words as he or she could. The participants were asked to write the words on a sheet of paper, and were given 3 min to complete this task.

2.2.3. Recognition

Immediately following the recall task, each participant was shown a series of 100 words, with the 50 words from the incidental encoding task and 50 new words randomly intermixed. For each word, participants were asked to answer whether they believed the word was old or new. The 50 new words contained 10 items from each of same five categories of words presented in the encoding tasks (i.e., NEU, PHA, PLA, NHA, and NLA). The dependent variable was d', a measure of signal (i.e., hits) to noise (e.g., false alarms).

2.3. Procedure

The participants were tested in small to medium sized groups over the course of a semester (20 to 60 at a time). For the incidental encoding and recognition tasks, answers were recorded directly onto scantron sheets, which were then computer-scored. Recall was always administered before the recognition task and was administered as a pen and paper test.

3. Results

3.1. Correlational analyses using the entire sample

3.1.1. Valence and arousal ratings

We began by examining the relationship between social and physical anhedonia scores, and the ratings of arousal and valence that participants completed on the words during the incidental encoding phase. As shown in Table 2, both physical and social anhedonia scores were significantly correlated with valence ratings, such that higher scores were associated with less negative valence ratings of negative words and less positive valence ratings of positive words. In contrast, there were few significant correlations between anhedonia scores and arousal ratings (see Table 2). The only significant correlation was between physical anhedonia and positive low arousal words, with higher physical anhedonia scores associated with higher arousal ratings.

3.1.2. Subsequent memory

We next examined the relationship between anhedonia scores and both recall and recognition. We first examined the relationships between anhedonia scores and the raw recall and recognition measures collapsing across stimulus type to examine the general relationship between memory and anhedonia scores. This analysis indicated that higher physical anhedonia scores were associated with both worse recall ($r=-0.14$, $P<0.01$) and recognition d' ($r=-0.13$, $P<0.01$). However, social anhedonia scores were not significantly associated

Table 2
Relationship between anhedonia and word ratings

Criteria	Negative high arousal valence ratings	Negative low arousal valence ratings	Positive high arousal valence ratings	Positive low arousal valence ratings	Negative high arousal arousal ratings	Negative low arousal arousal ratings	Positive high arousal arousal ratings	Positive low arousal arousal ratings
Physical anhedonia	−0.145**	−0.121*	0.107*	0.171*	0.013	0.009	−0.021	−0.136*
Social anhedonia	−0.197*	−0.158*	0.125*	0.117*	0.031	0.047	0.044	−0.091

* $P<0.05$.

with either recall ($r = -0.07$, $P > 0.19$) or recognition d' ($r = -0.04$, $P > 0.40$). Next, we examined the relationship between anhedonia scores and the degree to which either recall or recognition was altered as a function of the valence or arousal of the stimulus. To do so, we created difference scores for the recall measures (this was done because there were some individuals who had recalled none of the words in some of the categories), subtracting the number of neutral words recalled from the number of emotional words recalled (i.e., higher scores indicate a memory benefit for emotional words). We created percent change scores for recognition d', subtracting the d' of neutral words from the d' of emotional words and then dividing by the neutral words d' (we could not compute percent change scores for recall as some participants recalled 0 words in some cells). There were no significant correlations between either physical or social anhedonia scores and the degree to which memory improved most for either positive or negative words (whether high or low in arousal) as compared with neutral words, regardless of whether we examined recall or recognition scores (see Table 3). Intrusion rates in recall were not significantly correlated with social anhedonia ($r = 0.072$, $P = 0.09$) or physical anhedonia ($r = 0.05$, $P = 0.16$).

We found that social and physical anhedonia demonstrated similar relationships to valence ratings. This raises the question of how strongly related these two constructs are, and whether they are accounting for overlapping or independent variance in valence ratings. The zero-order correlation between social and physical anhedonia is 0.47 ($P < 0.001$), which suggests similar but not identical constructs. We next computed a series of hierarchical regression analyses using social and physical anhedonia, as well as the interaction between the two, to predict valence ratings. We included the interaction term in case high scores on both physical and anhedonia contribute to superadditive changes in subjective reports of valence. In one set of analyses, we entered social anhedonia in step 1, physical anhedonia in step 2, and the interaction in step 3. In a second set, we entered physical anhedonia first, followed by social anhedonia, and then the interaction. At each step, we examined whether adding the new predictor accounted for a significant increase in variance. For valence ratings of NHA ($r = 0.21$, $P < 0.01$) and NLA words ($r = 0.15$, $P < 0.09$), social anhedonia scores accounted for a significant increase in variance (for NHA words and trend level for NLA) over and above that accounted for by physical anhedonia scores when physical anhedonia was entered into the regressions first. In contrast, physical anhedonia scores did not account for a significant increase in variance over and above that accounted for by social anhedonia for either NHA ($r = 0.21$, $P > 0.20$) or NLA ($r = 0.15$, $P > 0.19$) words when social anhedonia was entered into the regressions first. Interestingly, we found the opposite pattern for PHA and PLA words. Social anhedonia did not account for a significant increase in variance over and above that accounted for by physical anhedonia for either PHA ($r = 0.18$, $P > 0.51$) or PLA ($r = 0.18$, $P > 0.46$) words when physical anhedonia was entered first into the regressions. However, physical anhedonia did account for a significant increase in variance over and above that accounted for by social anhedonia for both PHA ($r = 0.18$, $P < 0.01$) and PLA ($r = 0.18$, $P < 0.01$) words when social anhedonia was entered first. The interaction between social and physical anhedonia did not account for a significant increase in variance in any of the analyses. These results suggest a potentially stronger influence of social anhedonia on subjective experiences of valence for negative stimuli, but a potentially stronger influence of physical anhedonia on subjective experiences of valence for positive stimuli.

