

SUBTYPES OF ANHEDONIA AND FACIAL ELECTROMYOGRAPHY  
RESPONSE TO NEGATIVE AFFECTIVE PICTURES IN HEALTHY ADULTS

by

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## ABSTRACT

Flat affect (i.e., diminished expressivity) and self-reported anhedonia (i.e., lack of pleasure) are associated with many psychiatric disorders. There is a need to examine the relationship between specific anhedonia subtypes and flat affect in a non-clinical sample. Forty-seven undergraduate students (59% male; mean age 20.37; SD = 4.74) completed self-report questionnaires assessing four subtypes of anhedonia – consummatory/anticipatory by social/non-social. Participants then viewed 15 randomly-presented pictures (five neutral, ten negative) from the International Affective Pictures System while facial muscle activity (electromyography; EMG) was recorded. Male participants reporting a greater level of anhedonia, particularly consummatory social anhedonia, showed greater EMG activity change in the *corrugator supercilii* muscle to negative pictures, as compared with neutral pictures. Females showed the opposite pattern: more consummatory social anhedonia related to less EMG activity change in the *corrugator* muscle. In summary, consummatory social anhedonia in particular showed a strong relationship with facial expressivity that interacted with sex. In the presence of more consummatory social anhedonia, males show more negative facial reactions to negative stimuli while females show a more flattened affect. These findings may help explain discrepancies in existing research examining anhedonia and flat affect in clinical populations and have implications for etiology and treatments.

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## INTRODUCTION

Anhedonia refers to a deficit in the experience of pleasure and is often broken down into two distinct subtypes of pleasure deficits, consummatory and anticipatory. Consummatory anhedonia refers to a decreased capacity for pleasure in the moment (e.g., the enjoyment of the smell of freshly cut grass), while anticipatory anhedonia specifies diminished pleasure when thinking about an upcoming event (e.g., deriving pleasure from the anticipation of a favorite meal). Anhedonia can also be defined based on the type of stimulus, social or non-social. Social anhedonia is a lessened experience of pleasure from various types of social interaction (discernible from social anxiety; Brown, Silvia, Germeys & Kwapil, 2007) and is characterized by disinterest in such interactions. Non-social anhedonia refers to a deficit in the experience of pleasure in response to a stimulus or situation that is not primarily related to social interactions (Strauss, Wilbur, Warren, August, & Gold, 2011). Social and non-social pleasure can both in turn be considered either consummatory or anticipatory, depending on the stimulus or situation.

Anhedonia is considered a core symptom of several psychiatric disorders including schizophrenia-spectrum, depressive, and bipolar disorders (American Psychiatric Association, 2004). However, specific subtypes of anhedonia may be more prevalent within certain disorders. For example, several studies have shown that schizophrenia and depression are associated with intact consummatory pleasure capabilities but a deficiency in anticipatory pleasure (Horan, Blanchard, Clark, & Green, 2008; Heerey & Gold, 2007; Horan, Wynn, Kring, Simons, & Green, 2010; although see Strauss et al., 2011; depression: see review by Dichter, 2010). Also, social rather than non-social anhedonia is more predictive of later development of schizophrenia

(Heerey & Gold, 2007) and lower social functioning (Karcher & Shean, 2012). Further, non-social anhedonia seems to be unrelated to a specific diagnosis and is found in bipolar and schizophrenic patients and their families as well as healthy controls (Etain et al., 2009). There are also sex differences in anhedonia reported (males tend to report more social and non-social anhedonia in clinical and non-clinical samples [Miettunen & Jaaskelainen, 2008; Fonseca, Lemos, Muniz, Garcia, & Campillo, 2008]). Unfortunately, it is rare for studies to break down anhedonia into subtypes, which may reveal important implications for etiology and treatment.

Diminished facial expressivity in response to emotional stimuli is another core symptom of many psychiatric disorders and is often referred to in clinical rating scales as *constricted* or *flattened affect*. Facial electromyography (EMG) is an objective measure of facial emotional expression with good psychometric properties (Fridlund & Cacioppo, 1986; Lee, Shackman, Jackson, & Davidson, 2009). EMG can differentiate positively and negatively valenced emotional reactions by measuring activity in the *corrugator supercilii* (associated with negative emotion) and *zygomatic major* (associated with positive emotion) facial muscle groups (Cacioppo, Berntson, Larsen, Poehlmann, & Ito, 2000). Research using facial EMG has consistently reported diminished expressivity in response to emotional stimuli in a subset of individuals with schizophrenia (see review by Kring & Moran, 2008) and depression (Greden, Genero, Price, Feinberg, & Levine, 1986). There are also sex differences found in facial expressivity. For example, females tend to display greater EMG signals in response to unpleasant pictures than males (Huang & Hu, 2009; Lundqvist, 1995; Dimberg & Lundquist, 1990).

