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The impact of social content and negative symptoms on affective ratings in schizophrenia

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Abstract

The anhedonia paradox has been a topic of ongoing study in schizophrenia. Previous research has found that schizophrenia patients report less enjoyment from various activities when compared to their healthy counterparts; however, the two groups appear to have similar in-the-moment emotional ratings of these events (Gard et al., 2007; Herbener et al., 2007; Horan et al., 2006). This study examined these in-the-moment experiences further, by assessing whether they differed between social and non-social experiences. The data were collected from 38 individuals with schizophrenia and 53 matched healthy controls in the greater Chicago area. In-the-moment emotional experience was measured by self-reported arousal and valence ratings for social and non-social stimuli taken from the International Affective Picture System (IAPS). Clinical ratings for patients were gathered by the Positive and Negative Syndrome Scale. A series of ANOVAs revealed that controls were more aroused by the social than nonsocial unpleasant stimuli, whereas patients did not show this distinction. Further, regression analyses revealed that negative symptom severity uniquely predicted lower arousal responses to unpleasant social, but not nonsocial, stimuli. Our results indicate that both subject and stimulus factors appear to contribute to differences in emotional responses in individuals with schizophrenia.

Keywords

anhedonia; arousal; affective stimuli

1. Introduction

In the last two decades, a significant research literature has developed surrounding a “paradox” in emotional functioning in schizophrenia. This paradox lies in the fact that although individuals with schizophrenia often self-report “normal” responses to emotional

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stimuli while experiencing them in the moment (Aghevli et al., 2003; Gard et al., 2007; Hempel et al., 2005; Herbener et al., 2008; Horan et al., 2006), they tend to report less enjoyment when describing noncurrent emotions, via trait questionnaires, interviews using a retrospective or prospective format, and experience sampling studies assessing past or future pleasure (Gard et al., 2007; Herbener et al., 2007; Horan et al., 2006; Pizzagalli, 2010). Recently, Strauss and Gold (2012) questioned whether there is an emotion paradox in schizophrenia at all, and suggested, based on the accessibility model of emotional memory developed by Robinson and Clore (2002), that differences between current and noncurrent reports about emotional experience are normative as they theorize that emotion self-reports typically rely on different types of information. Specifically, in-the-moment reports are believed to be derived from experiential emotional knowledge, while noncurrent reports are believed to be drawn from a combination of episodic memory and semantic knowledge about the individual's experience of pleasure (Robinson and Clore, 2002). Further, cognitive biases and cognitive impairments are expected to particularly impact reports of non-current, but not current pleasure. This is a compelling theory, addressing many important aspects of emotional memory. However, this theory does not address some types of emotional memory, such as associative learning (Levine et al., 2009), nor has this model been empirically tested in schizophrenia populations.

Recent reviews of the literature have found that most studies have found no differences between patients and controls on momentary emotional experiences (Cohen and Minor, 2010; Kring and Horan, 2008). There are, however, some exceptions to this finding, with some studies documenting differences between schizophrenia patients (SZ) and healthy controls (HC) in their affective responses to emotional stimuli (Aminoff et al., 2011; Burbridge and Barch, 2007; Dowd and Barch, 2010; Lee et al., 2006). Specifically, Dowd and Barch (2010) found that SZ reported blunted in-the-moment experiences (i.e., they reported experiencing pleasant stimuli less positively than HC and unpleasant stimuli less negatively than HC). Others have found that SZ and HC reported similar arousal to pleasant and neutral stimuli, but found that SZ were less aroused by unpleasant stimuli when compared to HC (Aminoff et al., 2011; Burbridge and Barch, 2007), with an even greater decrease when the stimuli had human content (Aminoff et al., 2011). In contrast, Lee et al. (2006) found that SZ rated pleasant picture stimuli less positively, but their responses to unpleasant stimuli varied depending on the level of arousal of the stimuli. Therefore, at this point, it remains unclear how to explain differences in emotional experience in schizophrenia across studies.