3.2. Categorical analyses

We conducted categorical analyses in addition to continuous analyses because some of the previous literature has suggested that anhedonia may be best viewed as a dichotomous entity, where dysfunction is present only once a certain threshold is achieved (Blanchard et al., 2000). In addition, we wanted to use the same analytic method as used in many of the earlier studies on psychosis-proneness (e.g., Berenbaum et al., 1987; Ferguson and Katkin, 1996; Fiorito and Simons,

Table 3
Relationship between anhedonia and memory performance

Criteria	Negative high arousal recall	Negative low arousal recall	Positive high arousal recall	Positive low arousal recall	Negative high arousal recog d'	Negative low arousal recog d'	Positive high arousal recog d'	Positive low arousal recog d'
Physical anhedonia	−0.01	−0.03	−0.004	−0.05	−0.03	−0.02	−0.05	−0.05
Social anhedonia	−0.06	−0.04	−0.06	−0.02	−0.03	0.001	−0.04	0.01

Recog = recognition.

1994) so as to more directly compare our results to those of prior high-risk design studies. All significance levels for analyses of variance (ANOVAs) were adjusted according to the Geisser-Greenhouse procedure.

3.2.1. Arousal and valence ratings

To determine whether individuals who rated themselves high on either physical or social anhedonia measures differed from individuals who rated themselves as low on anhedonia measures, we examined the valence and arousal ratings obtained during the incidental encoding phase. To examine the valence ratings (see Fig. 1), we began with omnibus two-way ANOVAs, one for social anhedonia and one for physical anhedonia. Each of these ANOVAs had group (low versus high anhedonia individuals) as a between-subject factor, and word type (NEU, NHA, NLA, PHA, and PLA) as a within-subject factor. The ANOVA for social anhedonia revealed a main effect of word type, $F(4712)=1056.9$, $P<0.001$, that was modified by a group by word type interaction, $F(4712)=3.4$, $P<0.05$. Post hoc contrasts to follow up on the group by word type interaction indicated that both high and low social anhedonia individuals rated NHA and NLA words as more negative than NEU words (all P's<0.001), and PHA and PLA words as more positive than NEU words (all P's<0.001). In addition, both low and high social anhedonia individuals rated PHA words as more positive than PLA words (P's<0.001), and

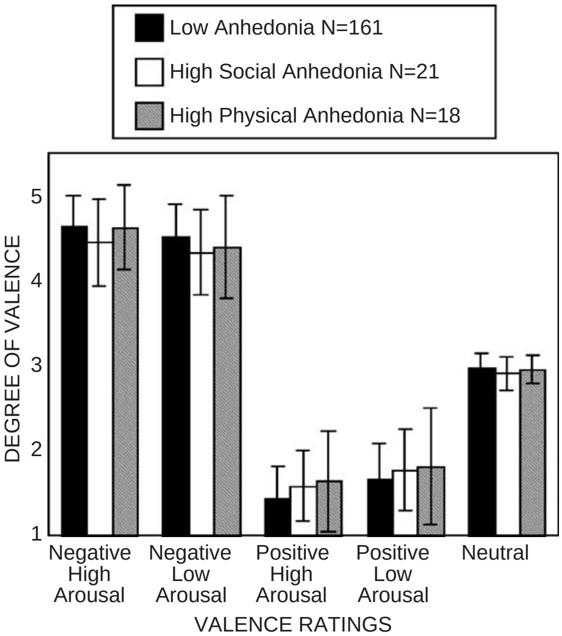

Fig. 1. Valence ratings.