It is important to consider that while anhedonia, a lessened experience of positive emotion, may appear to be a different manifestation of flat affect (a lessened expression of positive and negative emotion), it is not the same construct. Anhedonia is an internal emotional experience and flattened affect is outward expression. Further, anhedonia is only currently defined in terms of diminished of positive emotion, unlike flat affect which is both diminished positive and negative emotion expression. However, some researchers believe that anhedonia should be re-defined as a lessened experience of both positive and negative emotion (Berrios & Olivares, 1995). This is similar to the Emotion Context Insensitivity theory of depression (less positive and negative emotion) rather than the Negative Potentiation theory (Scher, Ingram, & Segal, 2005) of less positive emotion and more negative emotion (or at least, less diminished negative emotion, see review by Bylsma, Morris, & Rottenberg, 2007).

Research examining relationships between anhedonia and flattened affect within psychiatric disorders have produced mixed results. In schizophrenia, flat affect has generally been found to coexist with intact non-social consummatory pleasure ratings (see review by Cohen & Minor, 2008), though this finding is not always replicated (Strauss et al., 2011). Currently, schizophrenia is conceptualized as a spectrum disorder, ranging from a “normal” state, to increasing levels of schizotypy, to schizotypal personality disorder, to full blown schizophrenia (Cochrane, Petch, & Pickering, 2010). Schizotypy is a latent personality trait that is genetically related to schizophrenia and refers to clusters of symptoms typical of schizophrenia (e.g., anhedonia, magical thinking, and perceptual aberrations) but at an attenuated subclinical level of severity (Cohen, Callaway, Najolia, Larsen, & Strauss, 2012). Often, research uses schizotypy and schizotypal personality disorder as analogs for schizophrenia, as there are fewer



confounds present such as substance abuse, neuroleptic medication, and severe active symptomology. To gain further insight into the relationship of flattened affect and anhedonia, it is important to study these constructs in non-clinical samples (see call to action by Miettunen & Jaaskelainen, 2008). In what appears to be the only published study that related anhedonia and flattened affect in a non-clinical sample, Leung, Couture, Blanchard, Lin, and Llerena (2010) found higher levels of social anhedonia to be related to diminished facial expression, but used a facial-coding method instead of EMG and only examined the relationship in females. Sex differences also need to be further studied in anhedonia and flattened affect, as one study found sex to be a greater predictor of facial expressivity than anhedonia (Berenbaum, Snowwhite, & Oltmanns, 1987), though this study also used a facial-coding method instead of EMG.

The current study aims to better understand the relationship between self-reported anhedonia subtypes and objectively measured facial affective expressivity in males and females, as this will inform the understanding of these features within several psychiatric disorders, and psychosocial treatments which attempt to target abnormal emotional expression as a social skill component. This study will investigate whether facial expressivity (measured with EMG) relates to the level of self-reported anhedonia across the four subtypes (i.e., consummatory/anticipatory by social/non-social) in a non-clinical sample.

It is hypothesized that sex and anhedonia will interact to effect facial expressivity; i.e., males with more consummatory social anhedonia will have the weakest *corrugator* (because the stimuli is negatively valenced) EMG signals and females with less consummatory social anhedonia will have the strongest *corrugator* EMG signals. This is based on past research

showing more facial expressivity in females (Lundqvist, 1995; Dimberg & Lundquist, 1990; Huang & Hu, 2009) and more self-reported anhedonia in males (Miettunen & Jaaskelainen, 2008; Fonseca, Lemos, Muniz, Garcia, & Campillo, 2008). Consummatory, rather than anticipatory, anhedonia was hypothesized to show a more robust relationship with EMG, as it reflects self-report of typical “in-the-moment” emotion, similar to the in-the-moment EMG assessment. Additionally, social anhedonia was hypothesized to have the strongest relation to the EMG response, as it is the predominant anhedonia subtype linked to psychiatric disorders (especially schizophrenia) with co-existing flat affect. We also conducted exploratory analyses of the relationships between anhedonia and EMG response with the SAM ratings and the SPQ Constricted Affect subscale.

## METHODS

### Participants

Participants were enrolled in courses offered by a Psychology Department at a large university in the Southeastern United States, using an online recruitment system that awarded course credit in return for participation. Participants were recruited as part of a larger study (Ragsdale, Mitchell, Cassisi, & Bedwell, under re-review; Mitchell, Ragsdale, Bedwell, Beidel, & Cassisi, under review), which included an online administration of the Schizotypal Personality Questionnaire (SPQ), and two validity scales (SDS-A and IFS; see Measures below). After excluding individuals based on the validity scales or incomplete responses, participants falling in the top and bottom 20<sup>th</sup> percentile on the SPQ total score (i.e., high and low schizotypy groups) were invited to participate in the lab-based portion of the study. Following recruitment attempts and after excluding two individuals for invalid EMG data (due to artifact), 47 participants (59% male) were included in the data analyses. The average age of this sample was 20.37 (SD = 4.74) and the reported race was 66.1% Caucasian, 14.3% “Mixed/Other,” 10.7% Hispanic, 5.4% African American, and 3.6% Asian.