1.1. Role of social content in emotional response

One potential explanation for inconsistencies in the research on emotional experience is that researchers have not fully considered how stimulus content might influence responses. A recent meta-analysis by Llerena and colleagues (2012), examined whether SZ and HC exhibited similar current ratings of arousal across various types of emotion induction paradigms. They found that the groups were similarly aroused by pleasant and unpleasant stimuli, but that SZ were more aroused by neutral stimuli than HC. Notably, however, their moderator analyses indicated certain methodological factors that may play a role in self-reported arousal, such as rating scale and stimulus type. In particular, they found that SZ

rated complex neutral stimuli as more arousing than HC, but that the two groups rated non-complex neutral stimuli similarly.

These findings bring up an important question about how SZ process complex stimuli, particularly social stimuli. Many studies have revealed that SZ have difficulties in accurate facial affect perception (Bigelow et al., 2006; Hooker and Park, 2002; Johnston et al., 2010; Strauss et al., 2010b; Turetsky et al., 2007), and psychophysiological studies have identified functional abnormalities in neural response to affective facial stimuli (Hempel et al., 2003; Streit et al., 2001; Turetsky et al., 2007). These difficulties could reasonably influence emotional response to social stimuli. Further, Bigelow and colleagues (2006) reported that SZ exhibited impaired abilities in emotion identification for socially relevant stimuli, suggesting a specific deficit in social perception that may contribute to inconsistencies in research results which combine social and nonsocial stimuli.

In addition to deficits in emotion identification, Penn et al. (2008) noted impairments in social cognition which may influence emotional response in SZ. In particular, SZ have exhibited deficits in their ability to make accurate inferences about others' intentions (theory of mind). This impairment in perspective-taking may relate to reduced empathy in schizophrenia (Derntl et al., 2009; Smith et al., 2012), as these empathic skills are important in developing normative emotional responses.

Notably, one study of emotional response to visual stimuli that accounted for social content found differences between SZ and HC on arousal (Aminoff et al., 2011). While groups did not differ on their arousal ratings of neutral images, SZ were less aroused by unpleasant images than HC. This difference was greater still for images with human content. However, this experiment did not include an assessment of neutral social images, or any pleasant images, which may be valuable in understanding anhedonia.

1.2. Role of symptoms in emotional response

Inconsistent results across studies may also be influenced by differences in symptom type and severity across schizophrenia samples. Past research indicates that some SZ report experiencing less intense positive and negative emotions (Carpenter et al., 1988; Kirkpatrick et al., 2001; Strauss et al., 2010a); this decreased emotional experience is associated with the reduction of key aspects of human experience such as motivation, social behavior, speech, and the experience of enjoyment, and is typically associated with high levels of negative symptoms (Arango et al., 2004; Heinrichs et al., 1984). SZ with prominent and persistent negative symptoms also tend to experience less severe mood symptoms (Cohen et al., 2010; Kirkpatrick et al., 1994). Further, these individuals have demonstrated worse performance on emotion identification tasks relative to other SZ (Johnston et al., 2010; Strauss et al., 2010b).

Differences in positive symptom severity have also been associated with self-reported emotional response to affective stimuli. Lee and colleagues (2006) noted different patterns of responsivity within SZ, with a non-paranoid subgroup who responded more negatively and less positively to affective images, while a paranoid subgroup responded more strongly to lowly arousing stimuli and less strongly to highly arousing stimuli than comparison

subjects (Lee et al., 2006). Further, Russell and colleagues (2007) found that non-paranoid SZ exhibited greater hippocampal activation in response to emotional facial expressions, compared to paranoid SZ. Given the heterogeneous symptom presentation of schizophrenia, consideration of these symptoms may shed some light on the inconsistencies in the literature.

1.3. Present study aims

The main aim of the study is to investigate whether differences in subject symptom severity or type, and/or stimulus content might explain past inconsistent results in studies evaluating self-report ratings of response to emotional stimuli. Based on past research demonstrating impairments in interpretation of social stimuli, we hypothesize that schizophrenia subjects will report more blunted emotional responses to social stimuli than healthy comparison subjects. We predict that this difference will not exist in comparisons of ratings of the nonsocial stimuli. In addition, as greater negative symptom severity in schizophrenia has been related to decreased affective experience in general (Cohen et al., 2010; Kirkpatrick et al., 1994), as well as impairments in facial and postural affect recognition (Johnston et al., 2010; Strauss et al., 2010b), negative symptom severity is expected to predict a general decrease in emotional response to stimuli, as well as an interaction with content such that emotional blunting is greater in response to social than nonsocial stimuli.

