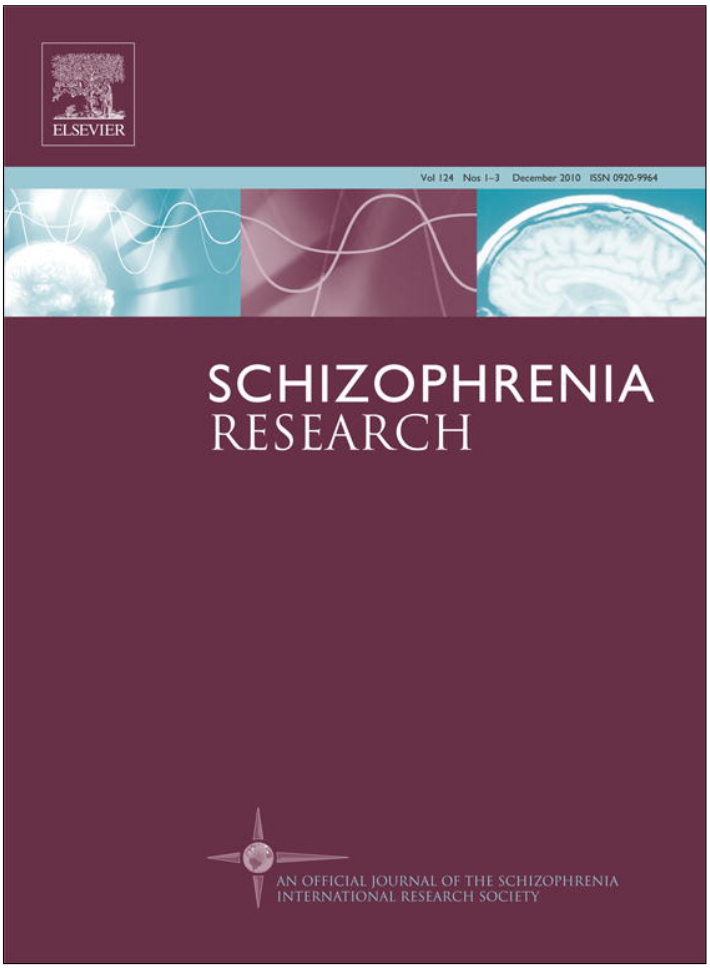

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Is social anhedonia related to emotional responsivity and expressivity? A laboratory study in women

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ABSTRACT

Social anhedonia is an important feature of schizophrenia and it is a promising indicator of schizotypy. Although social anhedonia is defined as an affective construct (less pleasure derived from social encounters), little is known about the emotional responsivity and expressivity of individuals with high levels of social anhedonia. After screening a large sample of female undergraduate students ($N = 1\,085$), a cohort of psychometrically identified individuals with high levels of social anhedonia ($n = 34$) and normally hedonic controls ($n = 45$) participated in laboratory assessments involving trait affectivity, self-reported dispositional emotional expressiveness, and the expression and experience of emotion in response to neutral, non-affiliative (i.e., comedy) and affiliative film clips. Results revealed that individuals with high levels of social anhedonia are characterized by lower positive affect, both as a trait and in response to emotionally evocative stimuli, and are less facially expressive, both by their own self-report and in response to film clips. Attenuated positive affect was observed across film stimuli, indicating a general reduction in affective response rather than a specific decrease in responsivity for affiliative stimuli. Future work should continue to investigate whether there is a unique role for social stimuli in the emotional lives of individuals with high levels of social anhedonia or whether these individuals tend to experience anhedonia more broadly regardless of social context.

1. Introduction

Disturbances in the experience and expression of emotion have long been considered prominent features of schizophrenia (Bleuler, 1950; Krapelin, 1971). Reflecting these early observations, contemporary assessments of symptomatology within schizophrenia include reduced hedonic capacity (anhedonia) and blunted affect (Andreasen, 1983; Kay et al., 1987). Moreover, a wide range of studies utilizing self-report instruments have provided evidence that, compared to healthy controls, individuals with schizophrenia report high trait anhedonia and high trait negative affect as well as low trait positive affect (e.g., Blanchard et al., 1994; Blanchard et al., 2001; for review see Horan et al., 2008). Additionally, experience sampling studies similarly report reduced intensity and less variability of positive affect in the daily lives of individuals with schizophrenia (Myin-Germeys et al., 2000).