Although participants were initially recruited based on the online SPQ total scores being relatively high or low, the scores from the lab-based re-administration of the SPQ reflected a relatively normal distribution. As the relationships between the SPQ and EMG data (without considering anhedonia) have already been previously reported from this sample (Mitchell et al., under review), the present study will focus on relationships between the self-reported anhedonia and EMG, while controlling for the SPQ total score.

## Measures

**Schizotypal Personality Questionnaire (SPQ).** The SPQ is a valid and reliable self-report questionnaire (Raine, 1991; Calkins, Curtis, Grove, & Lacono, 2004) which assesses traits associated with schizotypal personality disorder in accordance with the DSM-IV (American Psychiatric Association, 2000). In addition to a total score, three distinct domains are evaluated using 74 yes/no items, a: Cognitive-Perceptual, Interpersonal, and Disorganized factor. This measure was administered online during the screening phase and again during the lab-based phase. Each of the three domains is comprised of smaller subscales. Of interest to the current study is the Constricted Affect subscale that loads onto the Interpersonal factor. This subscale contains questions about self-perceived emotional expression, broadly defined through nonverbal gestures, speech, facial cues, and social contact in order to assess flattened affect.

**Temporal Experience of Pleasure Scale and the Anticipatory and Consummatory Interpersonal Pleasure Scales combined (TEPS-ACIPS).** The TEPS is a self-report measure that provides subscales for consummatory and anticipatory pleasure, which has been found to have good psychometric properties (Gard, Gard-Germans, Kring, & Oliver, 2006). The ACIPS is a recently developed unpublished scale by Dr. Diane C. Gooding and colleagues (personal communication) that is modeled after the TEPS (e.g., also provides anticipatory and consummatory subscales), but only includes questions about social stimuli. The TEPS-ACIPS is a combined version of the two scales which randomly interlaces items from each (provided by Dr. Gooding, personal communication). The combined TEPS-ACIPS consists of 35 Likert-rating questions ranging from very false for me (1) to very true for me (6). The TEPS-ACIPS assesses

consummatory (CON) and anticipatory (ANT) pleasure in social and non-social contexts. Both measures are scored in the direction of more pleasure (i.e., less anhedonia) resulting in a higher score.

**Infrequency Scale.** The Infrequency Scale is an 8-item self-report measure modeled after the Infrequency Scale of Personality Research (Jackson, 1984) to help identify/exclude participants that may be answering items randomly or without sufficient effort. The questions asked about highly improbable events (e.g., “There have been a number of occasions when people I know have said hello to me.”). Participants were excluded if they endorsed more than one of these items in the wrong direction.

**Abbreviated Marlowe-Crowne Social Desirability Scale (MC).** The MC scale is a short 13-item form of a 33-item Marlowe-Crowe Standard form, which has been found to have strong reliability with the standard measure ( $r = .93$ ) and is widely used to assess and control for response bias in self-report research (Reynolds, 1982). Participants were excluded if their MC score was more than two standard deviations above the mean for all participants who completed the online screening phase

**Self-Assessment Manikin (SAM).** The SAM (see Figure 1) was used during the lab-based phase to assess arousal, affective valence, and dominance in response to affective pictures using the number keys 0-9 on a keyboard. Arousal is measured on a range from calm (1) to excited (9) and includes a figure which illustrates arousal level. Similarly, valence and dominance are measured on scales from unpleasant (1) to pleasant (9) and in control (1) to dominated (9) respectively (Lang, Bradley, & Cuthbert, 2008).

### **Affective Picture Electromyography Task (APET)**

The APET consisted of fifteen pictures from the International Affective Picture System (IAPS) that were selected and presented in a random order. Based on published normative ratings using the SAM affective rating system, five neutral pictures and ten negatively valenced pictures (containing images of threatening stimuli and others in distress) were selected for viewing. Normative SAM ratings for the 15 pictures is presented in Table 1. Using E-Prime 2.0 (Psychology Software Tools), pictures were displayed for 8 seconds, immediately followed by the SAM ratings (unlimited time), followed by an interstimulus interval of 30 to 40 seconds.

### **Procedure**

The lab-based session consisted of informed consent, a re-administration of the SPQ (paper version), administration of the TEPS/ACIPS, followed by the APET. During the APET, EMG data of the *corrugator supercilii* and the *zygomatic major* muscle groups were recorded using MindWare Technologies Inc. (Gahanna, OH) and BioLab Acquisition software (Version 3.0; MindWare Technologies, 2010). Five cup-style Ag–AgCl facial electrodes (two measuring *corrugator supercilii*, two measuring *zygomatic major*, and one ground electrode) were filled with saline conductive gel and placed on the participant using 4-mm adhesive disks. EMG signals were amplified at a gain of 2000.

