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Sensory-processing sensitivity in social anxiety disorder: Relationship to harm avoidance and diagnostic subtypes

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Abstract

Sensory-processing sensitivity is assumed to be a heritable vulnerability factor for shyness. The present study is the first to examine sensory-processing sensitivity among individuals with social anxiety disorder. The results showed that the construct is separate from social anxiety, but it is highly correlated with harm avoidance and agoraphobic avoidance. Individuals with a generalized subtype of social anxiety disorder reported higher levels of sensory-processing sensitivity than individuals with a non-generalized subtype. These preliminary findings suggest that sensory-processing sensitivity is uniquely associated with the generalized subtype of social anxiety disorder.

Recommendations for future research are discussed.

Keywords

Sensory-processing sensitivity; Social anxiety disorder; Harm avoidance; Diagnostic subtypes

1. Introduction

Social anxiety disorder (SAD) is defined as “a marked and persistent fear of one or more social or performance situations in which the person is exposed to unfamiliar people or to possible scrutiny by others” (APA, 1994, p. 416). Results from the National Comorbidity Survey-Replication indicate that the lifetime prevalence rate of SAD is 12.1% (Kessler, Berglund, Demler, Jin, & Walters, 2005). If untreated, the disorder typically follows a chronic, unremitting course, leading to substantial impairments in vocational and social functioning (e.g., Stein & Kean, 2001; Stein, Torgrud, & Walker, 2000).

SAD often begins in the mid-teens, but can also occur in early childhood and can manifest itself early on as childhood shyness (Hayward, Killen, Kraemer, & Taylor, 1998; Mick & Telch, 1998; Neal, Edelmann, & Glachan, 2002; Neal & Edelmann, 2003; Rosenbaum, Biederman, Hirshfeld, Bolduc, & Chaloff, 1991; Rosenbaum, Biederman, Pollack, & Hirshfeld, 1994; Schwartz, Snidman, & Kagan, 1999). Childhood shyness (also known as behavioral inhibition) refers to a person’s degree of wariness and timidity when encountering novel people, objects, or events (Kagan, 2001) and related constructs have been discussed by others (e.g., Cloninger, 1987a,b; Eysenck, 1981; Gray & McNaughton, 1996). Similarly, SAD and adult shyness are greatly overlapping (Chavira, Stein, & Malcarne, 2002; Heiser, Turner, & Beidel, 2003).

Shyness is a stable and highly heritable personality trait (e.g., Daniels & Plomin, 1985). A number of family studies (e.g., Fyer, Mannuzza, Chapman, Liebowitz, & Klein, 1993; Lieb et al., 2000), twin studies (Skre, Onstad, Torgersen, Lygren, & Kringlen, 1993), and high-risk

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studies (Mancini, van Ameringen, Szatmari, Fugere, & Boyle, 1996) suggest that SAD is genetically transmitted, especially the generalized subtype of SAD (Mannuzza et al., 1995; Stein et al., 1998). For example, a direct-interview family study estimated the relative risks for generalized SAD to be 10-fold greater among first-degree relatives of probands with generalized SAD than among first-degree relatives of non-anxious controls (Stein et al., 1998). In contrast, the relative risks for developing SAD were not significantly different among first-degree relatives of probands with non-generalized SAD and non-anxious controls. Moreover, Mannuzza et al. (1995) reported that patients with generalized SAD had a significantly earlier age of onset of the disorder than patients with non-generalized SAD. These findings suggest that the generalized subtype begins at an earlier age and is more heritable than the non-generalized subtype of SAD. However, some researchers (e.g., Stein, Chartier, Lizak, & Jang, 2001) pointed out that it is unlikely that SAD itself, at the level of an Axis I disorder, is genetically transmitted. Instead, it is more likely that one or more temperamental risk factors for SAD are transmitted.

