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Sensory processing sensitivity and its relation to parental bonding, anxiety, and depression

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Abstract

Sensory processing sensitivity is a recently proposed construct referring to a tendency to process a variety of information more strongly and deeply than others. Although some research has found links between sensory processing sensitivity and psychological difficulties, highly sensitive people may not necessarily be predisposed to negative affect, but may be more sensitive to poor parenting. Two hundred thirteen college students were given a measure of sensory processing sensitivity (the HSPS), the parental bonding scale (measuring parental care and over-protection), the trait anxiety scale, and the Beck depression inventory. Sensory processing sensitivity predicted both anxiety and depression above and beyond parental factors, indicating that it may be an independent risk factor. An interaction was found between sensory processing sensitivity and parental care when measuring depression. Highly sensitive people may be particularly sensitive to uncaring parents. Results indicate that sensory processing sensitivity may be a temperamental disposition that interacts meaningfully with environmental factors.

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1. Introduction

Sensory Processing Sensitivity is a recently proposed construct (Aron & Aron, 1997) that refers to a tendency to more strongly and deeply process a variety of information including the arts, caffeine, other people's moods, hunger and pain. Approximately 25% of the population is hypothesized to be highly sensitive and sensory processing is considered to be a dichotomous, rather than continuous variable (Aron & Aron, 1997). Highly sensitive individuals tend to process and respond to lower thresholds of information and to better detect subtle differences in the environment. These processing differences are hypothesized to be genetically based, present at birth, and located in the central nervous system (Aron & Aron, 1997). Sensory processing sensitivity has been most comprehensively studied in a series of seven studies designed to create and validate the Highly Sensitive Person Scale (HSPS), a self-report measure of sensory processing style (Aron & Aron, 1997). Sensory processing is related, but not identical to, the constructs of behavioral inhibition (Carver & White, 1994; Gray, 1981), introversion (Eysenck, 1981, 1991), and shyness (Kagan, 1994). Sensory processing was specifically found to be independent of introversion and neuroticism, as well as the combination of these two variables (Aron & Aron, 1997). The goal of the present investigation is to examine how sensory processing sensitivity interacts with environmental variables (such as having uncaring or over-protective parents) in its relationship with psychological outcomes such as anxiety and depression.

Aron and Aron (1997) argued that sensory processing sensitivity has been confused with neuroticism, fearfulness, or reactivity because both highly sensitive and neurotic or fearful individuals may not proceed in the face of novel situations. However, the authors argued that highly sensitive people are not necessarily prone to more negative emotional states, but that they may be more sensitive to negative parental environments. Aron and Aron (1997) found two clusters of highly sensitive people, a smaller group who recalled troubled childhoods and a larger group who recalled happy childhoods. The group that recalled troubled childhoods was more introverted and emotional than those who recalled happy childhoods.

Research specifically using Aron and Aron's (1997) construct of sensory processing sensitivity has found that overall, highly sensitive people are more likely to experience anxiety disorders such as social phobia (Neal, Edelmann, & Glachan, 2002) and avoidant personality disorder (Meyer & Carver, 2000). Literature in the occupational therapy field has found sensory processing sensitivity (utilizing a different measure developed by Dunn, 2001) to be related to anxiety (Kinnealey & Fuiiek, 1999). A large epidemiological study has recently found that the related construct of behavioral inhibition was related to both anxiety and depression (Johnson, Turner, & Iwata, 2003). Aron and Aron (1997, 2005) argue that sensory processing sensitivity only leads to negative outcomes in the context of poor family environments.

Much research has supported the notion that specific family interaction styles predispose individuals to depression and anxiety. Several literature reviews have emphasized that low levels of parental care have been linked to greater likelihood of experiencing depression (Blatt & Homann, 1992; Gerlsma, Emmelkamp, & Arrindell, 1990). Although some research has indicated that parental over-protection (especially in interaction with low care) is related to depression (Sato et al., 1998), other research has not indicated a strong relationship (Mackinnon, Henderson, & Andrews, 1993).

Recalling a parental style of over-protectiveness has been linked to higher levels of anxiety. Specifically, recalling high levels of parental over-protection has been linked to general levels of anxiety (Bennet & Stirling, 1998), obsessionality (Cavedo & Parker, 1994), obsessive-compulsive disorder and panic with agoraphobia (Turgeon, O'Connor, Marchand, & Freeston, 2002). Studies have offered contradictory evidence on the effect of recalled levels of parental care on anxiety. Although some investigations have found relationships between anxiety and low levels of parental care (Leon & Leon, 1990; Parker, 1981), other investigations have found the relationships between anxiety and low care to be less clear, limited in scope and related to other variables (Cavedo & Parker, 1994).

