Polish adaptation of the Highly Sensitive Person Scale

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Abstract

Aim: Sensory processing sensitivity is defined as a personality trait that describes the tendency to process stimuli and information more strongly and deeply than others (Aron et al., 2012). The first and most frequently used scale to measure this trait is the Highly Sensitive Person Scale (HSPS) by Aron and Aron (1997). The article presents the process of creating the Polish adaptation of the tool.

Method: Exploratory and confirmatory factor analysis were used. The psychometric properties were checked on a sample of 1,360 participants.

Results: The obtained results confirm the multifactorial structure of the variable. In the Polish adaptation of the tool (HSPS), two separate factors were recognized: excessive stimulation and depth of processing. Six items were excluded due to their low factor loadings. The results indicate that the Polish version of the HSPS is a reliable tool. Its accuracy is also confirmed by correlations with neuroticism and extraversion, which, according to the theory, are statistically significantly related to the SPS construct (Aron & Aron, 1997).

Conclusion: The Polish adaptation of the scale demonstrated good psychometric properties and high reliability. However, research on the cultural aspect of sensory processing sensitivity should be continued, taking into account gender differences.

Keywords: high sensitivity, personality, sensory processing sensitivity, Highly Sensitive Person Scale

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High Sensitivity Theory

Aron and Aron (1997) introduced the personality construct of high sensitivity into the literature, which refers to the sensitivity of sensory processing that controls the way information is transmitted and processed in the brain.

Sensory processing sensitivity is a genetically determined feature that characterizes people susceptible to sensory stimuli of low stimulating value (Aron et al., 2012). People with this feature are described as highly sensitive due to their tendency to process stimuli and information more strongly and deeply than others (Aron & Aron, 1997; Aron et al., 2012). This trait is characterized by sensitivity to both internal and external stimuli (including physical, social and emotional stimuli). High sensitivity of sensory processing is therefore an individual disposition to receive and process external and internal stimuli more intensely than the average level in the population. According to the authors of the theory, it includes sensory processing of aesthetic experiences, pain threshold, susceptibility to caffeine, loud sounds and perception of other people's moods and feelings (Aron & Aron, 1997). Sensory processing sensitivity has often been identified by personality psychologists with other personality factors such as neuroticism and introversion (Aron & Aron, 1997). However, Aron and Aron (1997) distinguished it as a separate construct and showed that SPS is a separate trait that is highly correlated with neuroticism (Aron et al., 2005). Sensory processing sensitivity should not be confused with sensory processing disorder or sensory integration disorder. The authors of the scale originally suggested that it is a personality construct (Aron & Aron, 1997), while in recent studies, the sensitivity of sensory processing is presented as a temperamental feature (Aron et al., 2005; Jagiellowicz et al., 2016; May & Pitman, 2021; Tillmann et al., 2021)

Factor Structure of the Highly Sensitive Person Scale

The Highly Sensitive Person Scale (HSPS) was developed and validated in a series of studies aimed at understanding the personality construct regarding the sensitivity of sensory processing (Aron & Aron, 1997). The scale contains 27 items that measure various aspects of SPS, answers are given on a 7-point Likert scale, where 1 means – *not at all*, and 7 – *very much* (this term suits me). This scale was originally believed to be a unidimensional SPS construct (Aron & Aron, 1997). Hofmann and Bitran (2007) confirmed the single-factor structure of SPS through principal component analysis (PCA) and scree plots. The reliability of the scale in the cited studies ranged from α = .85 (Aron & Aron, 1997) to α = .87 (Aron & Aron, 1997; Hofmann & Bitran, 2007).