Importantly, a very different picture of emotional responding in schizophrenia emerges when laboratory studies using evocative stimuli (e.g., films, slides, social interactions, or food) are considered. In such studies, although individuals with schizophrenia do show diminished facial expression compared to healthy controls (Aghevli et al., 2003; Berebaum and Oltmanns, 1992; Kring and Earnst, 1999; Kring and Neale, 1996), with some exceptions (e.g., Mathews and Barch, 2010), they report having internal emotional experiences comparable to controls (e.g., Aghevli et al., 2003; Berebaum and Oltmanns, 1992; Dworkin et al., 1996, 1998; Fitzgibbons and Simons, 1994; Horan and Blanchard, 2003b; Horan et al., 2010; Kring,

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and Neale, 1996). Thus, in schizophrenia there is a replicable pattern of elevated anhedonia (as measured either in clinical interview or self-report trait measures), and diminished emotional expression (measured either in clinical interviews or with coding of facial affective expression in laboratory studies), with the seemingly paradoxical finding of preserved self-reported emotional responding to evocative stimuli (see review by Kring and Moran, 2008).

What is currently unclear is whether this same disjunction between self-reported traits and expressivity on the one hand, and intact responding to emotional stimuli on the other, is evident in schizophrenia-spectrum disorders and in those individuals with elevated traits hypothesized to be associated with risk for schizotypy. Such research would allow for a determination of whether emotional alterations in schizophrenia extend across spectrum conditions, and if they relate to particular facets or traits of schizotypy. Furthermore, research in nonclinical populations with schizotypy traits has the advantage of avoiding the medication confounds present in schizophrenia research (Blanchard and Neale, 1992).

Social anhedonia is a promising trait to explore because it is considered a core feature of schizotypy that is associated with risk for the development of this disorder (e.g., Meehl, 1962) and the defining characteristic of this construct is that of diminished experience of pleasure. Cross sectional findings have confirmed a range of clinical characteristics and cognitive deficits in those individuals who are high in social anhedonia (e.g., Blanchard et al., in press; Gooding et al., 1999, 2006; Kwapil et al., 2002; Mishlove and Chapman, 1985), and longitudinal studies have shown that social anhedonia is predictive of the onset of schizophrenia-spectrum disorders (e.g., Gooding et al., 2005; Kwapil, 1998). Interestingly, despite the obvious affective features of the construct of social anhedonia, there is actually very little research that has examined emotion in those identified as high in social anhedonia.

Several studies have now evaluated self-reported trait affectivity and daily emotional experience in nonclinical individuals high in social anhedonia. Compared to healthy controls, social anhedonia groups are characterized by decreased self-reported trait positive affect and increased trait negative affect (Berenbaum et al., 2006; Gooding et al., 2002; Gooding and Tallent, 2003; Ross et al., 2002). This pattern of reduced trait positive affect and higher trait negative affect in social anhedonia has recently been replicated in a large community study (Blanchard et al., in press). In particular, low levels of trait positive affect appear to be more closely linked to negative schizotypy than high trait negative affect (Horan et al., 2008). Studies of emotional experience in daily life have also found that elevated rates of social anhedonia are associated with decreased experience of positive affect (Brown et al., 2007; Kerns et al., 2008). These data would suggest a pattern of emotional experience in social anhedonia groups that parallels that described above for schizophrenia.

Importantly, there have been few laboratory studies utilizing evocative stimuli to examine emotional responding in social anhedonia groups (Gooding et al., 2002; Kerns et al., 2008; Mathews and Barch, 2006). Gooding et al. (2002) found no differences in participants' startle eyeblink modulation in response to positive affect-eliciting pictures from the IAPS. However, this study did not examine either self-reported affective responding to the stimuli nor were assessments of expressivity conducted. Mathews and Barch (2006) found that higher social anhedonia was related to less positive valence ratings of positive words and less negative valence of negative words. Finally, Kerns et al. (2008) report on two studies examining the relationship between social anhedonia and emotional responding. In both studies, social anhedonia was related to decreased positive (but not negative) affect intensity in response to affective pictures (Kerns et al., 2008). Thus, the latter two studies suggest a different pattern of findings from clinical samples; specifically, that emotions elicited in response to stimuli may be less intense in individuals with high levels of social anhedonia compared to controls.