The possible interactive effects between having an inhibited temperamental style and having unhealthy relationships with parents have been investigated in the infant attachment literature. Research has shown that behaviorally inhibited toddlers in a novel situation experience increased cortisol (indicative of a stress response) only when they are in insecure attachment relationships (Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996). Rather than soothing infants in novel situations, these mothers appear to interfere with their infant's coping mechanisms. Thus, highly sensitive people may experience novelty as aversive only in the context of an uncaring or overly intrusive social environment. Other investigations have found that insecure attachment can be best predicted by looking at the interaction between the personality of the mother and the sensitive temperamental style of the infant (Mangelsdorf, Gunnar, Kestenbaum, Lang, & Andreas, 1990, 2000).

Very little research directly tests the interaction effects between sensory processing sensitivity and childhood environment. In their validation study, Aron and Aron (1997) noted that the relationship between having a negative parental environment and recalling having a troubled childhood was stronger in highly sensitive individuals, especially for men. However, this finding was limited by their use of only 6 non-previously validated items to measure parental environment. Other research (Meyer & Carver, 2000) investigated the possible interactive effects of negative childhood memories and sensory processing sensitivity (measured continuously) in a regression model predicting features of avoidant personality disorder and failed to find a significant interaction.

Recently, the hypothesized model that sensory sensitivity interacts with parental environment has been tested more thoroughly by the original developers of the HSPS (Aron et al., 2005). In a series of four studies, they found that sensory sensitivity interacted with the recollected experience of individual's childhood to predict both negative affectivity (a combination of anxiety and depression) and shyness. Sensory processing was measured dichotomously such that the top 20–35% of the sample was considered highly sensitive. Recollection of parent experience was measured by both the limited items from the original validation study and with the parental bonding scale, although the scales of parental care and over-protection were apparently combined. In this study, there was not a significant correlation between sensory processing and negative parental environment.

The goal of this investigation is to examine the relationship between sensory processing sensitivity, parenting style (measuring both care and over-protection), anxiety and depression. One goal is to determine how knowledge of someone's sensory processing style contributes to the prediction of whether that person is anxious or depressed above and beyond parental style. Another goal is to determine whether the interactive effects between negative parental environment and

negative affect are replicated when looking separately at depression and anxiety, as well as when looking separately at parental care and over-protection.

2. Method

2.1. Participants

Two hundred thirteen undergraduates enrolled in Introductory Psychology at a small southeastern college volunteered to complete a series of questionnaires in exchange for academic credit. Participants were mostly women (74.6%), and mostly Caucasian (86.9%). Participants were mostly first year (72.8%) or second year (20.2%) students (mean age = 18.4). They were told their answers would be anonymous and filled out the following questionnaires.

2.2. Measures

The *Highly Sensitive Person Scale* (HSPS, Aron & Aron, 1997). This is a 27 item scale in which participants are asked to rate their agreement with a variety of statements on a Likert Scale ranging from 1 to 7. This scale has been found to have both convergent and discriminant validity and to represent one coherent factor. Items reflect sensitivity to a variety of internal and external factors such as noises, life changes, tastes, the arts, fabric, and other people's moods. Cronbach's alpha in the original investigation was 0.87. The Cronbach's alpha for the current investigation was also 0.87. Scores can range from 27 to 189, with higher scores indicating greater sensory processing sensitivity.

The *Parental Bonding Instrument* (PBI, Parker, Tupling, & Brown, 1979). This is a 25-item scale assessing a person's perception of their parents during their first 16 years of life. High care scores reflect parents who are affectionate, warm and empathic. Low care scores reflect parents who are cold and rejecting. High scores on over-protection reflect parents who are intrusive, controlling and tend to baby their children. Low scores on over-protection reflect parents who are detached and promote freedom and independence. Although the PBI can be used to differentially investigate care and over-protection in mothers and fathers, in the current investigation participants were asked to complete the PBI for whomever they considered to be their primary caregiver. In this sample, 90.2% chose to rate their mother, 8.3% chose to rate their father and 1.5% chose to rate another parental figure. Cronbach's alphas for the original investigation were 0.92–0.93 for care and 0.66–0.87 for over-protection. In the current investigation the Cronbach's alphas were 0.92 and 0.87 for care and over-protection respectively. Scores for parental care can range from 12 to 48, while scores for parental over-protection can range from 13 to 52, with higher scores indicating greater care and greater over-protection.