However, the results of analyses conducted by many other scientists who used HSPS in their research (Evans & Rothbart, 2008; Grimen & Diseth, 2016; Konrad & Herzberg, 2017; Smolewska et al., 2006) shed new light on the initial claims of Aron (1997). Smolewska et al. (2006) found that HSPS is created by three separate factors, referred to as AES – aesthetic sensitivity (awareness of aesthetics in one's environment), LST – low sensory threshold (unpleasant

stimulation) and EOE – ease of excitation (feeling overwhelmed by both external and internal expectations). The structure suggested by Smolewska et al. (2006) was supported by subsequent research (Aron & Aron, 2010; Booth et al., 2015; Konrad & Herzberg, 2017). However, previous research also showed weak factor loadings for some scale items (Smolewska et al., 2006). The results obtained in other studies indicate a two-factor structure (Cheek et al., 2009; Ershova et al., 2018; Evans & Rothbart, 2008; Montoya-Perez et al., 2019). In the Russian adaptation (Ershova et al., 2018), two factors were left in the final version of the tool, namely LST (low sensory threshold) and EOE (easy of excitation), and AES (aesthetic sensitivity) was removed. The two subscales included (i.e. low sensory threshold and ease of excitation) mostly contained the same items as the corresponding subscales in the Canadian adaptation (Smolewska et al., 2006). It is worth noting that in the Russian adaptation, many items were excluded, the final scale contains only 14 items, and in the Canadian adaptation only two test items were excluded. In turn, Evans and Rothbart (2008), who also recognized a two-factor structure, proposed other names for the subscales: NA (negative affectivity) and RS (relative sensitivity). Further multi-factor solutions are the five-factor structure in the Spanish adaptation of the tool (Chacon et al., 2021) and the Polish version of the tool (Baryła-Matejczuk et al., 2023).

The above review indicates a large diversity of the construction of cultural adaptations of the tool and provides the basis for considerations regarding the feature of high sensitivity.

This scale is the first tool created to examine SPS and at the same time the most frequently used by researchers. These facts influenced the decision to start research on the Polish validation of the tool. The rest of the article presents in detail the process of the new Polish adaptation of the full version of the tool.

Method

Translation

HSPS allows us to examine the sensitivity of sensory processing. Recently, this construct has attracted the interest of researchers from all over the world, and on the wave of this popularity, adaptations of the tool have been created in various countries, including Spain (Chacon et al., 2021), Germany (Konrad & Herzberg, 2017; Tillmann et al., 2018), Russia (Ershova et al., 2018) or Japan (Yano et al., 2020). The growing interest in this topic and the increasingly extensive literature convince us to focus on the Polish adaptation of the HSPS tool. Since distinguishing high sensitivity as a separate feature, the authors of the theory and other researchers have confirmed in many studies that it is something other than introversion or neuroticism – as previously thought (Aron & Aron, 1997; Aron et al., 2005). Therefore, a decision was made to adapt the tool to Polish conditions. Consent was obtained from the authors of the method to create a Polish adaptation of the HSP Scale tool.

The Polish adaptation was created based on the analysis of the theoretical construct of sensory processing sensitivity (Aron & Aron, 1997) about the Polish population of adults (Hornowska & Paluchowski, 2004). The translation was performed using the translation method and back translation procedure. First, an independent psychologist, fluent in English, made the first translation from English into Polish, and then another psychologist, also fluent in English, translated from Polish into English. The final version was then edited by a team of three psychologists fluent in English so that the content of the test items fully fit into the Polish cultural context.

Researched Sample

The sample of respondents was selected randomly from the population, incomplete answers were excluded. No inclusion criteria other than adulthood and voluntariness were used. A total of 1,360 people took part in the study, aged 18 to 70 ($M = 28.19$, $SD = 7.39$), and 27.6% of the group were men. Over 60% ($N = 818$) were people with higher education, 35.5% ($N = 483$) of people declared secondary education, 2.9% ($N = 40$) had primary education, and the rest ($N = 19$) had vocational education. More than half of the respondents 66.4% ($N = 903$) were in an intimate relationship at the time of the study.