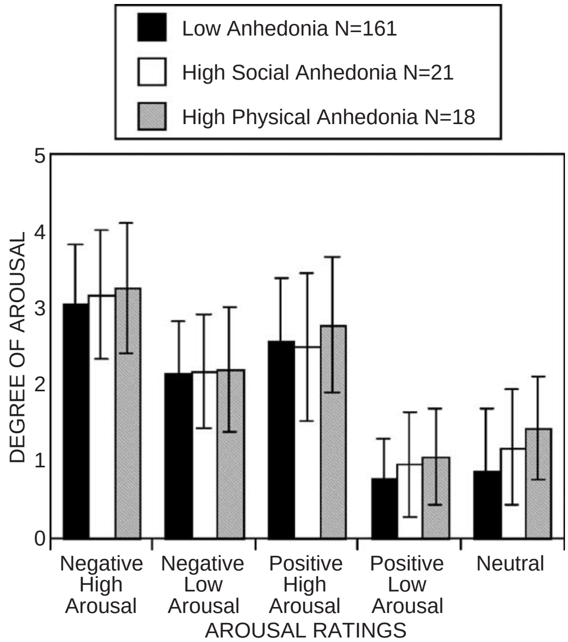

Fig. 2. Arousal ratings.

NHA words as more negative than NLA words ($P<0.001$ for low SA individuals, $P=0.07$ for high SA individuals). However, the group by word type interaction reflected the fact that the difference between PHA words and NEU words was somewhat smaller for high than for low social anhedonia individuals, $F(1173)=6.9$, $P<0.01$.

The ANOVA for physical anhedonia revealed a main effect of word type, $F(4704)=892.9$, $P<0.001$, and no group by word type interaction, $F(4704)=2.1$, $P=0.14$. Post hoc contrasts indicated that both low and high physical anhedonia individuals rated NHA and NLA words as more negative than NEU words, and PHA and PLA words as more positive than NEU words (all P's<0.001). Again, both low and high physical anhedonia individuals rated NHA words as somewhat more negative than NLA words, and PHA words as slightly more positive than PLA words (all P's<0.01).

The data from the arousal ratings were analyzed in the same fashion as the valence ratings (see Fig. 2). The ANOVAs for both social and physical anhedonia revealed main effects of word type, $F(4712)=183.2$, $P<0.001$ and $F(4704)=164.5$, $P<0.001$, but no main effects or interactions with groups (all $P>0.3$). Post hoc contrast indicated that all participants rated NEU words as less arousing than NHA, NLA and PHA words (all P's<0.001), but not significantly different from PLA words (all P's>0.09). In addition, all participants rated NHA words as more arousing than NLA words and

PHA words as more arousing than PLA words (all P's < 0.001).

3.2.2. Recall

To examine recall of emotional and non-emotional stimuli (see Fig. 3), we began with omnibus two-way ANOVAs, one for social anhedonia and one for physical anhedonia. Each of these ANOVAs had group (low versus high anhedonia individuals) as a between-subjects factor, and word recalled (NEU, NHA, NLA, PHA, and PLA) as a within-subject factor. The ANOVA for social anhedonia revealed a main effect of word type, $F(4720) = 34.93$, $P < 0.001$, but no group by word type interaction, $F(4720) = 0.10$, $P > 0.9$. Post hoc contrasts indicated that both groups recalled significantly more high arousal than low arousal words and more emotional than neutral words (all P's < 0.000). The ANOVA for physical anhedonia revealed a main effect of word type, $F(4712) = 35.05$, $P < 0.001$, but no group by word type interaction, $F(4712) = 1.37$, $P > 0.2$. Post hoc contrasts indicated that both groups recalled significantly more high arousal than low arousal words and more emotional than neutral words (all P's < 0.000). Intrusion rates were not significantly different for any of the groups (all P's > 0.4).

3.2.3. Recognition

To examine recognition for emotional and non-emotional stimuli (see Fig. 4), we began with omnibus two-way ANOVAs, one for social anhedonia and one for physical anhedonia. Each of these ANOVAs had group (low versus high anhedonia individuals) as a between-subjects factor, and word type d' (NEU, NHA, NLA, PHA, and PLA) as a within-subject factor. The ANOVA for social anhedonia revealed a main effect of word type, $F(4712) = 7.5$, $P < 0.001$, but no group by word type interaction, $F(4712) = 1.5$, $P > 0.3$. Post hoc contrasts indicated that both high and low social anhedonics remembered significantly more high arousal than low arousal words (all P's < 0.01). The ANOVA for physical anhedonia revealed a main effect of word type, $F(4704) = 69.9$, $P < 0.01$, and a group by word type interaction, $F(4704) = 3.2$, $P < 0.05$. Post hoc contrasts indicated that low physical anhedonia individuals had significantly higher d' scores for NHA versus NLA ($P < 0.05$), but high physical anhedonia individuals did not ($P = 0.14$), though numerically their d' scores were higher for NHA than NLA. In contrast, high physical anhedonia individuals had significantly lower d' scores for PHA versus PLA ($P < 0.05$), while low physical anhedonia individuals did not ($P > 0.2$), though the pattern was again the same for both groups. In addition, both groups had higher d' scores for NHA versus PHA and NLA versus PLA (all P's < 0.01).