## **Statistical Analyses**

Offline, data were subjected to a 30 Hz – 200 Hz band pass filter to exclude movement and eye-blink artifact and were fully rectified. As noted in the Participants section, two participants were excluded from further analysis due to invalid EMG signal, resulting in the final sample size of 47. The peak amplitude of the EMG signal during the 8 seconds following each stimulus was identified. We then calculated a peak EMG change (measured in microvolts) separately for the two muscle groups by subtracting the average peak amplitude from the neutral pictures from the average peak amplitude from the negatively valenced pictures. This peak EMG change score was used for all analyses. Each of the four subscales of anhedonia were examined in separate 2 x 2 mixed ANCOVAs that examined the influence of sex, anhedonia, and the interaction of the two in relation to the peak EMG change score, while controlling for the SPQ total score. In addition, 2 x 2 mixed MANCOVAs were used to examine the relationship between each of the anhedonia subtypes and sex (and interaction) on the combination of the arousal and valence from the SAM ratings, while controlling for the SPQ. Further exploratory analyses were conducted using Pearson correlations.

## RESULTS

The descriptive statistics for all measures can be found in Table 2 and zero-order correlations can be found in Table 3.

### Anhedonia Ratings and Change in Zygomatic EMG Response (Negative minus Neutral Pictures)

Results revealed that there was no main effect of anhedonia or sex, and no interaction between sex and anhedonia for any of the four anhedonia subtypes (all  $p$ 's > .50).

### Anticipatory Non-Social Pleasure (TEPS-ANT) and Change in Corrugator EMG Response

There was no main effect of sex,  $F(1,42) = 1.79, p = .19, \eta^2 = .04$ , or TEPS-ANT,  $F(1,42) = 0.001, p = .97, \eta^2 < .001$ . There was also no interaction between sex and TEPS-ANT,  $F(1,42) = 1.94, p = .17, \eta^2 = .05$ .

### Consummatory Non-Social Pleasure (TEPS-CON) and Change in Corrugator EMG Response

There was a significant main effect of sex,  $F(1,42) = 8.93, p = .005, \eta^2 = .17$ , as females showed a greater change in *corrugator* EMG response. There was no main effect for TEPS-CON,  $F(1,42) = 0.20, p = .66, \eta^2 = .005$ . However, there was a significant interaction between sex and TEPS-CON,  $F(1,42) = 9.39, p = .004, \eta^2 = .18$ . After covarying for the SPQ total score, males showed a significant negative correlation between TEPS\_CON and the *corrugator* EMG change (i.e., a greater level of consummatory non-social anhedonia related to a greater EMG change),  $r(25) = -.46, p = .02$ , while females showed no relationship,  $r(16) = .39, p = .11$ .



### Anticipatory Social Pleasure (ACIPS-ANT) and Change in *Corrugator* EMG Response

There was a significant main effect of sex,  $F(1,42) = 5.62, p = .02, \eta^2 = .12$ , as females showed a greater change in *corrugator* EMG response. There was no main effect for ACIPS-ANT,  $F(1,42) = 0.10, p = .75, \eta^2 = .002$ . However, there was a significant interaction between sex and ACIPS-ANT,  $F(1,42) = 5.85, p = .02, \eta^2 = .12$ . After covarying for the SPQ total score, males showed a significant negative correlation between ACIPS-ANT and the *corrugator* EMG change (i.e., a greater level of anticipatory social anhedonia related to a greater EMG change),  $r(25) = -.50, p = .01$ , while females showed no relationship,  $r(16) = .31, p = .21$ .

### Consummatory Social Pleasure (ACIPS-CON) and Change in *Corrugator* EMG Response

There was a significant main effect of sex,  $F(1,42) = 13.02, p = .001, \eta^2 = .24$ , as females showed a greater change in *corrugator* EMG response. There was no main effect for ACIPS-CON,  $F(1,42) = 1.92, p = .17, \eta^2 = .04$ . However, there was a significant interaction between sex and ACIPS-CON,  $F(1,42) = 13.55, p = .001, \eta^2 = .24$ . After covarying for the SPQ total score, males showed a significant negative correlation between ACIPS-CON and the *corrugator* EMG change (i.e., a greater level of consummatory social anhedonia related to a greater EMG change),  $r(25) = -.58, p = .002$  (see Figure 2), while females showed a significant positive relationship (i.e., a greater level of consummatory social anhedonia related to a weaker EMG change),  $r(16) = .49, p = .04$  (see Figure 3).

### Anhedonia Ratings and Subjective SAM Ratings of Pictures

MANCOVAs revealed that, of the four anhedonia subtypes, only TEPS-CON showed a significant relationship with the two SAM ratings (arousal and valence). The TEPS-CON showed a significant main effect with the two SAM ratings,  $F(2,41) = 5.12, p = .01, \eta^2 = .20$ , and there was no interaction between the TEPS-CON and sex in this relationship,  $F(2,41) = 1.83, p = .17, \eta^2 = .08$ . Partial correlations of this main effect (controlling for SPQ) showed a positive relationship between the TEPS-CON and arousal change,  $r(44) = .37, p = .01$ , and a negative relationship between the TEPS-CON and valence change,  $r(44) = -.40, p = .01$ . Individuals with more consummatory non-social anhedonia (i.e., lower TEPS-CON score) showed less of an increase in arousal, but a greater decrease in valence (i.e., more unpleasant), to negative, compared with neutral, pictures.