2. Methods

2.1. Participants

Participants in this study were 38 individuals who met DSM-IV (Diagnostic and Statistical Manuals of Mental Disorders 4th ed.; American Psychiatric Association, 1994) criteria for schizophrenia or schizoaffective disorder, who were recruited from the University of Illinois at Chicago Medical Center. These participants were chronic patients on a stable medication regimen for at least 4 weeks prior to baseline, and were excluded for having a history of mental retardation, head injury, hereditary neurological illness (e.g. Huntington's chorea, Wilson's disease, etc.), current substance abuse, or current use of benzodiazepines or sedatives. Diagnoses were determined by doctoral-level researchers using the Structural Clinical Interview for DSM-IV diagnoses (First et al., 1997). Fifty-three HC were recruited through advertisements posted on Chicago's public transportation system (for demographics information, see Table 1). HC were matched to the SZ on age, gender, education, and estimated intelligence. They were excluded for having a history of schizophrenia spectrum disorder or major mood disorder in first-degree relatives, history of neuroleptic use, or any psychotropic medication use within six months of baseline.

2.2. Instruments

The Positive and Negative Syndrome Scale (PANSS; Kay et al., 1987) was used to measure symptom type and severity in SZ. The PANSS is a 30-item measure rated by a clinician from a clinical interview, and includes assessment of positive and negative symptoms; average ratings were 15.82 (SD=5.01), and 16.42 (SD=6.37) for positive and negative symptoms, respectively.

The Word Reading subtest of the Wide Range Achievement Test—3rd edition (WRAT-3) was used to estimate premorbid intelligence in SZ, and was also administered to HC in order to provide a direct performance comparison between groups. Current intelligence in both groups was measured by the Wechsler Abbreviated Scale of Intelligence (WASI).

2.3. Procedure

Each participant viewed and rated 101 pictures drawn from the International Affective Picture System (IAPS; Lang et al., 2001). Stimuli were selected to sample the wide range of valence and arousal ratings in the IAPS system. Stimuli with sexually explicit or mutilation images were excluded given our focus on emotional responses to normative experiences. Fifty-nine of the stimuli were social (i.e., with human content) and forty-two of the stimuli were nonsocial (i.e., without human content). This distinction between social and nonsocial stimuli is consistent with previous studies (Harvey et al., 2007; Norris et al., 2004), including one that has recently emerged from this lab (Bjorkquist and Herbener, 2013). Both categories included a wide range of emotionally provocative stimuli, as previous studies have indicated that patients and controls have exhibited distinct patterns of response to pleasant and unpleasant stimuli (Burbridge and Barch, 2007; Dowd and Barch, 2010; Lee et al., 2006), and therefore valence should be taken into consideration. All pictures were presented individually on a desktop computer with a 19-inch flat screen monitor located 24 inches from where the participants were seated.

The participants were instructed to indicate how each image “makes [them] feel,” in order to elicit their momentary emotional reaction to the picture. Given the valence-arousal model of emotional experience (Feldman Barrett and Russell, 1999), participants were prompted to rate each picture in terms of valence (bad to good) and arousal (calm/bored to excited/agitated) using the Self-Assessment Manikin (SAM; Bradley and Lang, 1994). The SAM is a 9-point Likert scale that uses cartoon facial and body expressions to indicate the intensity of pleasure versus displeasure, as well as arousal versus calmness. Importantly, stimuli remained on the screen until subjects had completed their ratings, and thus ratings were not dependent on subjects’ memory for stimuli.

Stimuli were split into three valence categories (pleasant, unpleasant and neutral) based on IAPS norms, and then further divided into social and nonsocial groups within each valence. Analyses thus were focused on comparisons of emotional responses to 6 different categories of stimuli – pleasant social, unpleasant social, neutral social, pleasant nonsocial, unpleasant nonsocial, and neutral nonsocial. The six stimuli were matched on arousal ratings based on the IAPS normative data (Lang et al., 2001). Male and female subjects did not differ in their responses to stimuli, so the groups were combined for all analyses.