These results are somewhat different from those found with recall, in which PHA recall was higher than PLA, and there were no differences as a function of valence. To examine the source of these differences, we looked at accuracy for old and new words separately. ANOVAS on the old word recognition accuracy

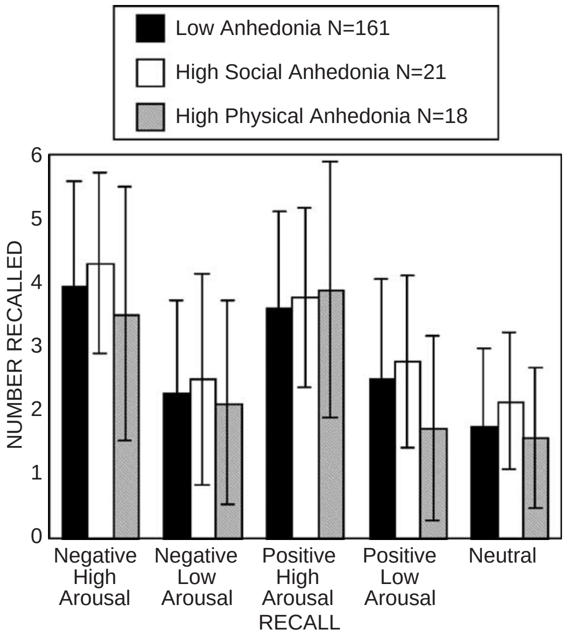

Fig. 3. Number of words recalled.

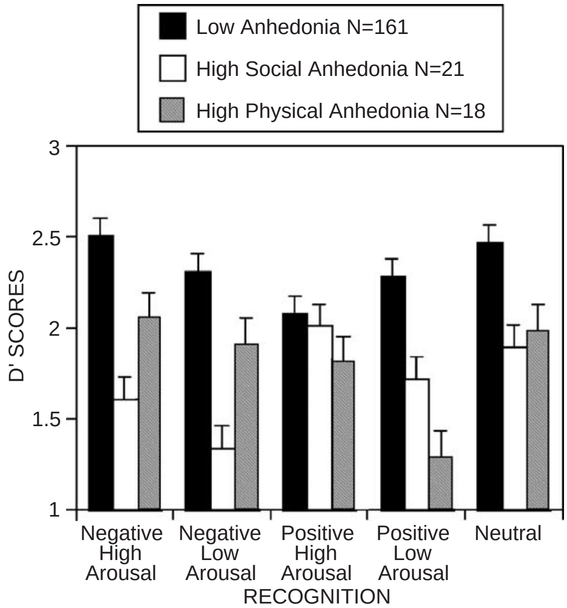

Fig. 4. d' Recognition scores.

scores, with group as a between-subjects factor (one ANOVA for social and one for physical) and word type as a within-subject factor revealed only main effects of word type (both P's < 0.001), and no group by word type interactions (both P's > 0.19). As can be seen in Table 4, recognition accuracy for old words showed a pattern similar to recall, with high arousal words better recalled than low arousal words, and high arousal words generally recognized better than neutral words. However, examination of recognition accuracy for new words reveals a different pattern. ANOVAs on new word recognition accuracy also revealed only main effects of word type (both P's < 0.001) and no group by word type interaction (both P's > 0.17). False alarm rates are much higher for NHA and PHA words than for NLA or PLA word, and false alarm rates for neutral words are very low. This pattern helps to explain why d' scores were high for neutral words, as this category incurred few false alarms.

3.2.4. Effects of depression on anhedonia and valence ratings

Both physical and social anhedonia are often correlated with depression. Further, depression can also have an influence on subjective emotional responses. Thus, to examine any potential confounded influences of depression on our findings of significantly negative correlations between both social and physical anhedonia and valence ratings, we conducted the following analyses. We first examined the relationships between BDI scores and anhedonia scores. Both physical (r = 0.17, P < 0.01) and social (r = 0.38, P < 0.01) anhedonia scores were significantly correlated with BDI scores, such that higher scores on both physical and social anhedonia were associated with higher BDI scores. We then examined the correlations between BDI scores and valence and arousal ratings. BDI scores were not significantly correlated with valence ratings (all r's between −0.05 and 0.05). However, higher BDI scores were associated with higher arousal ratings of both NHA (r = −0.11, P < 0.05) and NLA (r = −0.12, P < 0.05). We then performed partial correlations between the valence ratings and the anhedonia scores, controlling for depression. All of these correlations remained significantly at a magnitude similar to (or in some cases higher than) the zero-order correlations.

3.2.5. Effect size for categorical and continuous analyses

To examine the influence that sample size may play in the ability to detect significant results among the two different analysis methods, we ran an effect size analysis for both the categorical and continuous approaches. The mean Cohen's d for the continuous analyses was 0.289 and the mean Cohen's d for the categorical analyses was 0.222. Additionally, seven of the eight analyses for social and physical anhedonia on each of the emotional word categories showed larger effect sizes for the continuous than for the categorical approach.