In summary, our understanding of how social anhedonia is related to emotion is currently limited, and there are a number of methodological issues that constrain the interpretability of studies to date. First, of the three studies assessing emotional stimuli in social anhedonia only one directly assessed self-reported emotional responding (Kerns et al., 2008). In the other studies either stimuli (words) were rated and not the participants' own emotional reactions (Mathews and Barch, 2006), or self-report responses were not collected (Gooding et al., 2002). Second, given that social anhedonia does not reflect a pan deficit in emotion but rather a specific deficit in pleasure to social interactions, it is notable that much of the stimulus material that has been used is of a non-social nature (e.g., words, pictures of animals, and nature scenes), and when people are used in pictures such stimuli are not directly affiliative (e.g., sky divers, man on cliff; Blanchard, 1998). Although a few studies have incorporated stimuli containing erotic material, erotic images only capture one aspect of affiliative behavior, and do not directly involve other aspects of social affiliation (e.g., friendships, family relationships, support, emotional sharing, etc.) that may be more directly associated with conceptualizations of social anhedonia. Third, to our knowledge, no laboratory studies have examined facial displays of affect in social anhedonia — an important consideration given that blunted affect is a core feature of schizophrenia and evident in emotion elicitation studies of patient samples. There are some suggestive findings indicating that altered emotional expression might be associated with social anhedonia. Self-reported social anhedonia has been found to correlate with self-reported expressivity such that greater anhedonia is related to less emotional expression (Kring et al., 1994). In a study coding behavioral displays within a clinical interview, compared to controls, individuals with high levels of social anhedonia were found to have greater schizoidia ratings including diminished facial displays of affect (Collins et al., 2005).

The current study sought to examine emotional responding in individuals high in social anhedonia compared to a normally hedonic control group. We measured emotion using multiple methods including trait self-report measures of affect and emotional expression as well as self-reported responses to affect-eliciting film clips. With regard to emotional responses, we provided both a broad assessment of positive affect as well as a more focused assessment of warmth-affiliation. These two domains, though clearly related, may have distinct neural correlates, be differentially influenced by evocative stimuli, and these affective responses may also have differential associations with individual differences in affiliation (Depue and Morrone-Strupinsky, 2005; Morrone-Strupinsky and Depue, 2004). In addition to self-reports of emotional responding, we utilized behavioral coding of facial expressions in response to

the film stimuli. Given the importance of including stimuli which may specifically tap responses to interpersonal and affiliative contexts, we used previously developed film material depicting a close mate relationship, which has been demonstrated to induce affiliation in females (Morrone-Strupinsky and Depue, 2004). This study examined the following hypotheses:

1. At the trait dispositional level, individuals high on social anhedonia would report lower trait PA and less self-reported emotional expressivity compared to controls.
2. In response to evocative film clips, we examined the hypothesis that in individuals with high levels of social anhedonia, there would be a specific deficit in emotional responding, such that attenuated positive affect and warm and affection ratings would be most pronounced for the affiliative film clip (as would be indicated by a significant group x film type interaction).
3. Compared to the control group, the social anhedonia group would be characterized by less facial expressions in response to both the affiliative and comedy film stimuli.

2. Methods

2.1. Participants

Because the affiliative clip selected for the current study has only been demonstrated to induce affiliative responses in females, only women high on social anhedonia were included in the current study. All female freshman students living on campus at a mid-Atlantic university ($N = 3\ 850$) were contacted via mail with a recruitment letter inviting them to participate in an online survey. A total of 1082 participants completed the screening questionnaires (Revised Social Anhedonia Scale (RSAS; Eckblad et al., 1982), and its Infrequency Scale (IS; Chapman and Chapman 1976) described below). Subsequent group selection was based on individual responses to the RSAS (z-scored separately by race to account for potential discrepant responses among racial groups). Participants with scores on the RSAS that were at least 1.96 standard deviations above the mean were assigned to the social anhedonia group, whereas participants with RSAS scores of no more than.5 standard deviation above the mean were assigned to the control group, consistent with previous studies (Chapman et al., 1994; Kwapil, 1998). Nineteen participants (1.75%) were excluded after endorsing 3 or more items in the unexpected direction on the Infrequency Scale and 51 (4.7%) scored above the cut-off for social anhedonia, rates consistent with previous studies (Chapman et al., 1976; Horan et al., 2004). Control participants were selected to match social anhedonia participants on race. All participants provided informed consent. The final sample included 34 individuals with high levels of social anhedonia and 45 controls. See Table 1 for demographic characteristics.

2.2. Measures

2.2.1. Social anhedonia

The Revised Social Anhedonia Scale (RSAS: Eckblad et al., 1982) is a 40 true/false item inventory to assess social anhedonia, and was used as the screening questionnaire for the current study. The RSAS has demonstrated adequate validity, internal consistency (Mishlove and Chapman, 1985), and high test–retest reliability over a 90-day and 1-year period (Blanchard et al., 1998, 2001). The Infrequency Scale (Chapman and Chapman, 1976) was designed as an invalidity index for the RSAS. Three or more endorsed items suggest invalid responding.