### Relationship of Self-Reported Constricted Affect (SPQ subscale) with Anhedonia Subtypes, and Change in SAM Ratings and EMG *Corrugator* Activity

As depicted in Table 3, the SPQ Constricted Affect subscale showed a significant negative correlation with the ACIPS-ANT, and ACIPS-CON (i.e., more social anhedonia was related to greater self-reported constricted affect), but was not related to the TEPS subscales. However, the Constricted Affect subscale was not related to the change in EMG or SAM ratings to negative pictures.



## DISCUSSION

The hypothesis that sex and anhedonia would interact to affect facial expressivity was supported. The direction of the effect of anhedonia subtype on *corrugator* EMG signals depended on sex (with the exception of anticipatory non-social anhedonia). In consummatory non-social and anticipatory social anhedonia, more anhedonia related to a greater EMG change in males, but no relationship was found in females. This result was surprising: it was expected that males with more anhedonia would show the weakest EMG response, because males have overall less facial expressivity and more anhedonia based on research. It is interesting that more anhedonia (diminished positive emotion) related to a more negative facial expression in males (implying corresponding heightened negative emotion). This could be explained by the fact that anhedonia is defined as a decreased capacity for positive experience of emotion and does not consider negative emotion. A heightened negative response to emotional stimuli could be related to a potentiation of negative emotion seen in depression or just that negative is less blunted than positive, which is more consistently found in depression (see review by Blyma, Morris, & Rottenberg, 2007). Outside of depression, a recent study reported that non-clinical sample with high anhedonia levels had a stronger negative reaction to negative stimuli, shown by a stronger influence on cognitive processes (Tully, Lincoln, & Hooker, 2011), which could perhaps relate to a stronger negative expression.

Consummatory social pleasure, as expected, showed the strongest relationships. More consummatory social anhedonia related once again to a greater EMG in males (consistent with the pattern above). However, females showed a significant relationship in the opposite direction:

more consummatory social anhedonia related to a weaker EMG change in females. So, while males with more anhedonia show more negative reactions to negative stimuli, females with more anhedonia showed the expected less negative (blunted) reaction. This finding is not supportive of the Negative Potentiation theory, while results from male participants supported this theory. The results from female participants are more consistent with the Emotion Context Insensitivity theory, which states that both positive and negative stimuli produce less emotional reactivity. So, for females, consummatory social anhedonia may relate to blunted expression regardless of valence (although no positive stimuli were included in the present study), while for males, anhedonia appears to relate to blunted positive emotion and increased negative expression.

The exploratory analyses revealed that individuals with more consummatory non-social anhedonia showed less of an increase in self-reported arousal, but a greater decrease in self-reported valence to negative, compared with neutral pictures, which was similar across both sexes. That is, individuals reporting higher levels of this type of anhedonia rated the negative stimuli as more negative in valence, but less arousing, compared with individuals reporting lower levels of consummatory non-social anhedonia. Further, the SPQ Constricted Affect subscale (used to assess self-perceived flattened affect) was higher in individuals reporting higher levels of either subtype of social anhedonia, but was not related to EMG change. So, those who reported more social anhedonia also reported they were less emotionally expressive in general (i.e., not just through facial expression). However, neither the subjectively reported SAM ratings or Constricted Affect scores actually related to objectively-assessed (EMG) changes in facial expression to the negative pictures within males or females (see Table 3). These findings suggest that those who report more of certain types of anhedonia accurately interpret negative stimuli as

more negative, yet they expect to have and report less of a physical response to those negative stimuli. Since none of those reports relate to objective expressivity, they may not be correctly interpreting or predicting their physical responses to stimuli that they find negative.

The current results inform both assessment and treatment of flat affect and anhedonia in psychiatric disorders, as the results highlight the importance of considering sex. For example, males presenting with high levels of negative affective facial expression may still be experiencing anhedonia, while this is less likely for females. These relationships appear to be particularly strong with consummatory social anhedonia. In terms of treatment, patients presenting with either extreme of facial expressivity may benefit from clinician feedback and self-monitoring (e.g., through video review of their facial expressions in session). The findings of this study highlight the importance of considering sex in such treatment, given the differential relationship with the experience of anhedonia.

