The Interaction between Sensory Processing Sensitivity and Childhood Environment on Social Anxiety

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ABSTRACT
It is known that high sensory processing sensitivity can lead to positive or negative outcomes, depending partly on the childhood environment. It is also known that there is a link between high sensory processing sensitivity and social anxiety. However, no studies have investigated if the effect of sensory processing sensitivity on social anxiety was moderated by childhood environment. The present study assessed that and showed that there was no moderation effect. There was however a direct effect of both childhood environment and sensory processing sensitivity on social anxiety. High sensory processing sensitivity might thus be a risk factor for psychopathology.

Keywords
Sensory processing sensitivity, social anxiety, childhood environment, differential susceptibility hypothesis.

INTRODUCTION
Some individuals seem to be more aware of subtleties in their surroundings, more reactive to stimuli, and more enthralled by delicate smells, sounds, and images. They do not possess better eyesight or finer hearing and smelling capacities, but instead a trait called high sensory processing sensitivity (SPS). It is proposed to be a genetically determined trait which is assumed to affect about 15 to 20% of the population (Aron & Aron, 1997). Aron, Aron, and Jagiellowicz (2012) describe this phenomenon as the following: inhibition of behaviour in novel and/or conflict situations, greater awareness of sensory stimulation and stronger emotional reactions to it, as well as deeper and faster processing of sensory information.

For individuals with high SPS these embodiments can be linked to either positive or negative outcomes, as shown in several studies conducted by Aron, Aron, and Davies (2005). In these studies, the researchers set out to investigate the effects of a positive or negative childhood environment on individuals with high SPS. Here, childhood environment can best be seen as the conditions in which the child grows up referring to the family and home environment, the parental care, as well as the absence or occurrence of problems in the family such as alcoholism and mental illness. They showed that childhood environment and SPS had an interaction effect on negative affectivity and adult shyness. Adult shyness can be described as the fear of negative social evaluations leading to discomfort and a decreased desire to engage in social contact (Aron et al., 2005). Participants who scored high on SPS and experienced a negative childhood environment scored higher on negative affectivity and adult shyness than participants who scored low on SPS. Respectively, individuals who scored high on SPS but had a positive childhood environment scored lower on negative affectivity and adult shyness than individuals who scored low on SPS. High SPS thus seems to be linked to more extreme scores on both ends of the outcome measure, depending on the quality of the childhood environment. These findings are supported by the differential susceptibility hypothesis (Belsky & Pluess, 2009), which states that individuals who are presumed vulnerable because of temperamental and/or genetic reasons are the ones who are either the most susceptible to a negative childhood environment or reap the most benefit from a positive childhood environment.

It becomes apparent that individuals either benefit from high SPS or have to deal with its negative consequences. One potential negative consequence of high SPS (in interaction with an adverse childhood environment) is adult shyness, which has been shown to possibly evolve into social anxiety (Chavira, Stein, & Malcarne, 2002). The Diagnostic and Statistical Manual 5 (DSM-5) describes social anxiety as an intense fear or anxiety of social situations, being scrutinized by others, fear of negative evaluation, and being scared of showing anxiety symptoms (American Psychiatric Association, 2013). These findings give rise to the idea that there might be a connection between high SPS and social anxiety. There are, however, conflicting results regarding this topic. For example, Neal, Edelmann, and Glachan (2002) found a correlation between high SPS and social anxiety while Hoffmann and Bitran (2007) did not.

Aron et al. (2005) showed that high SPS in interaction with an adverse childhood environment predicted adult shyness, which in turn has been shown to possibly evolve into social anxiety (Chavira et al., 2002). However, there are also studies that linked adverse childhood environment on its own to various psychopathologies, such as social anxiety. Heim and Nemeroff (2001) for example found a correlation between early adverse experiences and an elevated risk for developing depression and/or anxiety disorders. They argue that adverse experiences in childhood sensitize the central nervous system and make the individual vulnerable for stress, depression, and anxiety, even into adulthood. On a similar note, McLaughlin et al. (2010) showed that individuals with a poor overall childhood environment were at higher risk of developing an anxiety and/or mood

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disorder later in life than individuals with a good overall childhood environment.