3. Results

3.1. Effect of social content on arousal and valence ratings

The main hypothesis of the present study was to determine whether SZ and HC differ in their emotional arousal response to social and nonsocial stimuli of varying degrees of valence. This was assessed using a 2 (Diagnostic group: HC, SZ) x 2 (Social content: social, nonsocial) x 3 (Valence: unpleasant, neutral, pleasant) repeated measures analysis of

variance (ANOVA) with arousal ratings as the dependent variable. A main effect of diagnostic group was found, $F(1,89) = 5.28$, $P < 0.05$, $\eta_p^2 = 0.06$, such that SZ reported higher arousal in response to all stimuli than did HC (see Figure 1). This main effect was qualified by a significant group by social content by valence interaction, $F(2,88) = 3.10$, $P = 0.05$, $\eta_p^2 = 0.07$. This interaction was followed up by examining the group by social content interaction at each level of valence: unpleasant, neutral, and pleasant (for cell means, see Table 2). Analyses within valence indicated that arousal reports did not differ between HC and SZ subjects for pleasant and neutral stimuli (see Figure 2). HC participants were significantly more aroused by social than nonsocial unpleasant stimuli, $t(52) = 3.55$, $P < 0.01$, $d = 0.24$, while SZ were similarly aroused by social and nonsocial stimuli, $t(37) = 0.48$, ns , $d = 0.04$ (see Figure 2).

Another Diagnostic group x Social content x Valence repeated measures ANOVA was conducted using emotional valence ratings as the dependent variable, and found a social by valence interaction effect, $F(2,88) = 25.32$, $P < .001$, $\eta_p^2 = 0.37$, such that all participants rated unpleasant social images more negatively than unpleasant nonsocial images, $t(90) = -2.52$, ns , $d = 0.16$, and rated neutral social pictures more positively than neutral nonsocial pictures, $t(90) = 5.48$, ns , $d = .58$. However, they rated pleasant social and nonsocial stimuli similarly, $t(90) = -0.98$, ns , $d = 0.06$. No significant three-way interactions were found.

3.2. Effect of negative symptom severity on emotional response

Another goal of this study was to test the hypothesis that greater negative symptom severity would predict blunted emotional response in schizophrenia, and particularly to social stimuli. To test for the unique contributions of positive and negative symptom severity on emotional response ratings, arousal and valence ratings of pleasant, unpleasant and neutral stimuli with and without human content were regressed onto both positive and negative symptoms scores simultaneously, in a series of standard regressions.

3.2.1. Predictors of unpleasant stimuli response—Positive and negative symptoms in patients accounted for trending significant variance in arousal to unpleasant social stimuli ($R^2 = 0.13$), $F(2,37) = 2.61$, $P = 0.09$. However, only negative symptoms uniquely predicted arousal to unpleasant social stimuli, $\beta = -0.36$, $t(37) = -2.22$, $P < 0.05$ (see Table 3). SZ with worse negative symptoms tended to rate unpleasant social stimuli as less arousing. Positive symptoms did not account for unique variance in arousal ratings.

Neither positive nor negative symptoms accounted for significant variance in arousal to unpleasant nonsocial stimuli ($R^2 = 0.07$), $F(2,37) = 1.40$, ns (for coefficients, see Table 4). Further, symptom severity did not account for variance in arousal to neutral social ($R^2 = 0.01$), $F(2,37) = 0.13$, ns , neutral nonsocial ($R^2 = 0.00$), $F(2,37) = 0.06$, ns , pleasant social ($R^2 = 0.04$), $F(2,37) = 0.71$, ns , or pleasant nonsocial ($R^2 = 0.06$), $F(2,37) = 1.10$, ns , stimuli.

4. Discussion

4.1. Responses to social and nonsocial stimuli

We had predicted that individuals with schizophrenia would demonstrate more blunted emotional responses to social than to nonsocial stimuli. The results of our analyses were

consistent with this hypothesis for unpleasant stimuli, but not for pleasant or neutral stimuli. In the analyses comparing diagnostic groups, there was a main effect of group – indicating overall higher arousal ratings by SZ participants, but also an interaction of group, valence and stimulus type that was driven by two effects – HC participants were significantly more aroused by unpleasant social than unpleasant nonsocial stimuli, and SZ subjects demonstrated the opposite pattern. Basically, unpleasant social stimuli were more salient than unpleasant nonsocial stimuli for HC subjects, but SZ subjects did not demonstrate this distinction. The specificity of findings to unpleasant stimuli is consistent with previous studies (Aminoff et al., 2011; Burbridge and Barch, 2007). Further, our results were consistent with Aminoff and colleagues' (2011) findings that SZ were less aroused by social than nonsocial unpleasant stimuli. A greater response to unpleasant social (relative to nonsocial) stimuli has been suggested to be an evolved human response (Goren et al., 1975; Johnson, 2005), which may be absent or reduced in individuals with schizophrenia.