A limitation of this study was not including positively valenced stimuli, as the larger study was focused on reactions to negative stimuli. Thus, as expected no relationships were found in the *zygomatic* EMG response for sex or anhedonia subtypes. Future research should examine these relationships in response to positively valenced stimuli to determine whether the *zygomatic* muscle group shows a similar pattern of relationships found in the present study with the *corrugator* muscle. This would provide broader support for the distinction that males with more self-reported anhedonia have more negative and less positive affect while females have less of both, which, in this study is only conclusive with regard to negative (*corrugator* EMG) reactions while positive affect attenuation is only supported by self-report measures. Another limitation of

this study is the small sample size with more males ( $n = 28$ ) than females ( $n = 19$ ). Future studies should use equal sized male and female groups in greater numbers.

In closing, this study shows that sex and anhedonia interact in relation to facial expressivity. Consummatory social anhedonia in particular shows a strong relationship with facial expressivity and shows the most robust interaction with sex. In the presence of more consummatory social anhedonia, males showed more negative facial reactions to negative stimuli while females showed a more flattened affect. These findings may help explain many discrepancies in current research examining anhedonia and flat affect in clinical populations and have real world implications for etiology and treatments for these symptoms within several psychiatric disorders.

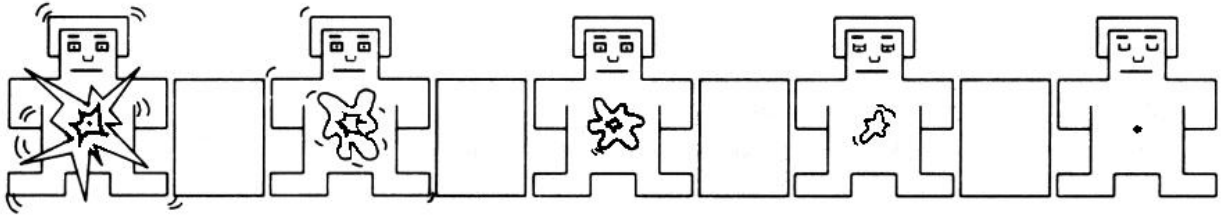


Figure 1: Self-Assessment Manikin (SAM)



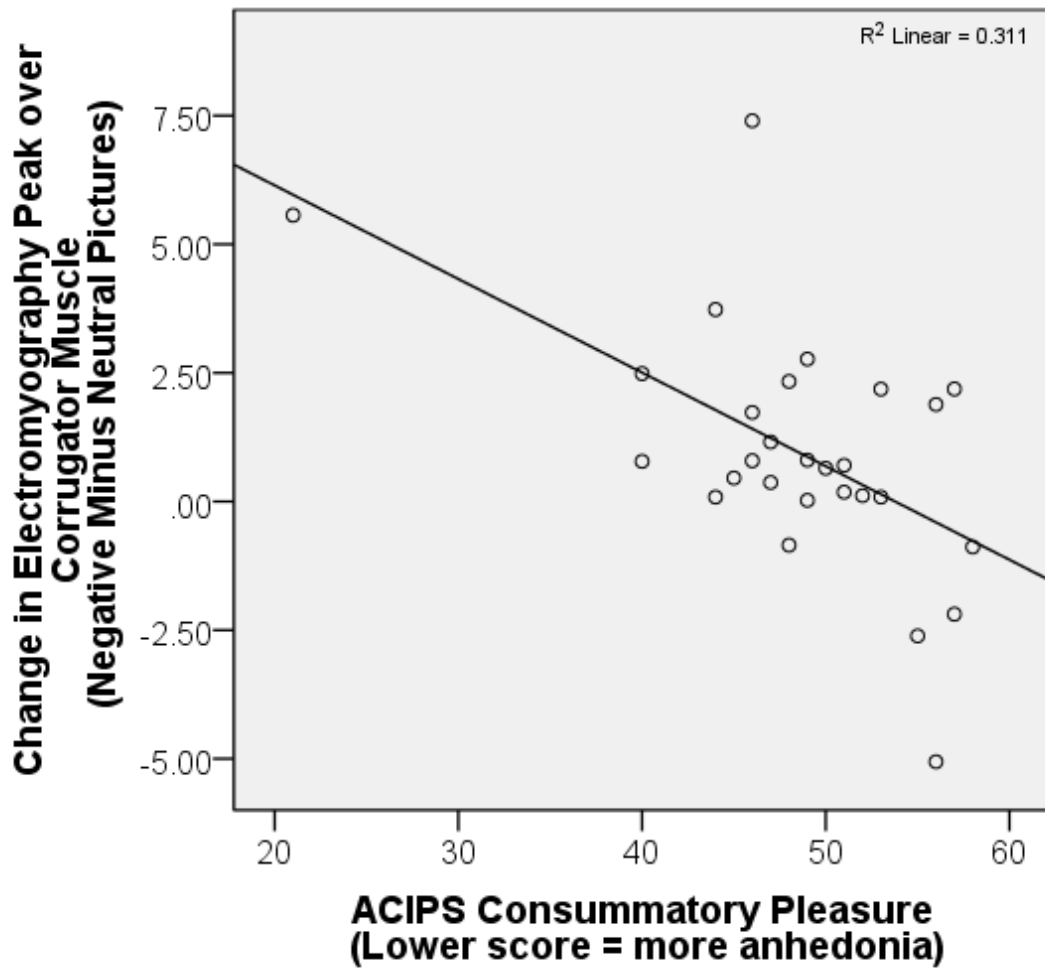


Figure 2: Scatter plot showing correlation of EMG change and ACIPS Consummatory pleasure in males