Research Procedure

The study was conducted from March to May 2022. The selection of the sample from the population was random. Each person joined the study voluntarily and could withdraw at any stage of the study. The subjects completed two questionnaires in the following order:
   – Polish translation of the Highly Sensitive Person Scale (Aron & Aron, 1997), which consisted of 27 questions. The respondents were asked to indicate the extent to which they agreed with each statement on a seven-point Likert scale, where 1 means – *I strongly disagree* and 7 – *I strongly agree*;
   – NEO-FFI Personality Inventory (Costa & McCrae (1989), Polish adaptation (Zawadzki et al., 1998), which consists of 60 self-description statements, the truth of which in relation to themselves is assessed by the respondent on a five-point scale. These items constitute five scales measuring: neuroticism, extraversion, openness to experience, agreeableness and conscientiousness.
Basic sociometric data were also included, such as age, gender, education, place of residence, and marital status. The study was approved by the Research Ethics Committee (no 4/16.11.2021).

Data Analysis Methods

To examine the factor structure of the adapted tool, factor analysis was used. This analysis took place in several stages. Although the HSPS scale was

introduced into the literature as a one-dimensional tool (Aron & Aron, 1997; Hofmann & Bitran, 2007) – as already emphasized above – there are results of various studies suggesting the separation of two factors (Cheek et al., 2009; Evans & Rothbart, 2008; Ershova et al., 2018; Montoya-Perez et al., 2019), three (Aron & Aron, 2010; Booth et al., 2015; Konrad et al., 2017; Smolewska et al., 2006), or even five factors (Baryła-Matejczuk et al., 2023; Chacon et al., 2021). For this reason, in the first stage of the analysis, confirmatory factor analysis (CFA) was used to verify whether the models existing in the literature were reflected in the data collected for the Polish validation. In the assessment of CFA models, an inspection of the Comparative Fit Index (CFI) was used, where expected values are higher than .90, and Root Mean Square Error of Approximation (RMSEA), where expected values are lower than .08 (Byrne, 1994). The analysis used a maximum likelihood estimator that is resistant to failure to meet the assumption of multivariate normality.

Due to the multitude of different measurement models of the validated scale and the difficulties in finding the optimal model, in the second stage, the validation sample was divided into two equal parts. In the first half, exploratory factor analysis (EFA) was performed. To assess the underlying number of factors, a parallel analysis (Horn, 1965) and minimum average partial (MAP; Velicer, 1976) test was performed. These are the recommended methods for assessing the number of factors (Fabrigar, 1999), which, according to simulation studies, are characterized by the greatest accuracy in correctly identifying the number of factors (Ruscio & Roche, 2012). Factor analysis was performed using principal axis estimation and, because most psychological constructs are correlated, oblique oblimin rotation was used. In the third and final stage of the analyses, the measurement model extracted based on EFA was tested in the second group using the confirmatory CFA method. To evaluate the CFA model, the same metrics described above were used. Exploratory analyses were performed in the R program, using the psych package (Revelle, 2022), and confirmatory analyses were performed in the Mplus v. 7.2 program (Muthén & Muthén, 2012).