Beck Depression Inventory (BDI, Beck & Steer, 1987). The BDI is a 21-item self-report instrument that reflects both the cognitive-affective and somatic aspects of depression. It is a reliable and well-validated measure of depressive symptoms in both clinical and non-clinical samples. Cronbach's alpha coefficients for the BDI in psychiatric and non-psychiatric populations range from 0.73 to 0.95. Scores can range from 0 to 63; higher scores indicate greater depression.

State Trait Anxiety Inventory (STAI-2, Spielberger, Gorsuch, & Lushene, 1970). The STAI-2 is a widely used self-report measure of trait anxiety with adequate reliability and validity. Only the “trait” portion was used in order to provide a measure of the participants’ usual level of anxiety. The original Cronbach’s alpha of the trait portion of the STAI is 0.90. Scores can range from 20 to 80, with higher scores indicating greater anxiety.

3. Results

3.1. Correlations

The correlations among all variables can be seen in Table 1. Sensory processing sensitivity was positively correlated to both anxiety and depression, although more strongly correlated with anxiety. Sensory processing sensitivity was also correlated with parental over-protection. In order to investigate more fully the quality of the reported parental over-protection, the correlations between the HSPS and specific items on the PBI were investigated. The items on the PBI that were most strongly correlated with the HSPS (all $p < 0.05$) were “Felt I could not look after myself unless he/she was around ($r = 0.21$),” “tried to make me dependent on him/her ($r = 0.20$),” “tended to baby me ($r = 0.17$),” and “Did not want me to grow up ($r = 0.15$).” Thus, highly sensitive people reported that they were infantilized and made dependent by their parents. However, it should be noted that the effect sizes of these correlations are relatively weak. More intrusive items such as “invaded my privacy” or “tried to control everything I did” were not significantly correlated to sensory processing sensitivity. Sensory processing sensitivity was not correlated to parental care.

As expected, a low level of parental care was strongly related to greater depression and a higher level of over-protectiveness was related to greater anxiety. A low level of parental care was also related to anxiety and a higher level of parental over-protectiveness was related to depression. Anxiety and depression were highly correlated.

3.2. Regressions

A simultaneous regression was run to examine the unique predictive effects of parental care, parental over-protection and sensory processing sensitivity in predicting anxiety and depression. For anxiety, when all variables were entered, $R = 0.546$, accounting for 29.8% of the total variance, $F(3, 209) = 29.55$, $p < 0.001$. Care, over-protection and sensory processing sensitivity all contributed unique variance. In order to determine how sensitivity and PBI variables predicted

Table 1
Correlations between all variables ($N = 213$)

	HSPS	BDI	STAI-trait anxiety	PBI-care	PBI-over protection
HSPS	1	0.22**	0.41**	-0.10	0.22**
BDI		1	0.77**	-0.45**	0.37**
STAI-trait			1	-0.37**	-0.36**
PBI-care				1	-0.49**
PBI-over-protection					1

** Correlation is significant at the 0.01 level (2-tailed).

anxiety when controlling for depression, another simultaneous regression was run including depression in the prediction equation. With all variables added, including depression, $R = 0.814$, accounting for 66% of the variance, $F(4, 208) = 102$, $p < 0.001$. In this analysis only sensory processing sensitivity and depression uniquely predicted trait anxiety. Parental factors were no longer significant predictors.

For depression, when sensory processing and parental variables were added, $R = 0.50$, accounting for 25% of the variance, $F(3, 209) = 23.73$, $p < 0.001$. Parental care, parental over-protection, and sensory processing sensitivity all contributed unique variance. In order to determine how sensory and parental variables predicted depression when controlling for anxiety, another simultaneous regression was run including anxiety in the prediction equation. With all variables added, including anxiety, $R = 0.801$, accounting for 64% of the variance in depression, $F(4, 208) = 93.37$, $p < 0.001$. In this analysis, parental care and sensory processing remained unique predictors of depression but parental over-protection no longer uniquely predicted depression levels. Beta weights and significant levels for each variable can be seen in Table 2 for both analyses.