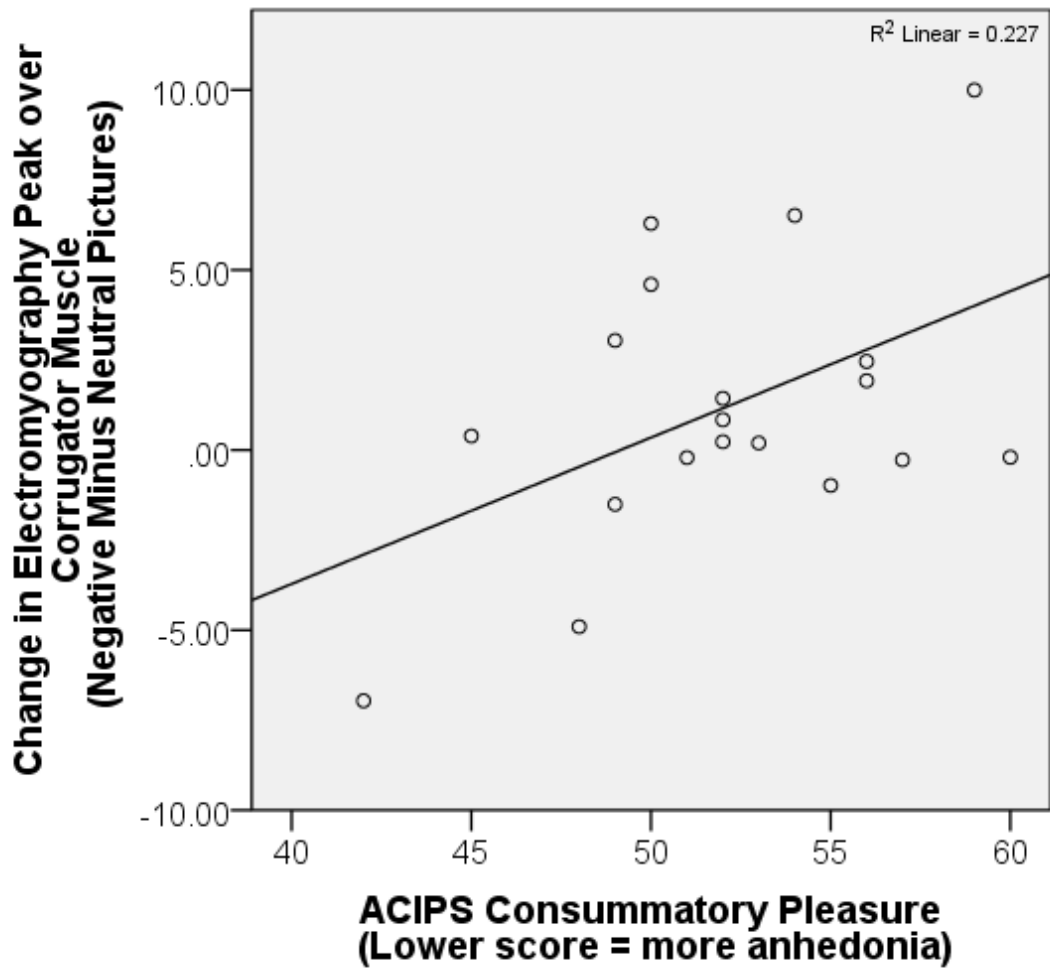


Figure 3: Scatter plot showing correlation of EMG change and ACIPS Consummatory pleasure in females

Table 1: Normative Ratings of International Affective Picture System (IAPS) Pictures From the Self-Assessment Manikin

	IAPS Picture Number/ Description	Valence Rating <sup>a</sup>	Arousal Rating <sup>b</sup>
		M(SD)	M(SD)
Negative	9413; men being hanged	1.76(1.08)	6.81(2.09)
	2703; crying children	1.91(1.26)	5.78(2.25)
	9040; starving child	1.29(0.64)	6.57(2.39)
	6500; knife to throat	2.73(2.38)	7.09(1.98)
	3168, mutilated face	1.56(1.06)	6.00(2.46)
	1114, open mouthed snake	4.03(2.16)	6.33(2.17)
	1525, attack dog	3.09(1.72)	6.51(2.25)
	2120, close up of angry male face	3.34(1.91)	5.18(2.52)
	6260, gun pointed at observer	2.44(1.54)	6.93(1.93)
	6830, masked man with guns	2.82(1.81)	6.21(2.23)
Neutral	7000, rolling pin	5.00(0.84)	2.42(1.79)
	7010, wicker basket	4.94(1.07)	1.76(1.48)
	7175, lamp	4.87(1.00)	1.72(1.26)
	7090, book	5.19(1.46)	2.61(2.03)
	7080, fork	5.27(1.09)	2.32(1.84)