4. Discussion

Our results indicated that both high physical and social anhedonia participants self-reported feeling less valence for emotional words, but they did not show a reduction in the influence of emotional content in subsequent memory tasks. Both social and physical anhedonics demonstrated reduced valence ratings for both positive and negative words. This result is partially consistent with Meehl's theory of a hyperactive aversive system, in that the anhedonic individuals did rate the positive words as somewhat less positive. However, Meehl's theory might have predicted that anhedonics would rate negative words as even more negative than controls, a prediction that was not

Table 4
Recognition accuracy for targets and distractors

Criteria	High physical anhedonia		High social anhedonia		Low physical and social anhedonia	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Negative high arousal target	0.92	0.10	0.92	0.11	0.93	0.09
Negative high arousal distractor	0.87	0.13	0.78	0.15	0.77	0.17
Negative low arousal target	0.85	0.17	0.86	0.16	0.86	0.13
Negative low arousal distractor	0.90	0.10	0.87	0.12	0.90	0.11
Positive high arousal target	0.88	0.13	0.89	0.13	0.91	0.09
Positive high arousal distractor	0.80	0.17	0.77	0.16	0.79	0.17
Positive low arousal target	0.85	0.18	0.85	0.20	0.91	0.10
Positive low arousal distractor	0.86	0.15	0.83	0.13	0.84	0.15
Neutral target	0.88	0.12	0.87	0.21	0.87	0.13
Neutral distractor	0.96	0.05	0.91	0.12	0.94	0.10

confirmed in the current study. Our results are also somewhat different from those of previous research, which found that when using pictures, valence ratings tend to be reduced for positive stimuli and not for negative stimuli (Fitzgibbons and Simons, 1992). It is possible that the differences between the current study and previous studies reflect the type of stimuli used (words), which may be more subtle in their ability to evoke an emotional response. It is possible that the use of more subtle stimuli may be better able to detect deficits in the processing of negative stimuli as they may provide more opportunities for individual differences to manifest themselves.

Prior studies examining self-report measures of emotional experience have produced mixed results as to whether high anhedonia individuals subjectively report experiencing emotion to the same degree as low anhedonia individuals. Our valence rating findings are consistent with prior studies finding reduced self-reports of emotion to affect eliciting stimuli in high anhedonia individuals (Ferguson and Katkin, 1996; Fitzgibbons and Simons, 1992; Fiorito and Simons, 1994; Simons et al., 1982; Putnam, 1997; Gooding et al., 2002). However, individuals reporting high social and/or physical anhedonia did not show any reductions in ratings of the arousal aspect of emotional words, which is consistent with the findings of Fitzgibbons and Simons (1992) and with the hypothesis that high anhedonia self-reports may reflect differential deficits in valence versus arousal aspects of emotional processing. The previous study by Berenbaum et al. (1987) (finding no impairments in anhedonia individuals' self-report ratings of emotion) did not ask participants to make separate ratings of valence and arousal. Thus, it is possible that Berenbaum et al. (1987) did not find reduced subjective emotional responses because intact arousal responses may have masked a deficit in valence responses. In contrast, several of the studies that did find a deficit in self-reports of emotional experience among high anhedonia individuals asked participants to make separate ratings of valence and arousal (Fiorito and Simons, 1994; Fitzgibbons and Simons, 1992). However, Fiorito and Simons (1994) found reduced arousal ratings and Fitzgibbons and Simons (1992) found intact arousal ratings in anhedonia individuals. This may be due to the different stimuli used in each of the studies. Fiorito and Simons (1994) used imagery scripts, and Fitzgibbons and Simons (1992) used selections from the International Affective Picture Scale (IAPS). It may be that the use of imagery is a more sensitive way to assess deficits that are not detected using pictures, or it may be that imagery taps into a broader range cognitive or emotional deficits because it requires effort on the part of the individual to generate the emotional experience.

This study is one of the few to examine the influence of emotion on cognitive processing in individuals who report high levels of anhedonia. Our findings indicate that people with anhedonia report feeling less valence for emotional words. However, this deficit was not associated with changes in later memory performance for emotional stimuli. The high anhedonia individuals showed as much of a memory benefit for emotional words as did individuals who reported low levels of anhedonia. One reason for the discrepancy between self-reports of emotional experience on the valence dimension and the actual subsequent memory for the stimuli among individuals reporting high levels of anhedonia may be related to the integrity of arousal ratings among the individuals reporting higher anhedonia. As noted in Section 1, studies have shown that arousal ratings of stimuli are as strongly, if not more strongly, predictive of subsequent memory for those stimuli than are valence ratings of the stimuli (Bradley et al., 1992). As such, individuals who report higher levels of anhedonia might show a "normal" influence of emotion on memory because they have intact abilities to experience or evaluate arousal properties of word stimuli, despite a reduced ability to evaluate valence components.