Up to this point it can be suggested that SPS is a complex construct that can be linked to both positive and negative outcomes in life, depending partly on the experienced childhood environment. There is also reason to assume that high SPS and social anxiety might be connected. Furthermore, there are studies showing that adverse childhood environment and the development of anxiety disorders are connected. However, no studies have been conducted which directly examined the interaction between SPS and adverse childhood environment on social anxiety. The studies conducted by Neal et al. (2002) and Hoffman and Bitran (2007), which assessed the link between high SPS and social anxiety, did not use childhood environment as a variable. Furthermore, these two studies yielded conflicting results, while using the same measurement instrument and a similar participant population. This might indicate that a third variable, such as childhood environment, might have influenced the results.

Therefore, the present study was set up in order to answer the following question: What are the combined and individual effects of SPS and childhood environment on social anxiety? In total, we tested three different hypotheses. Based on the differential susceptibility hypothesis we expected a crossover interaction, suggesting that individuals who scored high on SPS would be more extremely affected by their childhood environment on a measure of social anxiety than individuals who scored low on SPS. More specifically, individuals with high SPS and a negative childhood environment would be expected to score high on social anxiety, while individuals with high SPS and a positive childhood environment would be expected to score low on social anxiety. Likewise, we also hypothesized that individuals who scored low on SPS would not show extreme results on both ends of the social anxiety measurements. We also expected a main effect of SPS on social anxiety, suggesting that individuals with high SPS would score higher on social anxiety than individuals with low SPS, as shown by Neal et al. (2002). Furthermore, we expected a main effect of childhood environment on social anxiety, suggesting that individuals with a negative childhood environment would score higher on social anxiety than individuals with a positive childhood environment and vice versa. This would be in line with the results of Heim and Nemeroff (2001).

Method

Participants

The participants were 257 students of psychology and pedagogy at the Radboud University in Nijmegen (Netherlands). In total there were 234 (91.1%) females and 23 (8.9%) males, with a total mean age of 19.48 years (*SD* = 1.94). The majority of the participants were Dutch (80.5%), with the rest either being German (16.7%) or coming from other countries (2.7%). Based on the participant's level of SPS we formed two groups, namely a high SPS and a low SPS group. We chose to form groups rather than to use SPS as a continuous variable because this is commonly done in SPS research (Aron & Aron, 1997; Aron et al., 2005).

Material

In order to assess SPS, childhood environment and social anxiety we used the Highly Sensitive Person Scale (HSPS) (Aron & Aron, 1997), the Measurement of Parental Style (MOPS) (Parker et al., 1997), and the Liebowitz Social Anxiety Scale (LSAS) (Liebowitz, 1987) respectively. Furthermore we controlled for negative affectivity using the Positive and Negative Affectivity Schedule (PANAS) (Watson, Clark, & Tellegen, 1988). Controlling for social introversion was done using a four-item questionnaire devised by Aron and Aron (1997) and Aron et al. (2005). Cronbach's alpha for all questionnaires ranged between 0.75 and 0.95.

Procedure

The participants were recruited via the Sona System, which is a website where researchers of the Radboud University can post their studies and potential participants can sign up. After participation, the participants were rewarded with participation points, which all first-year students of psychology and pedagogy have to acquire. On the website of the Sona System the participants were presented with a web link to the website of the Qualtrics questionnaire. Qualtrics is an online tool used to create, distribute, and fill in questionnaires. On the landing page the participants found instructions and the informed consent, which they had to read and accept in order to gain access to the study. After that, the participants were presented with questions about their demographics, such as age, nationality, and gender. Subsequently, the participants were presented with the previously mentioned questionnaires to fill in.

Data-analyses

The data was analysed using IBM SPSS Statistics 21. We cleaned the data by excluding participants who did not respond to all questions as well as participants who gave a wrong answer to a control question.