One of these possible temperamental risk factors is sensory-processing sensitivity (Aron & Aron, 1997; Aron, Aron, & Davies, 2005). This construct, which can be reliably measured with the 27-item Highly Sensitive Person Scale (HSPS; Aron & Aron, 1997), is conceptualized as a unidimensional personality trait that manifests itself in the form of avoidance of overstimulation. It has been proposed that sensory-processing sensitivity can lead to shyness when negative affect is triggered through an adverse childhood experience (Aron et al., 2005). In other words, sensory-processing sensitivity might be a heritable vulnerability factor for shyness under certain environmental conditions.

A conceptually related temperamental trait is harm avoidance of Cloninger's psychobiological model of temperament (Cloninger, 1987a,b).¹ Harm avoidance measures the tendency towards behavioral inhibition to avoid punishment, novel stimuli, and non-reward. The 100-item Tridimensional Personality Questionnaire (TPQ; Cloninger, 1987a,b) was designed to measure harm avoidance and two other personality traits—novelty seeking and reward dependence. Several studies have reported greater harm avoidance in individuals with SAD when compared to controls (Chatterjee, Sunitha, Velayudhan, & Khanna, 1997; Marteinsdottir, Tillfors, Furmark, Anderberg, & Ekselius, 2003; Stein et al., 2001).

The current study is the first to examine sensory-processing sensitivity in a sample of individuals with SAD. The objectives of the study were to: (1) provide preliminary psychometric data of the HSPS in a SAD sample by comparing the scale to a measure of social anxiety and the TPQ subscales and (2) compare the diagnostic subgroups in the HSPS. We expected that HSPS shows significant correlations with social anxiety and the Harm Avoidance subscale of the TPQ. Moreover, we expected that participants with generalized SAD show greater scores in the HSPS than individuals with non-generalized SAD.

2. Method

2.1. Participants

The sample consisted of 89 adult outpatients who presented for diagnostic evaluation and possible treatment at the Center for Anxiety and Related Disorders at Boston University. On average, participants were 30 years old (S.D.: 9.32; range: 18–74), and received 15.41 years of education (S.D.: 2.14; range 10–22). The majority of the sample was female (51.70%),

¹Other related constructs include introversion, inhibition, shyness, and sociability. A discussion of the conceptual difference and overlap between these constructs and sensory-processing sensitivity with preliminary data to support this distinction is provided elsewhere (Aron & Aron, 1997; Aron et al., 2005). One of the reviewers further pointed out that neuroticism and negative affectivity might be other related constructs.

Caucasian (84.30%), and single (66.30%). The clinicians conducting the diagnostic assessments assigned 67 participants (75.28%) a generalized subtype of SAD; the remaining 22 individuals were assigned a non-generalized subtype of SAD (24.72%).

A comparison between the two social phobia subtypes in comorbid Axis I disorders showed that 54 (80.60%) participants with generalized SAD and 15 (68.18%) participants with non-generalized SAD had at least one additional Axis I diagnosis. This difference was not statistically significant, $\chi^2(1) = .89, p = .36$ (with continuity correction). Furthermore, 30 (44.78%) participants with generalized SAD and 7 (31.82%) participants with non-generalized SAD met criteria for at least 2 additional diagnoses. Again, this difference was not statistically significant, $\chi^2(1) = .67, p = .41$ (with continuity correction).

2.2. Inclusion and exclusion criteria

As a result of the inclusion criteria for an NIMH treatment study, participants were only eligible if they endorsed a significant fear of public speaking among one of their social fears (i.e., a public speaking fear rating of at least 4, using a 0–8 point clinician-administered scale). The majority of individuals who received a diagnosis of SAD (90%) met this inclusion criterion.

Exclusion criteria were the following: (1) prior non-response to cognitive-behavioral treatment for SAD, (2) current diagnosis of psychoactive substance abuse or dependence, (3) current active suicidal potential, (4) current diagnosis of bipolar disorder, or (5) current diagnosis of schizophrenia or other psychotic disorders.