Second, our analyses indicated that greater negative symptom severity was specifically associated with a decreased arousal response to unpleasant social stimuli. The specificity of the link between negative symptom severity and arousal response to unpleasant stimuli is consistent with previous behavioral studies (Aminoff et al., 2011; Burbridge and Barch, 2007), as well as recent studies of emotional response to unpleasant social versus nonsocial stimuli (Aminoff et al., 2011). Further, Michalopoulou and colleagues (2008) noted negative relationships between neural activation in response to fearful facial expressions and negative, but not positive, symptoms. Although far from conclusive, these studies raise interesting questions about the relationship between negative symptoms and responses to social stimuli.

The specificity of atypical arousal response to social versus nonsocial unpleasant stimuli may help to explain the inconsistency in past studies comparing arousal responses to stimuli that do not take stimulus content into account. More importantly, they may help to explain some of the difficulties in social functioning experienced by individuals with schizophrenia. Pinkham and colleagues (2011) documented a positive association between neural response to negative affective facial stimuli and better social functioning in individuals with SZ. Individuals with atypically low levels of emotional arousal in response to unpleasant social stimuli may have difficulty recognizing, and thus appropriately responding to, negative responses in social interactions – leaving them more vulnerable to victimization, as well as increasing the difficulty in negotiating the ups and downs of successful interpersonal relationships (Meehl, 1962).

The content of the unpleasant stimuli may also have had an influence on its association with negative symptoms. Most of the unpleasant slides contained fear-provoking images, such as angry people or aggressive animals. Previous literature on the experience of fear in schizophrenia has indicated that SZ exhibit reduced amygdala activation (Das et al., 2007) in response to fearful social stimuli (facial expressions). Further, Michalopoulou and colleagues (2008) found that neural activation in response to fearful facial expressions in a gender identification task was negatively associated with negative, but not positive, symptoms. Derntl and colleagues (2012) also found a negative correlation between amygdala activation and severity of negative symptoms. At present, there are no studies that

directly compare social and nonsocial unpleasant stimuli on neural response or negative symptoms in SZ. However, taken together, the current literature appears to corroborate the present study's findings that more severe negative symptoms uniquely predict reduced emotional response to unpleasant social stimuli. These results extend the findings of a recent meta-analysis that methodological factors such as stimulus type may serve as a moderator in the study of emotional arousal (Llerena et al., 2012).

Predicting response to unpleasant social is particularly important because these responses may have an effect on the quality of these individuals' social interactions. The ability to respond to and empathize with another individual's pain or sadness is an important component of forming relationships. A positive association between neural response to negative affective facial stimuli and social functioning has been found in SZ (Pinkham et al., 2011). The results from this study indicate that SZ, at trend, are not showing the higher preferential arousal to social as opposed to nonsocial stimuli that is found in HC (Lavie et al., 2004; Santos et al., 2012), which could play a significant role in poor social functioning. Without the ability to be preferentially engaged by social emotional stimuli, an individual is less likely to seek out, develop, and maintain successful interpersonal relationships (Meehl, 1962). This, in turn, may result in a decreased exposure to social situations and decreased practice of interaction skills.

Notably, we found that SZ reported significantly higher experience of arousal in response to all valences of images than healthy subjects. Although counterintuitive, this result is consistent with multiple studies that have shown that SZ report a heightened arousal in response to emotional and neutral stimuli in comparison to HC (Monkul et al., 2007; Tremeau et al., 2009). Further, functional imaging studies have reported a heightened resting level activation of the amygdala in SZ, in contrast to HC (Taylor et al., 2005), as well as a higher activation to neutral faces (Hall et al., 2008), suggesting a higher baseline of emotional arousal. In fact, a recent meta-analysis found that the often-reported reduced amygdala response to fear stimuli in SZ was only found in studies using a within-subjects contrast between neutral and unpleasant stimuli, suggesting there may in fact be a heightened response to neutral stimuli rather than a diminished response to unpleasant stimuli (Anticevic et al., 2012).