3.3. Possible interactive effects of sensory processing and parental style on anxiety and depression

In order to investigate whether parental care and parental over-protection have differential effects on depression and anxiety for highly sensitive people, 2×2 analyses of variance were conducted. Aron and Aron (1997) defined highly sensitive people as those scoring in the top 25th percentile on the HSPS. Thus, this variable was dichotomized to compare highly sensitive

Table 2
Regressions predicting depression and anxiety

	B	SE B	Beta
<i>Predicting trait anxiety</i>			
Parental care	-0.39	0.10	-0.27**
Parental over-protection	0.19	0.09	0.15*
Sensory processing	0.19	0.03	0.35**
<i>Predicting depression</i>			
Parental care	-0.39	0.08	-0.36**
Parental over-protection	0.16	0.16	0.16*
Sensory processing	0.06	0.03	0.15*
<i>Predicting trait anxiety (controlling for depression)</i>			
Parental care	-0.03	0.07	-0.02
Parental over-protection	0.04	0.06	0.03
Sensory processing	0.13	0.02	0.25**
Depression	0.93	0.06	0.70**
<i>Predicting depression (controlling for trait anxiety)</i>			
Parental care	-0.17	0.05	-0.16*
Parental over-protection	0.05	0.05	0.05
Sensory processing	0.04	0.02	0.12*
Trait anxiety	0.56	0.04	0.74**

* $p < 0.05$.

** $p < 0.01$.

people, scoring 124 or above, ($N = 55$, $M = 135.72$, $SD = 10.32$), with non-highly sensitive people, scoring 23 or below ($N = 158$, $M = 103.56$, $SD = 12.90$). The sensory processing variable was dichotomized in this way because of the hypothesis that the top 25th percentile represents a unique subgroup of individuals who can be considered “highly sensitive people.” Parental bonding and care were dichotomized based on a median split. For care, scores 32 and above were considered high care ($N = 108$, $M = 34.4$, $SD = 1.26$), while scores 31 and below were considered low care ($N = 105$, $M = 24.0$, $SD = 6.34$). For over-protection, scores of 11 or below were considered low over-protection ($N = 105$, $M = 6.87$, $SD = 2.7$), while scores of 12 and above were considered high over-protection ($N = 108$, $M = 18.83$, $SD = 5.58$).

Two ANOVAS were run to determine the possible interactive effects of care and over-protection with sensory processing on anxiety (Fig. 1). There were strong significant main effects for care, over-protection, and sensory processing (all $p < 0.001$) in both analyses indicating that low care, greater over-protection, and being “highly sensitive” were all related to greater levels of anxiety. Neither the interaction between care and sensory processing, $F(1, 209) = 2.3$, $p = 0.13$, nor interaction between over-protection and sensory processing were significant, $F(1, 209) = 0.01$, $p = 0.92$.

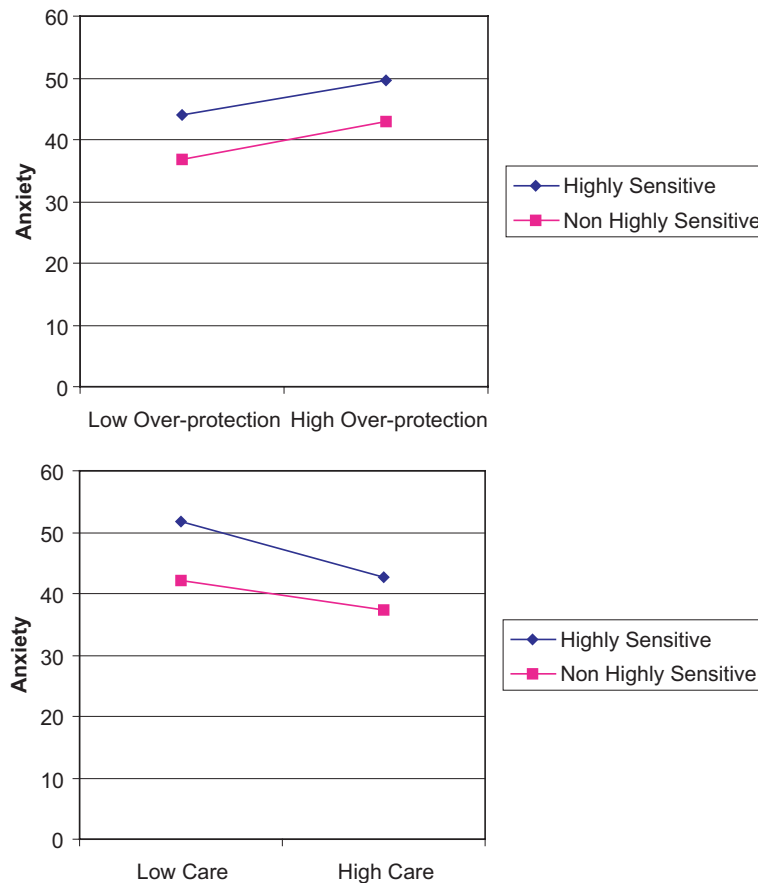


Fig. 1. Interaction of parental bonding, sensory processing sensitivity and anxiety.