2.2.2. Trait affectivity

Trait positive affect (PA; 27 items) and trait negative affect (NA; 28 items) were measured with the General Temperament Survey (GTS; Clark and Watson, 1990). These scales have high internal consistency reliabilities and good convergent and discriminant validity across a number of samples (Carver and White, 1994; Watson and Clark, 1992), including schizophrenia (e.g., Horan and Blanchard, 2003a).

2.2.3. Self-reported emotional expressivity

The Emotional Expressivity Scale (EES; Kring et al., 1994) is a 17-item self-report questionnaire that is a general index for outward expressivity, regardless of emotional valence (e.g., positive or negative) or channel (facial, vocal, or gestural) of expression. The EES has shown to be highly reliable, with excellent internal consistency and 4-week test–retest correlation reliability (Kring et al., 1994).

The Berkeley Expressivity Questionnaire (BEQ; Gross and John, 1995) is a 16-item self-report questionnaire that assesses both the general strength of emotion-response tendencies and the degree to which such tendencies are typically expressed as manifest behavior. The BEQ is comprised of three subscales: Positive Expressivity, Negative Expressivity, Impulse Strength, and also has high internal consistency (Gross and John, 1997).

2.2.4. Self-reported experience of emotion

A scale based on the circumplex model of emotion (Larsen and Diener, 1992) was administered to assess emotional experience (i.e., mood) at baseline and in response to the film stimuli. Participants were asked to rate the extent to which they were experiencing each of the 36 affective terms "right now, that is, at the present moment." The 18-item positive mood scale consists of items tapping activated pleasant affect, pleasant affect, and unactivated pleasant affect. The 18-item negative mood scale consists of items reflecting activated unpleasant affect, unpleasant affect, and unactivated unpleasant affect. Participants rated each of the 36 mood adjectives on a 5-point scale (very slightly or not at all, a little, moderately, quite a bit, or extremely). These scales have been shown to have good internal consistency reliabilities for both patients with schizophrenia and for non-

Table 1
Descriptive statistics for demographic characteristics for social anhedonia (n = 34) and Control (n = 45) Groups.

	Social anhedonia	Control
	Mean (SD)	Mean (SD)
Age	18.24 (.61)	18.11 (.32)
Ethnicity	N (%)	N (%)
Caucasian	23 (67.6%)	34 (75.6%)
African-American	2 (5.9%)	4 (8.9%)
Hispanic/Latino	0 (0.0%)	1 (2.2%)
Asian American	8 (23.5%)	4 (8.9%)
Other	1 (2.9%)	2 (4.4%)

Note. SD = standard deviation.

patient samples (e.g., Horan and Blanchard, 2003b; Kring and Earnst, 1999).

The Warm and Affectionate scale (WA; Morrone-Strupinsky and Depue, 2004) was designed to measure the emotional state accompanying affiliation. The WA requires a single rating for feelings of warmth and affection on a 7-point Likert scale.

2.2.5. Behavioral coding of facial expression

Facial expressions in response to the film stimuli were rated by using the Facial Expression Coding System (FACES; Kring and Sloan, 1991). The FACES coding system involves making separate frequency counts for positively and negatively valenced facial expressions. Each individual facial expression is rated on duration (in seconds) and intensity (from 1 = low to 4 = high), and mean scores represent the duration and intensity per expression. Given variability in film length across emotion conditions, the frequency variable was adjusted to reflect the frequency of expressions per minute. As duration and intensity are already expressed as averages per facial expression, no adjustment was necessary to account for varying film length. Emotion studies using FACES to measure facial expressions have examined congruent expressions to the emotional eliciting stimuli (e.g., Aghevli et al., 2003; Earnst and Kring, 1999; Kring and Neale, 1996; Kring et al., 1993); thus, analyses in this study focused only on positive expressions on all films (neutral, comedy, and affiliative).

2.2.5.1. Coder training. A graduate student and an advanced undergraduate student, trained by the first author (WL) performed the FACES ratings. Raters were blind to group status, and agreement between the two coders was established during a training period, using pilot videotaped expressed facial emotions of participants not included in the study. Coders then independently rated tapes for all participants, and periodic random checks of their agreement were conducted to prevent coder drift. Inter-rater agreement (ICC) ranged from .96 to 1.00, indicating excellent agreement between raters.

2.2.6. Film clips

Three different film clips were used in the current study to induce emotional states. These film stimuli included an affiliative (9 min, 35 s), comedic (5 min, 33 s), and neutral film clip (2 min, 58 s). The affiliative film clip (Morrone-Strupinsky and Depue, 2004) used a female main character given findings that vicarious identification is increased when the participant is of the same gender as the actor (Morrone et al., 2000). The affiliative film clip portrays the development of a close mate relationship of a couple who has their first child (Morrone-Strupinsky and Depue, 2004). This film clip is effective in inducing an emotional state of warmth and affection as indexed by the Warm and Affectionate scale in healthy females (Morrone-Strupinsky and Depue, 2004).