Preliminary Analyses

In order to form groups of high and low SPS we chose the top and bottom 20% of the HSPS sum scores and used them as cut-off points, only using participants who scored above the 80th percentile or below the 20th percentile. The two groups were then matched in terms of sample size, age, and gender. A Mann-Whitney *U* Test and a Chi-Square Test were employed to ensure that both groups did not differ significantly in terms of age and gender, respectively.

Main Analyses

In order to analyse the main effects of SPS and childhood environment on social anxiety, as well as the interaction effect between SPS and childhood environment on social anxiety, a regression analysis was conducted. This was done with the help of the "Process" macro by Andrew F. Hayes using the moderation analysis function. The design was a between-subject design, with SPS being the between subject factor (qualitative; high/low), childhood environment being the moderator (quantitative), and social anxiety being the dependant variable (quantitative). Furthermore we controlled for social introversion and negative affectivity by using both as covariates in the analysis.

Explorative Analysis

Using negative affectivity as the dependent variable instead of social anxiety allowed us to replicate the design

used by Aron et al. (2005). This way we could test whether or not we would also find an interaction between SPS and childhood environment on negative affectivity similar to their results.

RESULTS

Preliminary Analyses

The Mann-Whitney *U* Test used to analyse age differences across the two groups was not significant ($U = 1013.5$, $p = 0.719$). This means that the two groups did not differ in terms of age. The chi square test used to analyse gender differences between the groups was also not significant ($\chi(1) = 2.19$, $p = 0.139$), indicating that the groups did not differ in terms of gender. For age and gender statistics per group, see table 1.

Table 1

	Age		Gender	
Group	*M*	*SD*	Male	Female
High SPS	19.22	1.35	2	44
Low SPS	19.38	1.71	6	39

Main Analyses

The overall model was significant ($R^2 = 0.21$, $b = 90.81$, $t(87) = 36.29$, $p < 0.001$), explaining 21% of the variance. The interaction between SPS and childhood environment on social anxiety was not significant ($b = -0.26$, $t(87) = -0,25$, $p = 0.805$.). Individuals in the low and high SPS group were not affected in a different manner by their childhood environment regarding social anxiety. The main effect of SPS on social anxiety was significant ($b = 16.88$, $t(87) = 3.37$, $p = 0.001$). The results indicated that a higher level of SPS was associated with higher levels of social anxiety. The main effect of childhood environment on social anxiety was marginal significant ($b = 0.91$, $t(87) = 1,76$, $p = 0.081$), suggesting a trend which indicates that a less optimal childhood environment might be associated with higher levels of social anxiety. For descriptive statistics per group see table 2.

Table 2

	LSAS Sum		MOPS Sum	
Group	*M*	*SD*	*M*	*SD*
High SPS	100.63	22.16	21.96	5.79
Low SPS	80.29	20.43	18.19	2.17

LSAS Sum: Sum score of the Liebowitz Social Anxiety Scale.
MOPS Sum: Sum score of the Measurement of Parental Style.

Explorative Analysis

Using the sum score of the PANAS as the dependent variable lead to the following results: The overall model was significant ($R^2 = 0.50$, $b = 28.83$, $t(87) = 37.10$, $p < 0.001$), explaining 50% of the variance. The interaction was not significant ($b = 0.30$, $t(87) = 0.70$, $p = 0.485$). The main effect of childhood environment was marginal significant ($b = 0.23$, $t(87) = 1.86$, $p = 0.066$) and the main effect of SPS was significant ($b = 9.13$, $t(87) = 7.10$, $p < 0.001$).

Discussion

This study was set up in order to assess the combined and individual effects of high SPS and childhood environment on social anxiety. While we did not find a significant interaction effect, we did find a significant main effect of SPS on social anxiety and a marginal significant main effect of childhood environment on social anxiety. There are several ways to interpret and explain these results.