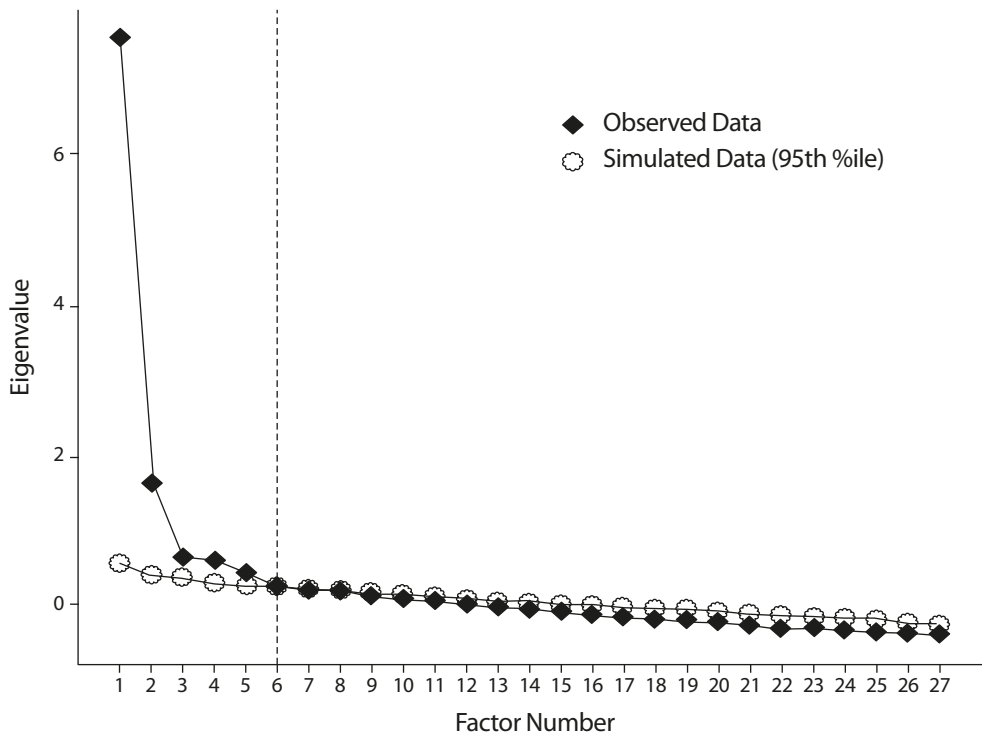# Results

Evaluation of Existing Models

Table 1 (p. 118) shows the fit indices of models described in the literature, which were verified using CFA. Of the five measurement models analyzed, none fitted the data satisfactorily in terms of the CFI statistics. In the case of RMSEA statistics, the analyzed models oscillated around the upper acceptable limit. The original one-factor model turned out to be the worst fit and the model with five factors (Model 4) was the best fit. To sum up, because none of the models turned out to fit sufficiently well, in the next step of the analysis we used an exploratory approach to assess potential sources of low fit of the data to the model.

Table 1

Fit Indices of Measurement Models Described in the Literature

Model	$X^2_{(df)}$	p	CFI	RMSEA	90%CI
(1) Aron & Aron, 1997	$3378.48_{(324)}$	.001	.695	.083	.081, .086
(2) Smolewska et al., 2006	$2382.67_{(272)}$	.001	.765	.076	.073, .078
(3) Ershova et al., 2018	$1549.53_{(149)}$	.001	.792	.083	.079, .087
(4) Chacón et al., 2021	$2400.28_{(314)}$	.001	.792	.070	.067, .073
(5) Baryła-Matejczuk et al., 2023	$1553.08_{(142)}$	.001	.801	.085	.082, .089

Data Exploration

In the first stage of exploration, the number of factors that should be extracted was assessed. The results of the parallel analysis, which are presented in Figure 1, showed that the eigenvalues of the first six factors calculated based on empirical data are higher than the simulation values. However, because the

Figure 1

Empirical and Simulated Eigenvalues of Individual Factors in Parallel Analysis

values of only the first two factors turned out to be greater than 1, it can be assumed that the parallel analysis suggests the separation of the two factors. The results of the MAP test also indicated that the two-factor model most adequately describes the structure of the adapted scale, explaining 35% of its total variance. Therefore, a two-factor solution was adopted in further analyses. The rotated factor loadings of the discussed solution are presented in Table 2. Of the 27 test items analyzed, the loadings of four of them (i.e. items 4, 6, 13 and 17) turned out to be not indicators of any of the two factors. Furthermore, two items (i.e., 3 and 18) were found to load on two factors simultaneously, and as a result, it can be considered a poor indicator of both variables. The strength of the loadings of the remaining factors turned out to be appropriate. Moreover, there were no significant cross-loadings between the factors. In summary, the EFA results suggest removing the following six test items that were found to be poor indicators of the factors being measured: 3. "Other people's moods affect me." 4. "I tend to be very sensitive to pain." 6. "I am particularly sensitive to the effects of caffeine.", 13. "I startle easily.", 17. "I try hard to avoid making mistakes or forgetting things.", 18. "I try to avoid violent movies and TV shows."