A comedic, non-social film clip that has been widely used in similar studies (e.g., Earnst and Kring, 1999; Kring and Neale, 1996; Kring et al., 1993) was included to compare affiliative and affective differences between social and non-social film clips. The clip consists of excerpts taken from a slapstick comedy movie depicting a man and a woman encountering a number of things that go wrong with their new house with minimal interaction between characters. Previous studies have demonstrated that this film clip is effective in inducing state positive affect in controls and individuals with schizophrenia, as compared to both negative (sad, fear) and neutral films (e.g., Kring and Neale, 1996). A neutral film clip consisting of a narrated segment of tropical rain forest scenes served as a control.

2.3. Procedures

Following group assignment, individuals with high levels of social anhedonia and control participants completed measures of trait affectivity (NA and PA) and self-report measures of emotional expressiveness prior to arriving for their appointments for the laboratory task. Self-report measures of baseline affective states (including state PA, state NA, and warmth-affection) were administered approximately 5 min after each participant arrived to the laboratory. In order to minimize order effects of the film clips, each participant was randomly assigned to view one of six tapes, with each tape presenting the 3 film clips in different orders. Film clips were presented on a 27 in. color television monitor, with a 5-minute resting interval between each film clip to complete questionnaires and to dissipate emotion induced by the prior film. During each viewing, participants' facial responses were videotaped by a concealed digital camera for later coding.

2.4. Statistical analyses

T-tests were used to examine the group differences in trait affectivity and state affect prior to viewing the film clips. Second, a multivariate analysis of variance (MANOVA) was conducted on the self-reported emotional expressivity measures, and followed-up by post-hoc one-way ANOVAs. Third, repeated measures ANOVA was performed to examine whether there were group differences in emotional responsivity to the film stimuli. Fourth, repeated measures ANOVA was performed to examine whether there are any group differences in laboratory ratings of facial expressions across the different film stimuli.

3. Results

3.1. Trait and baseline state affect

Individuals with high levels of social anhedonia reported lower trait PA (t [77] = −4.66, p<.05), lower baseline state PA (t [77] = −2.33, p<.05), and lower baseline warmth and affection (t [77] = −2.36, p<.05) compared to controls. In contrast, there were no group differences in levels of trait or state NA (t [77] = 1.45, p>.05; t [77] = .91, p>.05, respectively). These results indicated that the social anhedonia group reported lower levels of PA, both dispositionally and on a specific occasion, whereas they reported similar levels of NA compared to controls (see Table 2).

3.2. Self-reported emotional expressivity

A MANOVA conducted to compare the self-reported emotional expressivity of the social anhedonia and control groups revealed a significant main effect of group (F [4, 71] = 17.77, p<.01). Post-hoc ANOVAs indicated that individuals

with high levels of social anhedonia reported lower EES scores, lower BEQ Positive Expressivity, lower BEQ Negative Expressivity, and lower BEQ Impulse Strength relative to controls (Table 2).

3.3. Intercorrelations among expressivity and self-reported affect

Baseline state NA and trait NA were significantly associated in both groups, and baseline state NA was also correlated with trait PA in the social anhedonia group (Table 3). Baseline state PA was significantly related to trait PA in the social anhedonia group, and this correlation approached significance in the control group. The two measures of self-reported expressivity, the EES and BEQ, were highly intercorrelated with each other in both groups with *r*'s ranging from .327 to .779. In general, there were few significant correlations between self-reported expressivity and baseline state or trait affect, with the exception of trait PA evidencing significant associations with self-reported expressivity in the control group (see Table 3 for all correlations).

3.4. Self-reported evoked emotion

A 2 (group: social anhedonia vs. controls) × 3 (film condition: neutral–comedy–affiliative) repeated measures ANOVA was conducted separately for PA, NA, and warmth and affection. Means and effect sizes for self-reported emotional responses to the film clips are presented in Table 4.