The non-significant interaction effect is not in line with our hypothesis, which states that there should have been a crossover interaction between SPS and childhood environment on social anxiety. This pattern has been found by Aron et al. (2005) while using negative affectivity and adult shyness as dependent variables, which is in line with the differential susceptibility hypothesis (Belsky & Pluess, 2009). While adult shyness can be seen as the predecessor of social anxiety (Chavira et al., 2002), it could be possible that the interaction with social anxiety does not work that way, which our data would suggest. However, according to the results of Aron et al. (2005) there should be a significant interaction when using negative affectivity as the dependent variable. Our explorative analysis did not show this pattern, since the interaction was not significant. It could be possible that there simply is no interaction effect with SPS, meaning that individuals with high SPS and individuals with low SPS do not differ in the manner they are affected by their environment. The assumption that high SPS can be linked to positive and negative outcomes depending partly on the childhood environment could not be supported by our data.

We did however find a significant main effect of SPS on social anxiety, meaning that participants in the high SPS group reported significantly higher levels of social anxiety. This was in line with our hypothesis and current literature (Neal et al., 2002). Seeing that the differential susceptibility hypothesis does not hold true for our data, our results can rather be explained by the Diathesis Stress Model (Zuckermann, 1999). The diathesis stress model states that there is a diathesis, which is a vulnerability or predisposition for the development of psychological problems, and a stressor, which then activates the pathological state. The stressor thus acts on the diathesis which results in psychopathology. Here adverse childhood environment cannot be seen as the stressor, since the interaction effect was not significant. If it was indeed the stressor, the individuals in the low SPS group would not have been affected as much by their childhood environment, since they do not possess the diathesis, namely high SPS.

We also found a marginal significant main effect of childhood environment on social anxiety. While not truly significant, these results point in the same direction as our hypothesis and previous research (Heim & Nemeroff, 2001; McLaughlin et al., 2010), suggesting that a bad childhood environment is associated with greater risk for the development of psychopathology such as social anxiety. A possible reason why our data only yielded a marginal significant effect instead of a significant effect could be the nature of our sample: All of our participants were students. Bradley and Corwyn (2002) showed that academic attainment is linked to a higher socioeconomic status (SES), which in turn is linked to better parental care. Since our participants were students, it would be likely that most of them grew up in families with an average or above average SES and thus enjoyed good parental care.

This was also a limitation of our study. Our sample was not very diverse, since all participants were students, the

majority of them being female with almost all of them being either Dutch or German. Since this lowers the external validity of our study, generalisation beyond female Dutch and German students of psychology and pedagogy should be done with caution. Another limitation is the non-experimental nature of our study, which makes it impossible to assess valid causal relations. It is not known if social anxiety is the cause or the consequence of high SPS and a bad childhood environment. Another limitation of our design is the fact that the participants were asked to remember the first 16 years of their lives in order to evaluate their childhood environment. This might not be the most precise and/or reliable measure.

Having these limitations in mind, future research should thus focus on gathering a more diverse sample, by including more males, individuals who do not attend university, and individuals from various countries. This way the external validity would be higher and a potential sampling bias could be prevented. Future research could also make us of a longitudinal design, which might yield a more precise measure of their childhood environment. While it is true that there were some limitations, it is still possible to draw conclusion from our study. Our data suggests high SPS to be a risk factor more than anything else. Furthermore, our data indicates that adverse childhood environment might also be a risk factor for social anxiety which works independently of SPS. All in all, our study can be seen as a valuable addition to the scientific debate. More research needs to be done, since at the moment there are contradicting results regarding the role of high SPS in the development of psychopathology.

ROLE OF THE STUDENT

Lars Jaswetz was an undergraduate student working under the supervision of Drs. H. Niermann. The general frame of the research (sensory processing sensitivity) was assigned by the supervisor, while the specific research question and variables (combined and individual effect of childhood environment and sensory processing sensitivity on social anxiety) were conceived and chosen by the student. The online questionnaire, the data collection, and the data-analyses were also done by the student. The supervisor however gave frequent feedback and advise which was crucial for this research.

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