Two ANOVAS were run to determine the possible interactive effects of care and sensory processing as well as over-protection and sensory processing on depression (Fig. 2). There were significant main effects for parental care, over-protection and sensory processing in both analyses (all $p < 0.001$) indicating that having lower parental care, greater parental over-protection, and being highly sensitive all related to higher levels of depression. There was no significant interaction between over-protection and sensory processing $F(1, 209) = 0.547, p = 0.46$. However, there was a small, but significant interaction between care and sensory processing $F(1, 209) = 4.9, p = 0.03$. This interaction indicates that a low level of care is related to disproportionately higher levels of depression in highly sensitive people. Analysis of simple effects indicates that for individuals with low care highly sensitive people were significantly more depressed than non-highly sensitive people, $t(103) = -3.66, p < 0.001$. However, for individuals with high care there was no significant difference between highly sensitive and non-highly sensitive individuals $t(106) = -1.39, p = 0.17$.

In order to determine whether the interactive effects would be found when sensory processing was treated as a linear variable, the interactive effects of sensory processing, parental care, and parental over-protection were examined in regression equations. Analyzed in this way, none of

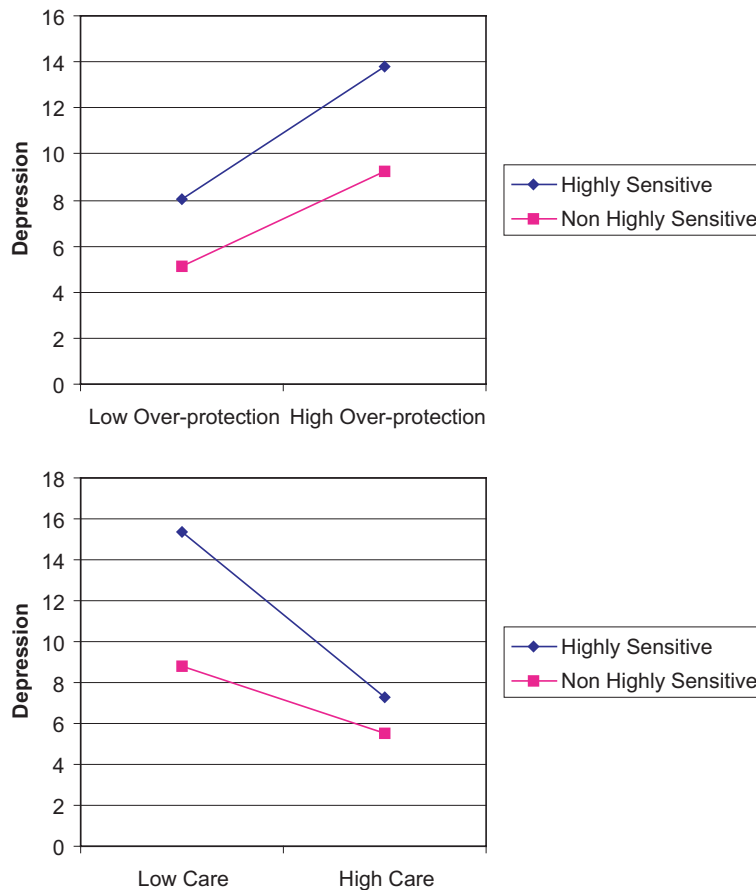


Fig. 2. Interaction of parental bonding, sensory processing sensitivity and depression.

the interaction terms between sensory processing and care and sensory processing and over-protection were significant in predicting either depression or anxiety. Thus, the interactive effect between sensory processing and parental care in predicting depression is not seen when sensory processing is conceptualized as a linear variable.