3.4.1. Positive affect

For PA in response to film clips, the repeated measures ANOVA showed a significant main effect for group (F [1, 77] = 6.01, p<.05) and a significant main effect for film condition (F [2, 76] = 16.68, p<.01), but no significant group by film condition interaction (F [2, 76] = 1.83, p>.05). Post-hoc pairwise comparisons suggested the films induced PA as intended, with the highest levels of PA reported in response to the affiliative and comedy film clips relative to the neutral film, and higher levels of PA reported in response to the affiliative film compared to the comedy film in both groups (all p's<.05). Post-hoc pairwise comparisons also showed that, compared to controls, individuals with high social anhedonia reported significantly lower levels of PA across all three films (p's<.05). Thus, although the social anhedonia group reported lower levels of PA regardless of film type, all participants experienced the affiliative film as eliciting the highest levels of PA.

3.4.2. Negative affect

For NA, there was a significant main effect for film condition (F [2, 76] 10.96, p<.01), but the main effect for group (F [1, 77] = .29, p>.05) and the group by film condition interaction (F [2, 76] = 3.66, p>.05) were not significant. Post-hoc pairwise comparisons demonstrated that all participants reported lower levels of NA during the comedy and affiliative films compared to the neutral film (all p's<.01), but reported no differences between the comedy and affiliative films.

3.4.3. Warm and affection

For warm and affectionate ratings in response to the films, there was a significant main effect for film condition (F [2, 76] = 40.59, p<.01), but no significant main effect for group (F [1, 77] = 2.50, p>.05) or the group by film condition interaction (F [2, 76] = 2.17, p>.05). Similar to the results for PA, all participants reported the highest levels of warmth and affection for the affiliative and comedy films relative to the neutral film, with the highest level of warmth and affection reported for the affiliative film as compared to the comedy film (all p's<.01). However, the social anhedonia and control groups reported similar levels of warmth-affiliation.

3.5. Elicited emotional expressivity in response to film conditions

Equipment errors with the digital recording resulted in missing data for 4 individuals with high social anhedonia and 3 control participants. Intercorrelations among the FACES variables were significant for members of both groups viewing the neutral and affiliative film clips, ranging from .46 to .82 for the social anhedonia group and .32 to .82 for the control group. However, for individuals with high levels of social anhedonia, correlations among FACES variables was relatively low for the comedy film (−.04 to .38). Subsequently, a 2 (group: social anhedonia vs. controls) x 3 (film condition: neutral–comedy–affiliative) repeated measures ANOVA was conducted sepa-

Table 2
Descriptive statistics for study measures for social anhedonia (n = 34) and control (n = 45) Groups.

	Social anhedonia	Control		Cohen's *d*
	Mean (SD)	Mean (SD)	*t*	
Trait PA	13.27 (7.17)	20.22 (5.70)	−4.66*	1.07
Trait NA	15.21 (8.29)	12.78 (6.66)	1.45	.32
Baseline state PA	42.06 (11.69)	48.20 (11.58)	−2.33*	.53
Baseline state NA	28.91 (10.39)	27.27 (5.53)	.91	.19
Baseline warm/affection	1.97 (1.07)	2.60 (1.23)	−2.36*	.55
			F	
EES	48.85 (14.39)	69.91 (10.63)	53.89**	1.66
BEQ total	4.14 (.92)	5.14 (.66)	31.17**	1.25
Positive expressivity	4.61 (1.03)	5.98 (.54)	55.37**	1.67
Negative expressivity	3.17 (1.17)	4.30 (.99)	20.73**	1.04
Impulse strength	4.62 (1.24)	5.16 (.95)	4.49*	.49

Note. SD = standard deviation; PA = positive affect; NA = negative affect; EES = Emotional Expressivity Scale; BEQ = Berkeley Expressivity Scale; *p<.05, **p<.01.

Table 3
Intercorrelations among baseline and trait measures for social anhedonia (below diagonal) and control (above diagonal) groups.

	Baseline PA	Baseline NA	Baseline WA	Trait PA	Trait NA	EES	BEQ total	BEQ positive	BEQ negative	BEQ impulse
Baseline PA	–	−.210	.673**	.290	−.114	.061	.226	.302*	.073	.217
Baseline NA	−.225	–	−.184	−.115	.368*	−.281	−.065	−.170	−.043	.009
Baseline WA	.528**	−.035	–	.110	.033	.138	.292	.154	.184	.322*
Trait PA	.425*	−.379*	.138	–	−.214	.389*	.335*	.417**	.351*	.080
Trait NA	−.135	.437*	.105	−.350*	–	.072	.255	.020	.130	.381*
EES	.268	−.106	.209	−.202	.117	–	.707**	.593**	.728**	.365*
BEQ total	.315	.149	.215	−.201	.473**	.704**	–	.650**	.867**	.780**
BEQ positive	.520**	.022	.294	.085	.247	.604**	.834**	–	.497**	.239
BEQ negative	.127	−.083	.122	−.321	.337	.779**	.750**	.493**	–	.453**
BEQ impulse	.136	.388*	.110	−.201	.505**	.327	.775**	.522**	.271	–

Note. PA = positive affect; NA = negative affect; WA = warmth/affection; EES = Emotional Expressivity Scale; BEQ = Berkeley Expressivity Scale; *p<.05, **p<.01.

rately for frequency, mean duration, and mean intensity. See Table 5 for descriptive statistics and effect sizes.