It would also be helpful in future studies to examine aspects of cognitive processing that may be more sensitive to variations in the valence of stimuli as opposed to arousal properties. If individuals with high anhedonia do have deficits in processing the valence components of stimuli, we might see more evidence for impairments in cognitive processes that are more selectively sensitive to emotional valence. Alternatively, it is possible that self-reports of emotional experience in anhedonia individuals do not necessarily reflect how internal processing of emotional information is occurring and that part of the dysfunction lies in the inability of anhedonia individuals to accurately report their internal states, as suggested by Gooding and Tallent (2003). If this is true, then high anhedonia individuals may show intact subsequent memory for affectively valenced material because they are processing the valence information at some level, despite reporting a reduction in valence ratings for the emotional words due to their inability to accurately report on their internal states.

We used a deep encoding task for processing the emotional information. Previous research has found that the way in which a stimulus is encoded can have strong effects on what stimuli are remembered. For example, Ferre (2003) found that both negative and positive stimuli are remembered equally over neutral stimuli when semantically encoded, but when physically encoded, only positive stimuli are remembered better than neutral stimuli in healthy individuals. Reber et al. (1994) found that superficial processing of emotional stimuli led to better memory for only emotional stimuli in healthy individuals. In contrast, when deep processing was utilized, emotional and neutral words were equally recalled. Although Ferre and Reber differ on the pattern of results found for deep encoding (Reber found equal memory for all types and Ferre found better memory for emotional over neutral stimuli), both studies suggest that it is important to examine the level of processing on pattern of memory for emotional stimuli. Given the findings of these studies, it is possible that we would have found greater evidence for deficits in emotional memory among anhedonic individuals if we had used a shallow encoding task instead of a deep encoding task. That is, both Reber and Ferre found that deep encoding produced better memory overall (at least for emotional stimuli), but that shallow encoding produced more difficulties for memory. Thus, using a deep encoding task may have provided additional support for the encoding of valence information for high anhedonia individuals. It is possible that if we had used a shallow encoding task that provided less support, we might have found a more pronounced memory deficit among anhedonia individuals over and above any memory difficulties in healthy controls. In addition, our task included a conscious rating of emotional words (which could be conceptualized as "controlled"), but an incidental encoding of words for the subsequent memory task (which could be conceptualized as "automatic"). It is possible that such a distinction between automatic and controlled emotional processing may be important in understanding the nature of emotional function in anhedonia. For example, it is possible that automatic emotional processes are intact in anhedonia, while explicit, controlled processes are impaired, thus leading to our findings of impaired valence ratings yet intact memory.

We found stronger evidence for reduced valence responses to emotional words when the entire data set was analyzed continuously versus when we analyzed the data categorically. The reason for conducting the categorical analyses was that there is some research on schizotypy, suggesting that there are underlying taxa of social and or physical anhedonia (Blanchard et al., 2000; Chapman et al., 1980; Meehl, 1962; Meyer and Keller, 2001). Such a finding could imply that dysfunction associated with anhedonia may only appear in individuals who show a level of anhedonia above some threshold (presumably a threshold indicative of being a member of a social or physical anhedonia taxon). However, we found a more continuous relationship between degree of anhedonia and changes in self-reports of valence. This may reflect one of two factors. First, it may be simply that we had more power to detect significant effects in the continuous analyses using the entire sample than in the analyses using only extreme groups. This possibility is reasonable given that we saw a somewhat similar, though less significant, pattern of results in the categorical as compared with the continuous analyses. However, examination of the effect sizes for the categorical and continuous analyses suggested larger effect sizes for the continuous analyses, which is not consistent with a simple power explanation. Alternatively, our results may be more consistent with dimensional models of personality disorders that have argued against the presence of clear latent taxa (Widiger and Sanderson, 1995). Clearly more research using a wider range of measures of emotional processing will be needed to more definitively address this issue.

This study examined both physical and social anhedonia in participants, in part to compare our results with those of previous studies that often used only one or the other scale, and also to examine the consistency of results across these two components of anhedonia. Only one previous study collected information on both social and physical anhedonia in relation to self-reports and physiological responses to emotional pictures (Gooding et al., 2002). However, this study did not present data on the individuals with physical anhedonia, and thus it was not possible to compare the results for social and physical anhedonia participants in this previous study. Our results indicated that social and physical anhedonia were highly correlated with each other, and that both high social and high physical anhedonia were associated with reduced valence ratings, but not associated with arousal ratings or emotional influences on memory. However, more detailed analyses examining the independent contribution of each type of anhedonia to emotional processing suggests that physical anhedonia may be somewhat more strongly related than social anhedonia to decreased valence ratings of positive words and that social anhedonia may be somewhat more strongly related to decreased valence ratings of negative words. Thus, although social and physical anhedonia are strongly related, they may have somewhat different influences on the processing of negative versus positive stimuli. As such, it will be important to examine both types of anhedonia in future studies to delineate their separate contributions to emotional processing more fully.

One limitation of this study is that it was conducted with college students who demonstrate somewhat restricted ranges of anhedonia (e.g., few individuals with very high self-reports of anhedonia). As such, it will be important in future studies to examine individuals in a community setting where there may be more of a range in self-reports of anhedonia and where there may be more variability in functioning on emotional processing measures. Another limitation concerns the inherent problems associated with self-report measures. Self-report measures have the possibility of inducing demand characteristics. However, several studies have used self-report measures of emotion along with physiological measures of emotion to ensure that self-reports of emotional experience correlate with other more objective tests. In these studies, self-report measures have been found to reflect the same deficits seen on physiological measures. In addition, the test was self-paced, and thus we do not have information about response times to complete each section.