2.3. Procedure

After contacting the Center, all participants received the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; DiNardo, Brown, & Barlow, 1994), which is a semi-structured clinical interview to determine the presence or absence of all DSM-IV anxiety and mood disorders. The interview also included questions to determine the diagnostic subgroups of SAD. The typical time duration of the interview was between 3 and 5 h. In order to establish reliability of this assessment procedure, a subsample of the participants of this study were interviewed twice by two independent clinicians. The Kappa coefficient between these two raters was .77 when SAD was assigned as a principal diagnosis ($n = 80$). Further results of this reliability study are reported elsewhere (Brown, DiNardo, Lehman, & Campbell, 2001). In addition, participants were asked to fill out the following self-report measures:

Highly Sensitive Person Scale (HSPS; Aron & Aron, 1997)—The HSPS is a 27-item scale to measure sensory-processing sensitivity. The scale shows adequate reliability and convergent and discriminant validity.

Social Phobia and Anxiety Inventory (SPAI; Turner, Beidel, Dancu, & Stanley, 1989)—The SPAI is a 109-item measure that has been widely used to assess the cognitive, somatic, and behavioral dimensions of SAD. The measure yields an agoraphobia subscale score, which assesses anxiety associated with classic agoraphobic situations, a difference score, which is derived by subtracting the agoraphobia subscale score from the total score, and a social phobia subscale score, which includes the agoraphobia subscale score. Turner et al. (1989) recommended using the difference score as an indicator of social anxiety, because it resulted in better discrimination between patients with SAD and patients with panic disorder. The SPAI is capable of discriminating socially phobic persons from those with other anxiety disorders (Turner et al., 1989) and from normal controls (Beidel, Turner, Stanley, & Dancu, 1989). Test-retest and internal reliability have been shown to be high for this scale (Turner et al., 1989). Convergent and discriminant validity of this instrument have also been demonstrated (Beidel et al., 1989; Turner et al., 1989).

Tridimensional Personality Questionnaire (TPQ; Cloninger, 1987a)—The TPQ is a 100-item instrument that was designed to measure these three personality traits: novelty seeking, reward dependence, and harm avoidance. These three personality dimensions are believed to be genetically independent and associated with specific behavioral response patterns (Cloninger, 1987b). Novelty seeking is characterized by exploratory activity and aversion to monotony. Reward dependence involves the maintenance of reward-inducing behavior and reduction of behavior that elicits punishment. Harm avoidance reflects a tendency towards behavioral inhibition to avoid punishment, novel stimuli, and non-reward. The TPQ has been shown to have very good psychometric characteristics (Cloninger, Przybeck, & Svrakic, 1991).

A total of 89 participants filled out the SPAI and the HSPS (67 participants with generalized SAD and 22 individuals with non-generalized SAD). The TPQ was introduced at a later point in the study. As a result, there were only 36 participants who provided complete data on the TPQ, SPAI, and HSPS (29 participants with generalized SAD and 7 individuals with non-generalized SAD).

3. Results

3.1. Psychometric data

The 27-item HSPS scale showed adequate internal consistency, Cronbach's $\alpha = .87$; unequal-length Spearman Brown: .86. The score ranged between 5 and 27 with a mean of 16.98 (S.D.: 5.81), median of 17, mode of 17, a skewness of $-.098$ (S.E.: .26) and a kurtosis of $-.87$ (S.E.: .51). These data suggest that the scores are normally distributed. A principal component analysis of the measure identified 9 factors with Eigenvalues of greater than 1, explaining 65.83% of the total variance. The Eigenvalues of these factors were 6.47, 2.11, 1.76, 1.44, 1.32, 1.27, 1.21, 1.14 and 1.06. A Scree plot favored a 1-factor solution; the first factor accounted for 23.96% of the explained variance. These results are consistent with the studies by Aron and Aron (1997).