4. Discussion

The goal of this investigation was to examine the relationship between sensory processing, parental style, anxiety and depression as well as to look for possible interactive effects. Both depression and anxiety were strongly related to low levels of care and high levels of over-protection. Although research has consistently shown a relationship between care and depression (e.g. Blatt & Homann, 1992) and over-protection and anxiety (e.g. Bennet & Stirling, 1998), this investigation found that both care and over-protection were related to both depression and anxiety in a non-clinical college sample. The high correlation between depression and anxiety indicate that for this sample these variables were not strongly differentiated but point to a general level of psychological discomfort. The overlap between anxiety and depression in the current investigation ($r = 0.77$) was somewhat higher than typical findings of correlations between 0.45 and 0.75 (Clark & Watson, 1991). Clinical samples have generally shown better differentiation between anxiety and depression (Clark & Watson, 1991); thus replication with a clinical sample would allow for a better understanding of how sensory processing contributes uniquely to anxiety versus depression.

Sensory processing sensitivity was strongly related to both depression and anxiety and contributed unique variance above and beyond parental factors for both forms of psychological distress. Sensory processing was particularly strongly related to anxiety, which is consistent with previous research (e.g. Neal et al., 2002). In fact, when controlling for depression, only sensory processing uniquely predicted anxiety and parent factors did not. A physiological tendency to process information at lower thresholds of stimulation may predispose an individual to be more attuned to possible threats in the environment and to be more physiologically reactive. Sensory processing sensitivity appears to be an independent risk factor for the experience of psychological distress above and beyond parental experiences.

Interestingly, sensory processing sensitivity was correlated with parental over-protection. Highly sensitive people recall their parents as believing they could not take care of themselves and trying to make them dependent. They also recall their parents as trying to baby them and not wanting them to grow up. Parents of highly sensitive children may see their children as particularly sensitive and fragile and react accordingly. On the other hand, individuals who have parents that communicate the message that they cannot take care of themselves and need to be protected may, as a result, become more highly sensitive. This may be a mutually interactive effect where a temperamental predisposition for sensitivity leads to particular parenting behaviors that enhance that sensitivity. The relationship between sensory processing sensitivity and parenting behaviors merits more careful investigation. The relationship between sensory processing sensitivity and parental over-protection was not reported in Aron et al. (2005) study, likely because parental care and over-protection were not analyzed separately.

A main goal of this investigation was to test Aron and Aron's (1997) hypothesis and replicate Aron et al.'s (2005) finding that highly sensitive people would only experience psychological

distress in the context of negative parenting. This hypothesis was only partially supported. In all analyses, there were strong main effects for sensory processing, indicating that overall more highly sensitive people experience higher levels of depression and anxiety. However, for depression, there was a small, but significant interaction between parental care and sensory processing sensitivity. This interaction indicated that highly sensitive individuals were more depressed only in the context of low parental care. However, this interaction was not seen when sensory processing was measured as a linear variable using regression analysis, consistent with the Meyer and Carver (2000) findings. In other words, the interactive effect was found when the most highly sensitive people (the top 25th percentile) were set apart from the rest of the group. Additionally, it must be noted that no interactive effects were found for anxiety, indicating that the role of sensory processing style in producing anxiety may be additive to parental experiences, rather than interactive. Aron et al. (2005) used a combined measure of depression and anxiety so it is impossible to determine whether they would have found interactive effects for anxiety as well as depression if measured separately.

Although Aron et al. (2005) did not separately analyze the interactive effects of parental care and over-protection, this investigation found no interactive effects for parental over-protection. This indicates that highly sensitive people may react particularly more negatively to cold and uncaring environments than to domineering or intrusive environments. Parents who are cold and uncaring may fail to act as a buffer between external negative events and internal affect. Over-protective parents may be intrusive and over controlling; however, they likely act as a buffer between a child and negative stimulation in the environment.

Although the construct of sensory processing sensitivity is relatively new to the literature, it provides a useful conceptualization of how temperamental factors may interact with parental behaviors to produce psychological difficulties. These findings imply that sensory processing sensitivity may be a variable with considerable clinical utility. Although sensory processing sensitivity is rarely measured in clinical settings, it may provide valuable information in understanding why certain individuals are predisposed toward depression and anxiety, especially in certain environments. Nevertheless, sensory processing sensitivity is a construct that needs further exploration. Thus far, all investigations about sensory processing, including the present investigation, have utilized self report measures. It remains unclear whether self-reported sensory processing style is related to physiological differences in tactile sensitivity or threshold to stimuli. Furthermore, although sensory processing sensitivity is hypothesized to be a genetic individual difference variable present at birth, longitudinal investigation of this construct, as distinct from behavioral inhibition or shyness, has yet to be undertaken. Further research would also be useful to better understand the similarities and differences between sensory processing sensitivity and other related constructs such as behavioral inhibition and shyness.

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