3.5.1. Frequency

For the number of positive expressions displayed (i.e., frequency count) per minute, results showed a significant main effect for group ($F[1, 70] = 4.90$, $p<.05$) and a significant main effect for film condition ($F[2, 69] = 73.93$, $p<.01$), but no group by film condition interaction ($F[2, 69] = 2.58$, $p>.05$). All participants displayed the greatest number of positive facial expressions during the comedy film and affiliative film compared to the neutral film, and displayed more positive facial expressions per minute during the comedy film relative to the affiliative film (all p's<.01). The significant group effect indicated that individuals with high social anhedonia expressed fewer numbers of positive facial expressions per minute as compared to the control group ($p<.05$).

3.5.2. Duration and intensity

For the mean duration of positive expressions displayed (i.e., average duration per expression) and the mean intensity of positive expressions displayed (i.e., average intensity per expression), there was a significant main effect for film condition (p's<.01), but the main effect for group and the group by film condition interaction were not significant. As with frequency, participants displayed the longest duration and intensity for the comedy film, followed by the affiliative film (all p's<.05).

Table 4
Descriptive statistics for group differences in self-reported affect across films.

	Social anhedonia	Controls	Cohen's *d*
	Mean (SD)	Mean (SD)	
Neutral film			
Positive affect	39.76 (10.32)	44.42 (14.24)	.37
Negative affect	25.76 (8.93)	26.93 (7.78)	.14
Warm-affection	2.09 (1.24)	2.18 (1.44)	.07
Comedy film			
Positive affect	42.26 (10.04)	49.71 (14.56)	.56
Negative affect	24.50 (9.16)	22.89 (4.49)	.22
Warm-affection	2.44 (1.44)	2.80 (1.34)	.26
Affiliative film			
Positive affect	43.94 (14.27)	52.36 (14.25)	.59
Negative affect	25.24 (8.70)	23.18 (5.56)	.28
Warm-affection	3.24 (1.42)	4.00 (1.19)	.58

Note. SD = standard deviation.

4. Discussion

This study investigated emotional responsivity and expressivity in individuals high in the schizotypy trait of social anhedonia. Emotional experience and expression were assessed across multiple methods including self-report measures of trait affect and dispositional emotional expression as well as emotional responding to evocative stimuli (measured with self-report and behavioral coding of facial expression). The current study design extends prior laboratory research with the use of a novel social affiliative film stimulus to examine affective reactions associated with social anhedonia. Additionally, it is the first study to examine facial expressivity in response to affect-eliciting stimuli in social anhedonia.

It was hypothesized that, compared to controls, individuals with high social anhedonia would report lower levels of trait affectivity and lower levels of self-reported emotional expressivity. Consistent with previous studies investigating trait affectivity in social anhedonia (e.g., Blanchard et al., in press; Gooding et al., 2002), the social anhedonia group reported less trait positive affect than the healthy control group. In addition, consistent with prior research (Kring et al., 1994), the social anhedonia group endorsed significantly lower levels of self-reported expressivity. There were no group differences in trait NA, a finding inconsistent with prior studies (e.g., Blanchard et al., in press; Horan and Blanchard, 2003a). These findings indicate that at the trait level, individuals high in social anhedonia endorse

Table 5
Descriptive statistics for behavioral codings of facial expressivity across films for social anhedonia and control groups.

	Social anhedonia	Controls	Cohen's *d*
	Mean (SD)	Mean (SD)	
Neutral			
Frequency	.045 (.146)	.064 (.271)	.08
Intensity	.133 (.434)	.095 (.297)	.10
Duration[a]	1.54 (7.23)	.541 (2.05)	.19
Comedy			
Frequency	1.08 (.830)	1.57 (.894)	.57
Intensity	1.13 (.672)	1.26 (.578)	.20
Duration	12.77 (18.10)	8.48 (8.66)	.30
Affiliative			
Frequency	.292 (.459)	.475 (.606)	.34
Intensity	.490 (.544)	.728 (.548)	.44
Duration	4.17 (5.90)	6.49 (9.61)	.29

Note. SD = standard deviation.
[a] Duration presented in seconds.

self-descriptions of reduced positive affect and reduced emotional expression.