In summary, the results of this study indicate that individuals who report high physical and social anhedonia also rate emotional words as less valenced than non-anhedonic healthy controls, but they do not show differences in either arousal ratings or memory for emotional words. One explanation for these results is that subjective experiences of emotional valence are indeed reduced in individuals with social and physical anhedonia but that this reduction in valence does not produce a deficit in memory (potentially due to intact experience of emotional arousal). Alternatively, it is possible that social and physical anhedonia individuals are not able to accurately report their experience of emotional valence, leading to a dissociation between reduced self-reports of emotional valence, but intact influence of emotional valence on memory. In addition, our results suggest that examining anhedonia as a continuous trait rather than categorizing individuals as high or low in anhedonia may be a more sensitive means to detect changes in emotional responding associated with self-reports of anhedonia.

Appendix A. Instructions given to participants for word-rating task

"Words differ in the kinds of emotions that they can make people feel, and they differ in how calm or aroused they can make people feel. The purpose of this experiment is to find out how people feel about certain words by having you rate a list of words with regard to how pleasant or unpleasant they are, and how calming or arousing they are. You should read each word very carefully. Then I am going to ask you to make two ratings for each word. First I am going to ask you to rate how negative or positive the word makes you feel, using this scale [show SAM Figure]. For example, if the word has a very pleasant meaning for you, then rate it as "1." If the word has a somewhat pleasant meaning for you, then rate it as "2." If the word has no pleasant or unpleasant meaning for you, then rate it as "3." If the word has a somewhat unpleasant meaning for you, then rate it as "4." If the word has a very unpleasant meaning for you, then rate it as "5". Make your rating for each word by inserting the appropriate number on the page next to the word. Second, I am going to ask you to rate how arousing or calm the word makes you feel, using this scale [show picture]. For example, if the word makes you feel very aroused, then rate it as "1." If the word makes you feel somewhat aroused, then rate it as "2." If the word does not make you feel either aroused or calm, then rate it as "3." If the word makes you feel somewhat calm, then rate it as "4." If the word makes you feel very calm, then rate it as "5". Again, make your rating for each word by inserting the appropriate number on the page next to the word. Remember to read each word carefully before you rate it. Make your rating on the basis of how you feel about the word, not on how you think people in general would rate the word.

Appendix B. Words used in the incidental encoding task

Neutral	Negative high arousal	Negative low arousal	Positive high arousal	Positive low arousal
Context	Assault	Awful	Comedy	Calm
Quote	Attack	Cancer	Delighted	Carefree
Recruit	Danger	Depression	Ecstasy	Comfort
Century	Hate	Detest	Excited	Friendly
Minute	Horror	Dreadful	Joy	Gentle
Pious	Killing	Grief	Kiss	Peaceful
Zone	Suicide	Hopeless	Laughter	Relaxed
Multiply	Terror	Lonely	Love	Safe
Signal	Torture	Misery	Passion	Sunny
Border	Violent	Sad	Pleasure	Trust

References

Adolphs, R., Cahill, L., Schul, R., Babinsky, R., 1997. Impaired declarative memory for emotional material following bilateral amygdala damage in humans. Learning and Memory 4 (3), 291–300.

Beck, A.T., Steer, R.A., 1987. Beck Depression Inventory Manual. The Psychological Corporation, San Antonio, TX.

Berenbaum, H., Oltmanns, T.F., 1992. Emotional experience and expression in schizophrenia and depression. Journal of Abnormal Psychology 101 (1), 37 – 44.

Berenbaum, H., Snowhite, R., Oltmanns, T.F., 1987. Anhedonia and emotional responses to affect evoking stimuli. Psychological Medicine 17 (3), 677 – 684.

Blanchard, J.J., Bellack, A.S., Mueser, K.T., 1994. Affective and social-behavioral correlates of physical and social anhedonia in schizophrenia. Journal of Abnormal Psychology 103 (4), 719 – 728.

Blanchard, J.J., Gangestad, S.W., Brown, S.A., Horan, W.P., 2000. Hedonic capacity and schizotypy revisited: a taxometric analysis of social anhedonia. Journal of Abnormal Psychology 109 (1), 87 – 95.

Bradley, M.M., 2000. Emotion and motivation. In: Cacioppo, J.T., Tassinary, L.G. (Eds.), Handbook of Psychophysiology, 2nd ed. University Press, New York, pp. 602 – 642.

Bradley, M.M., Greenwald, M.K., Petry, M.C., Lang, P.J., 1992. Remembering pictures: pleasure and arousal in memory. Journal of Experimental Psychology 18 (2), 379 – 390.