3.2. Covariation between the HSPS with the SPAI and TPQ

Table 1 depicts the correlations between the HSPS, the difference score of the SPAI (SPAI-Difference), the agoraphobia subscale of the SPAI (SPAI-Agoraphobia), and TPQ subscales Novelty Seeking, Reward Dependence, and Harm Avoidance. The results showed that the HSPS was poorly correlated with the SPAI-Difference scale, $r = .08$, $p = .48$, but highly correlated with the SPAI-Agoraphobia subscale, $r = .44$, $p < .0001$. Fig. 1 shows a clear linear relationship between these two scales. In addition, the HSPS shows the predicted positive correlation with HA, $r = .52$, $p = .002$ (Fig. 2).

3.3. Differences Between Diagnostic Subtypes

In order to retain the maximum amount of participants for the statistical analyses, we performed two separate multivariate tests employing a General Linear Model. Table 2 displays the means, standard deviations, and results of the of univariate follow-up tests of this analysis.

The first test compared generalized and non-generalized SAD in the SPAI-Difference subscale, SPAI-Agoraphobia subscale, and the HSPS (one of the 89 participants was excluded from the analysis because of missing data). The results showed a significant multivariate group effect, $F(3, 84) = 15.38$, $p < .0001$, $\text{partial } \eta^2 = .35$. The univariate follow-up tests revealed that generalized SAD had higher scores in the SPAI-Difference subscale, $F(1, 86) = 25.01$, $p < .$

001, $partial \eta^2 = .23$, the SPAI-Agoraphobia subscale,² $F(1, 86) = 9.18, p = .003, partial \eta^2 = .098$, and the HSPS, $F(1, 86) = 9.98, p = .002, partial \eta^2 = .10$.

The second test compared generalized and non-generalized SAD in the three subscales of the TPQ (2 of the 38 participants were excluded due to missing data). The results revealed a significant multivariate group effect, $F(3, 32) = 5.85, p = .003, partial \eta^2 = .35$. Univariate follow-up tests showed that the only difference between the TPQ subscales was in the Harm Avoidance scores. The generalized subtype had higher scores than the non-generalized subtype, $F(1, 34) = 17.07, p < .0001, partial \eta^2 = .33$. No group difference was observed for the other two TPQ subscales ($F < .23, p > .6, \eta^2 < .008$).

4. Discussion

In a series of experiments, Aron and Aron (1997) introduced sensory-processing sensitivity as a unidimensional construct that is related, but not identical, to social introversion and emotionality. In order to measure this construct, the authors developed a reliable and valid 27-item measure, the Highly Sensitive Person Scale (HSPS), and noted that “although the scale was not designed for clinical applications (and has not been evaluated in that context), it would seem to have potential in this area” (Aron & Aron, 1997, p. 364). The present study is the first attempt to evaluate the utility of this scale in individuals with SAD, a common disorder with considerable overlap to shyness.

In order to evaluate the utility of the HSPS, we recruited 89 participants with a DSM-IV diagnosis of SAD. The sample composition was typical for individuals with this disorder and the majority of the sample met criteria for the generalized subtype (74%). Participants were asked to fill out the HSPS and the SPAI, a reliable and valid measure of social anxiety. It should be noted that the HSPS does not contain any items related to social anxiety. Only one item specifically asks the respondent about his/her shyness (item 27: “When you were a child did parents or teachers seem to see you as sensitive or shy?”).