The second study aim sought to examine emotional responding to evocative stimuli. With regard to the manipulation of emotion, it is clear from the results that the affiliative and comedy films both produced significant changes in the participants' mood as planned, with higher positive affect (PA), lower negative affect (NA), and higher warmth-affection, as compared to the neutral film. Compared to the comedy film, the affiliative film produced higher PA and higher warmth-affection, suggesting that it induced an affiliative state as intended. Group comparisons revealed that compared to controls, individuals with high social anhedonia reported attenuated state PA in response to all films including the affiliative and the comedy film. There were no group differences in negative affect or warmth-affection ratings in response to any of the films. This pattern of findings is consistent with a generalized diminution of positive affect in social anhedonia and does not support a deficit specific to affiliative stimuli.

With regard to behavioral displays of emotion, results indicated that compared to controls, individuals high in social anhedonia had significantly fewer facial expressions in response to the viewing the evocative films. However, there were no group differences in the average intensity or duration of facial expressions. This pattern of findings suggest that although individuals high in social anhedonia may make fewer expressions, that when they do have a facial display it is not necessarily an attenuated expression (as indicated by intensity or expression). These current findings of diminished emotional expression in social anhedonia are consistent with prior reports of diminished expression in a clinical interview (Collins et al., 2005), and extend these results to show that reduced expression in social anhedonia is evident when employing standardized laboratory stimuli and using detailed behavioral coding of facial displays.

Thus, the above results are suggestive of a pattern of emotional disturbance in social anhedonia which includes lower trait PA, reduced emotional responsivity, and diminished emotional expressivity. The emotional responsivity findings replicate and extend recent research in non-clincial samples demonstrating that social anhedonia is related to reduced self-reports of emotional experience in response to evocative stimuli (Mathews and Barch, 2006; Kerns et al., 2008) Whereas a disjunction of experience and expression of emotion has been reported for individuals with schizophrenia (e.g., Aghevli et al., 2003; Earnst and Kring 1999; Kring and Neale, 1996; Kring et al., 1993), a convergence between these response domains was found within this nonclinical sample with high levels of social anhedonia. This suggests that the current findings should be replicated across the schizophrenia-spectrum to ascertain whether results are broadly applicable. For example, results may suggest that the dissociation between expression and experience of emotion may not yet be prevalent in this nonclinical group, thereby necessitating study of emotional functioning across the phases of psychosis. Alternately, this pattern of findings may suggest the importance of considering individual difference variables in studying emotional constructs, especially within schizophrenia (given the phenotypic heterogeneity within this disorder). Specifically, reduced emotional responding may not characterize all individuals with schizophrenia but instead relate more specifically to those who report high levels of social anhedonia. Consistent with this notion, Horan et al. (2010) found a medium effect size for the relationship between social anhedonia and reduced emotional responding within schizophrenia.

4.1. Limitations

There are several methodological limitations that should be considered. First, this study only utilized female participants because validity for the film-induced affiliation paradigm has only been documented in women thus far (Morrone-Strupinsky and Depue, 2004). Given gender differences in emotion (e.g., Gross and John, 1995; Kring and Gordon 1998; Lang et al., 1993) it will be important to replicate the current findings in males. Another limitation of the present study is that clinical assessments of personality disorders were not conducted. It would be informative to employ structured diagnostic interviews in future studies to better determine if clinical levels of schizotypy and other disorders are present in participants or family members. Given the potential contribution of depression to anhedonia (e.g., Blanchard et al., 2001), it can be argued that depression, rather than schizotypy, may contribute to the differences between the social anhedonia and healthy control groups. Although we did not directly evaluate depressive symptoms, Clark and Watson's (1991) tripartite model suggests that depression is characterized by high levels of negative affect in conjunction with low levels of positive affect. Given that both trait and state negative affect were not elevated in our social anhedonia group, it is unlikely that depression contributed to the present findings. Finally, our measurement of warmth-affiliation was based on a single item and this may have resulted in a less sensitive or less reliable assessment of this domain (compared to the 18-item PA and NA scales). These measurement issues may have contributed to diminished ability to detect group differences in warmth-affection and a more extensive measurement approach to affiliative feelings should be considered in future studies.

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Contributors

Dr. Leung designed and conducted the study as her dissertation, and provided some of the text and most of the data analysis. Dr. Couture carried out relevant additional analyses and wrote the initial draft of this article. Dr. Blanchard contributed to the study design and execution, and wrote portions of the manuscript. Ms. Lin and Ms. Llrena contributed to literature reviews and writing of the manuscript.

Conflict of interest

All authors report no conflict of interest.

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