Table 2: Descriptive Statistics by Sex

	Males			Females		
	Mean	SD	Range	Mean	SD	Range
<b>1. ACIPS-CON</b>	48.5	7.29	21 to 58	52.11	4.57	42 to 60
<b>2. ACIPS-ANT</b>	33.61	4.22	23 to 40	34.95	3.27	29 to 40
<b>3. TEPS-CON</b>	37.46	5.59	28 to 47	38.86	5.75	23 to 47
<b>4. TEPS-ANT*</b>	44	6.79	33 to 58	48	4.4	41 to 59
<b>5. ZYGO</b>	-.85	2.51	-8.1 to 3.92	-.19	1.21	-3.87 to 2.05
<b>6. CORR</b>	.96	2.38	-5.06 to 7.4	1.2	3.9	-6.96 to 10
<b>7. Arousal</b>	2.77	1.29	-.3 to 4.9	3.54	1.69	-.3 to 5.6
<b>8. Valence</b>	-2.06	1.11	-4.3 to -.3	-2.62	1.15	-4.6 to -.6
<b>9. SPQ Total Score</b>	25.07	17.03	3 to 63	21.95	16.181	2 to 58
<b>10. Constricted Affect Subscale</b>	2.46	1.97	0 to 7	1.63	1.67	0 to 6

*Notes.* ACIPS-CON = Total Consummatory score on the Anticipatory and Consummatory Interpersonal Pleasure Scale. ACIPS-ANT = Total Anticipatory score on the Anticipatory and Consummatory Interpersonal Pleasure Scale. TEPS-CON = Total Consummatory score on the Temporal Experience of Pleasure Scale. TEPS-ANT = Total Anticipatory score on the Temporal Experience of Pleasure Scale. ZYGO = Peak amplitude of the *Zygomatic Major* EMG to Negative minus Neutral Pictures. CORR = Peak amplitude of the *Corrugator Supercilii* EMG to Negative minus Neutral Pictures. Arousal = Average SAM Arousal Rating to Negative minus Neutral Pictures. Valence = Average SAM Valence Rating to Negative minus Neutral Pictures. SPQ = Schizotypal Personality Questionnaire. Constricted Affect Subscale = Total Score on Constricted Affect Subscale of the SPQ.

\*=  $p < .05$  between sexes

Table 3: Zero-Order Correlations by Sex; Males (n = 28) are shown below the diagonal, females (n = 19) are shown above the diagonal.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
<b>1. ACIPS-CON</b>	—	.59**	.61**	0.28	-.01	.48*	.40	-.36	-.12	-.30
<b>2. ACIPS-ANT</b>	.74**	—	-.03	.428	-.01	.30	.25	-.16	-.13	-.22
<b>3. TEPS-CON</b>	.52**	.47*	—	-.145	.04	.40	.57*	-.50*	.16	-.00
<b>4. TEPS-ANT</b>	.49**	.68**	.49**	—	.29	.12	.22	-.04	.36	.15
<b>5. ZYGO</b>	-.12	.04	-.15	-.11	—	.17	.06	.15	.29	.16
<b>6. CORR</b>	-.56**	-.46*	-.47*	-.38*	.19	—	.29	-.43	.08	-.09
<b>7. Arousal</b>	.11	.25	.13	.36	.24	-.08	—	-.76**	-.08	-.22
<b>8. Valence</b>	-.01	.16	-.30	-.18	.13	.07	-.48**	—	.19	.37
<b>9. SPQ Total Score</b>	-.03	-.12	.13	-.05	.06	-.22	-.16	-.11	—	.86**
<b>10. Constricted Affect Subscale</b>	-.29	-.37	-.14	-.22	-.08	.11	-.20	-.08	.59**	—

*Notes.* ACIPS-CON = Total Consummatory score on the Anticipatory and Consummatory Interpersonal Pleasure Scale. ACIPS-ANT = Total Anticipatory score on the Anticipatory and Consummatory Interpersonal Pleasure Scale. TEPS-CON = Total Consummatory score on the Temporal Experience of Pleasure Scale. TEPS-ANT = Total Anticipatory score on the Temporal Experience of Pleasure Scale. ZYGO = Peak amplitude of the *Zygomatic Major* EMG to Negative minus Neutral Pictures. CORR = Peak amplitude of the *Corrugator Supercilii* EMG to Negative minus Neutral Pictures. Arousal = Average SAM Arousal Rating to Negative minus Neutral Pictures. Valence = Average SAM Valence Rating to Negative minus Neutral Pictures. SPQ = Schizotypal Personality Questionnaire. Constricted Affect Subscale = Total Score on Constricted Affect Subscale of the SPQ.

\*\*p<.01. \*= p<.05.

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