Contrary to our hypothesis, the results showed that there was no significant correlation between the HSPS and the SPAI-Difference subscale. However, we observed a significant correlation between the HSPS and the agoraphobia subscale of the SPAI. This suggests that sensory-processing sensitive is related to general agoraphobic avoidance, but not self-reported social anxiety among individuals with SAD. This is a surprising finding that cannot be explained easily. It is possible that the relatively greater HSPS scores in participants with generalized SAD might be related to subtype differences in any third variables, such as comorbid disorders or level of negative affect. In fact, a study by Herbert, Hope, & Bellack (1992) reported more comorbid diagnoses among generalized than among non-generalized SAD. In contrast, other studies did not report a significant difference between the diagnostic subtypes in the number of comorbid Axis I (e.g., Hofmann, Newman, Ehlers, & Roth, 1995; Holt, Heimberg, & Hope, 1992). Similarly, our study also did not find any significant differences in the frequency of comorbid Axis I disorders. Furthermore, the strong association between the agoraphobia subscale of the SPAI and the HSPS does not seem to be related to the diagnostic status because only one participant with non-generalized SAD and only two participants with generalized SAD met criteria for panic disorder with agoraphobia. Clearly, more research is needed to replicate and further explore these results, and to examine whether similar findings can be observed across a wider spectrum of social anxiety. It is further important to examine whether sensory-processing sensitivity measures a unique trait that is distinguishable from other individual difference variables, such as neuroticism, negative affectivity, and shyness.

²One individual with non-generalized SAD and two individuals with generalized SAD met criteria for panic disorder with agoraphobia.

A temperament variable that has been closely linked to shyness is harm avoidance. Cloninger, Przybeck, Svrakic, & Wetzel (1994) define harm avoidance as follows: "Individuals high in Harm Avoidance tend to be cautious, careful, fearful, tense, apprehensive, nervous, timid, doubtful, discouraged, insecure, passive, negativistic, or pessimistic even in situations that do not worry other people. These individuals tend to be inhibited and shy in most situations" (p. 20).

Consistent with our hypothesis, harm avoidance was highly associated with sensory-processing sensitivity. However, harm avoidance was also correlated with self-reported anxiety, whereas sensory-processing sensitivity was not. Previous studies have further shown that harm avoidance decreases with symptom improvement in patients with depression (Brody et al., 2000; Chien & Dunner, 1996; Strakowski, Dunayevich, Keck, & McElroy, 1995), dysthymia (Hellerstein, Kocsis, Chapman, Stewart, & Harrison, 2000), obsessive-compulsive disorder (Brody et al., 2000; Lyoo et al., 2001), generalized anxiety disorder (Allgulander, Cloninger, Przybeck, & Brandt, 1998) and SAD (Hofmann & Loh, 2006). Moreover, harm avoidance has been found to correlate highly with neuroticism (Caseras, Avila, & Torrubia, 2003), a personality trait that is also strongly associated with anxiety and mood disorders (Clark, Watson, & Mineka, 1994). Further studies will need to be done in order to establish the discriminant validity and stability of the HSPS.

In a recent discussion of the construct, Aron et al. (2005) suggested that sensory-processing sensitivity is a vulnerability factor for adult shyness, which is similar to Kagan's conceptualization of behavioral inhibition (e.g., Kagan, Reznick, & Snidman, 1988). Kagan and colleagues hypothesize that differences exist between inhibited and uninhibited individuals in their threshold of responsivity in certain brain structures. The amygdala is particularly prominent in this model since it plays a central role in processing emotional material and responding to unfamiliar stimuli. Kagan (2001) posits that the activation threshold of certain brain structures, and specifically the amygdala, to unfamiliarity or challenge is tonically lower in inhibited than in uninhibited children. Future studies should specifically examine the relationship between behavioral inhibition and sensory-processing sensitivity and their psychophysiological and neurobiological correlates.