Cahill, L., Babinsky, R., Markowitsch, H.J., McGaugh, J.L., 1995. The amygdala and emotional memory. Nature 377 (6547), 295 – 296.

Chapman, L.J., Edell, W.A., Chapman, J.P., 1980. Physical anhedonia, perceptual aberration, and psychosis proneness. Schizophrenia Bulletin 6, 639 – 653.

Chapman, J.P., Chapman, L.J., Kwapil, T.R., 1995. Scales for the measurement of schizotypy. In: Raine, T., Lencz, T., Mednick, S. (Eds.), Schizotypal Personality. Cambridge University Press, New York, pp. 79 – 106.

Christianson, S.A., 1992. In: Christianson, S.A. (Ed.), Handbook of Emotion and Memory. Lawrence Erlbaum, Hillsdale, NJ, pp. 307 – 340.

Eckblad, M., Chapman, L.J., Chapman, J.P., Mishlove, M., 1982. The Revised Social Anhedonia Scale.

Ferguson, M.L., Katkin, E.S., 1996. Visceral perception, anhedonia, and emotion. Biological Psychology 42 (1–2), 131 – 145.

Ferre, P., 2003. Effects of level of processing on memory for affectively valenced words. Cognition and Emotion 17 (6), 859 – 880.

Fiorito, E.R., Simons, R.F., 1994. Emotional imagery and physical anhedonia. Psychophysiology 31 (5), 513 – 521.

Fitzgibbons, L., Simons, R.F., 1992. Affective response to color-slide stimuli in subjects with physical anhedonia: a three-systems analysis. Psychophysiology 29 (6), 613 – 620.

Francis, W.N., Kucera, H., 1982. Frequency Analysis of English Usage: Lexicon and Grammar. Houghton Mifflin, Boston.

Gooding, D.C., Davidson, R.J., Putnam, K.M., Tallent, K.A., 2002. Normative emotion-modulated startle response in individuals at risk for schizophrenia-spectrum disorders. Schizophrenia Research 57 (1), 109 – 120.

Gooding, D.C., Tallent, K.A., 2003. Spatial, object, and affective working memory in social anhedonia: an exploratory study. Schizophrenia Research 63 (3), 247 – 260.

Kerns, J.G., Berenbaum, H., 2000. Aberrant processing in people at risk for psychosis. Journal of Abnormal Psychology 109 (4), 728 – 732.

Koh, S.D., Grinker, R.R., Marusarz, T.Z., Forman, P.L., 1981. Affective memory and schizophrenia anhedonia. Schizophrenia Bulletin 72 (2), 292 – 307.

Kwapil, T.R., Miller, M.B., Zinser, M.C., Chapman, J.P., Chapman, L.J., 1997. Magical ideation and social anhedonia as predictors of psychosis proneness: a partial replication. Journal of Abnormal Psychology 106 (3), 491 – 495.

Lang, P.J., 1980. Behavioral treatment and bio-behavioral assessment: computer applications. In: Sidowski, J.B., Johnson, J.H., Williams, T.H. (Eds.), Technology in Mental Health Care Delivery Systems. Ablex, Norwood, NJ, pp. 119 – 137.

Larsen, R.J., Diener, E., 1992. Promises and problems with the circumplex model of emotion. In: Clark, M.S. (Ed.), Emotion. USC, Thousand Oaks, CA, pp. 25 – 59.

Mathews, J.R., Barch, D.M., 2004. Episodic memory for emotional and non-emotional words in schizophrenia. Cognition and Emotion 18 (6), 721 – 740.

Meehl, P.E., 1962. Schizotaxia, schizotypy, schizophrenia. American Psychologist 17, 827 – 838.

Meyer, T.D., Keller, F., 2001. Exploring the latent structure of the perceptual aberration, magical ideation, and physical anhedonia scales in a German sample. Journal of Personality Disorders 15 (6), 521 – 535.

Putnam, K.M., 1997. Physical anhedonia and emotional response: an analysis of multiple output systems. Dissertation Abstracts International: Section B: The Sciences and Engineering 58(B).

Rado, S., 1962. Psychoanalysis of Behavior: The Collected Papers of Sandor Rado, vol. 2. Grune and Stratton, New York.

Reber, R., Perrig, W.J., Flammer, A., Walther, D., 1994. Levels of processing and memory for emotional words. Swiss Journal of Psychology 53 (2), 78 – 85.

Russell, J.A., 1980. A circumplex model of affect. Journal of Personality and Social Psychology 39 (6), 1161 – 1178.

Simons, R.F., Macmillan, F.W., Ireland, F.B., 1982. Anticipatory pleasure deficit in subjects reporting physical anhedonia: slow cortical evidence. Biological Psychology 14 (3-sup-4), 297 – 310.

Widiger, T.A., Sanderson, C.J., 1995. Toward a dimensional model of personality disorders. In: Livesley, W.J., et al. (Eds.), The DSM-IV Personality Disorders. Guilford Press, New York, pp. 433 – 458.