4.2. Limitations and future directions

Due to the cross-sectional nature of the data collection, these analyses cannot address the direction in causality in the relationship between clinical presentation and in-the-moment emotional experiences. In addition, the PANSS scale, while widely used in schizophrenia research, does not assess some aspects of negative symptoms (e.g., avolition, anhedonia) that are important to our conceptual understanding of schizophrenia. Future studies may consider using a more specific measure of negative symptoms that aligns more closely with the deficit syndrome, on which much of our literature review focused.

The use of a bipolar scale to assess positive and negative response to the stimuli limited the ability of the study to detect significant differences in subjective experience of valence. Although we attempted to address this issue by cutting our bipolar rating into categories, it

will be important to replicate the current findings to ensure that this methods issue did not interfere with research results.

Similar to many other studies, our “in-the-moment” ratings of emotional experiences were based on responses to presented images, not real-life experiences. Although we found significant effects of social in contrast to nonsocial stimuli on arousal ratings in this sample, studies assessing in-the-moment experiences of schizophrenia patients and healthy controls during actual social interactions would be an important addition to our field. Studies addressing this issue are in progress in our lab.

4.3. Conclusion

This study sought to address the inconsistent findings of momentary emotional response in SZ by examining the impact of social content and symptom severity on these experiences. Our results indicate that a variety of both subject and stimulus factors appear to contribute to differences in emotional responses in individuals with schizophrenia. We suggest that atypical emotional responses to emotional stimuli may contribute to decreased investment in social engagement in individuals with schizophrenia. Given that heterogeneity of symptom presentation in schizophrenia may complicate interpretation of study results, symptom severity (particularly negative symptoms) should be considered when analyzing emotional response in schizophrenia.

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Figure 1.

Mean levels of reported arousal by all stimuli as a function of diagnostic group and social content. HC = healthy control. SZ = schizophrenia patient.

Figure 2. Mean levels of reported arousal by unpleasant, neutral, and pleasant stimuli as a function of diagnostic group and social content. HC = healthy control. SZ = schizophrenia patient.

Table 1

Subject Demographic Information

	HC	SZ
Age	38.98 (10.41)	38.84 (10.34)
Gender M/F	24/29	19/19
Education	13.58 (1.74)	14.31 (4.19)
WRAT-3	97.92 (11.78)	95.74 (15.98)
WASI	101.92 (15.04)	97.42 (24.34)

Note. Standard deviations are in parentheses. WRAT-3 = Wide Range Achievement Test—3rd edition. WASI = Wechsler Abbreviated Scale of Intelligence. None of these variables significantly differ between groups.

Table 2

Means of Arousal and Valence as a Function of Social Content

	Social		Nonsocial	
	HC	SZ	HC	SZ
Ratings of Emotional Response				
Arousal Responses				
Arousal Responses to Unpleasant Stimuli	6.48	7.12	6.12	7.06
Arousal Responses to Neutral Stimuli	4.68	5.22	4.97	5.64
Arousal Responses to Pleasant Stimuli	4.23	4.61	3.61	3.69
Arousal Responses Overall	5.26	5.78	4.64	5.13
Valence Responses				
Valence Responses to Unpleasant Stimuli	2.77	2.60	2.99	2.69
Valence Responses to Neutral Stimuli	5.07	5.09	4.60	4.71
Valence Responses to Pleasant Stimuli	6.53	6.71	6.65	6.70
Valence Responses Overall	4.63	4.63	5.11	5.13

Note. Higher scores on valence indicate positive valence and higher scores on arousal indicate greater arousal.

Table 3

Predictors of Arousal Response to Unpleasant Social Stimuli

Predictors	<i>B</i>	<i>SE</i>	<i>β</i>	<i>t</i>	<i>p</i>
Positive Symptoms	0.00	0.03	-0.01	-0.04	0.97
Negative Symptoms	-0.06	0.03	-0.36	-2.22	0.03

Table 4

Predictors of Arousal Response to Unpleasant Nonsocial Stimuli

Predictors	<i>B</i>	<i>SE</i>	<i>β</i>	<i>t</i>	<i>p</i>
Positive Symptoms	0.02	0.04	0.08	0.49	0.63
Negative Symptoms	-0.06	0.03	-0.28	-1.67	0.10