Finally, we compared individuals with a generalized subtype of SAD with those who do not meet this criterion (non-generalized subtype). There is some evidence to suggest that only the generalized subtype of SAD is genetically transmitted (Mannuzza et al., 1995; Stein et al., 1998). Moreover, it has been proposed that temperamental risk factors rather than SAD itself are transmitted (e.g., Stein et al., 2001). An example of such a risk factor may be sensory-processing sensitivity (Aron et al., 2005). Our study cannot directly test this hypothesis. However, our findings did not rule out the possibility that sensory-processing sensitivity is a specific vulnerability factor for the generalized subtype of SAD. Although HSPS correlated with $r = .08$ with self-reported social anxiety, there were significant differences between the diagnostic subtypes in the HSPS scores. This finding is interesting, because it has been assumed that the diagnostic subtype specifier simply differs in the degree of social anxiety (see Hofmann, Heinrichs, & Moscovitch, 2004, for review). However, some genetic studies (e.g., Stein et al., 1998) and the present findings question this assumption.

The main limitations of this study include the relatively small number of subjects for the TPQ analyses, the lack of a normal control group, the reliance on self-report data, and the limitations of cross-sectional data. In sum, we conclude that the HSPS is a promising scale to study individual risk factors of SAD. Various directions for future experiments have been suggested and the most valuable information would come from longitudinal data that examines sensory-processing sensitivity as one of the potential risk factors for developing SAD.

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Fig. 1. Scatter plot and regression of the covariation between the agoraphobia subscale of the Social Phobia and Anxiety Inventory (SPAI-Agoraphobia) and the Highly Sensitive Person Scale, $r = .44$, $p < .0001$.

Fig. 2. Scatter plot and regression line of the covariation between Harm Avoidance subscale of the Tridimensional Personality Questionnaire and the Highly Sensitive Person Scale, $r = .52, p < .0001$.

Table 1

Intercorrelations between self-report scales

	SPAI-Difference	SPAI-Agoraphobia	NS	RD	HA	HSPS
SPAI-Difference						
SPAI-Agoraphobia		.44**	.03	-.21	.29	.08
NS			-.08	.02	.41*	.44**
RD				.11	-.04	-.04
HA					-.07	.12**
Total mean (standard deviation)	106.46 (30.46)	21.63 (13.98)	13.31 (4.71)	17.09 (3.76)	23.25 (4.38)	16.98 (5.81)

Note: The table shows means and standard deviations (bottom row) and product-moment correlations. SPAI-Difference, Social Phobia and Anxiety Inventory, difference score; SPAI-Agoraphobia, Social Phobia and Anxiety Inventory, agoraphobia subscale score; NS, Novelty Seeking scale of the Tridimensional Personality Questionnaire (TPQ); RD, Reward Dependence scale of the TPQ; HA, Harm Avoidance scale of the TPQ; HSPS, Highly Sensitive Person Scale. The analyses were based on 89 participants for the SPAI and HSPS scales and between 32 and 36 participants for the correlations with the TPQ scales.

* Correlation is significant at $p < .05$ (two-tailed).

** Correlation is significant at $p < .01$ (two-tailed).

Table 2
Comparison between social phobia subtypes in self-report measures

	Generalized subtype	Non-generalized subtype	F-value
HSPS	17.99 (5.66)	13.68 (5.11)	9.98**
SPAI			
Difference	114.75 (25.71)	81.36 (31.07)	25.01**
Agoraphobia	24.06 (13.08)	14.05 (14.46)	9.18**
TPQ			
Harm Avoidance	24.21 (3.38)	18.00 (4.32)	17.07***
Novelty Seeking	13.62 (4.96)	12.71 (1.89)	.22
Reward Dependence	17.38 (3.98)	18.14 (2.97)	.23

Note: The table shows means (standard deviations) and results of statistical tests. HSPS, Highly Sensitive Person Scale; SPAI, Social Phobia and Anxiety Inventory; TPQ, Tridimensional Personality Inventory. The group comparisons in the SPAI and HSPS scales were based on 22 individuals with generalized social phobia and 66 individuals with non-generalized social phobia. The TPQ analyses were based on 29 individuals with generalized social phobia and 7 individuals with non-generalized social phobia.

**
 $p < .01$ (two-tailed).

 $p < .001$ (two-tailed).