Table 2

Rotated Factor Loadings

| Item	Over-stimulation	Depth of processing
1. Łatwo staję się przytłoczony/przytłoczona silnymi bodźcami sensorycznymi.	**.70**	−.05
2. Zauważam subtelne sygnały w moim otoczeniu.	−.05	**.72**
3. Nastroje innych ludzi mają na mnie wpływ.	**.35**	**.35**
4. Jestem bardzo wrażliwy/wrażliwa na ból.	.22	.08
5. Czasami podczas bardzo zajętych dni potrzebuję odciąć się od bodźców i szukam miejsca, gdzie będę sam/sama.	**.46**	.16
6. Jestem szczególnie wrażliwy/wrażliwa na działanie kofeiny.	.18	.24
7. Mam wrażenie, że silniej niż inni odczuwam bodźce sensoryczne, takie jak zapach, smak czy dotyk.	.13	**.69**
8. Mam bogate i złożone życie wewnętrzne.	.06	**.61**
9. Głośny hałas sprawia, że czuję się niekomfortowo.	**.47**	.28
10. Potrafię być głęboko poruszony/poruszona muzyką lub sztuką.	.03	**.50**
11. Czasami czuję się tak bardzo przytłoczony/przytłoczona, że wybucham.	**.47**	.22
12. Jestem sumienny/sumienna.	−.03	**.34**
13. Łatwo mnie zaskoczyć.	.23	−.04
14. Złoszczę się, kiedy mam dużo do zrobienia w krótkim czasie.	**.65**	−.10
15. Kiedy ludzie czują się niekomfortowo w aktualnym otoczeniu, wiem, co zrobić, aby polepszyć ich samopoczucie (np. zmiana oświetlenia albo miejsca siedzenia).	−.16	**.64**

Continuation of table 2

Item	Over-stimulation	Depth of processing
16. Jestem zirytowany/zirytowana, kiedy ktoś chce ode mnie wiele rzeczy naraz.	**.65**	−.04
17. Staram się bardzo unikać popełniania błędów i zapomina-nia o czymś.	.23	.24
18. Staram się unikać brutalnych filmów i programów telewi-zyjnych.	**.31**	.26
19. Kiedy dużo dzieje się wokół mnie, odczuwam nieprzyjemne pobudzenie.	**.60**	.21
20. Bycie bardzo głodnym/głodną wywołuje we mnie silną re-akcję, zaburzając koncentrację lub nastrój.	**.37**	.09
21. Zmiany w moim życiu wyprowadzają mnie z równowagi.	**.69**	−.07
22. Dostrzegam subtelne różnice oraz intensywność zapachów, smaków i dźwięków.	.02	**.78**
23. Uważam, że to nieprzyjemne, gdy wiele się dzieje naraz.	**.82**	−.11
24. Priorytetem jest dla mnie takie uporządkowanie życia, aby uniknąć przykrych lub przytłaczających sytuacji.	**.45**	.05
25. Przeszkadzają mi intensywne bodźce, takie jak głośne dźwięki czy chaotyczne sceny.	**.61**	.22
26. Jeżeli muszę z kimś konkurować albo ktoś mnie obserwuje, kiedy coś robię, to jestem tak zdenerwowany/zdenerwowa-na lub roztrzęsiony/roztrzęsiona, że radzę sobie znacznie gorzej z zadaniem.	**.71**	.02
27. Kiedy byłem/byłam dzieckiem, moi rodzice i nauczyciele uważali mnie za osobę nieśmiałą i wrażliwą.	**.36**	.06
Variance explained	21%	14%

Note. Loadings with a strength above .30 are bolded.

Data Confirmation

In the third and final step of the analyses, the model identified through data mining was verified. The CFA results indicated a low level of fit in terms of the CFI statistics and a moderate level of fit in terms of RMSEA ($\chi^2(188) = 902.56$; $p < .001$; CFI = .816; RMSEA = .075 [.070, .080]). Inspection of the model improvement indicators revealed three significant correlations between the residual values. Including them in the model significantly improved the level of fit to acceptable levels ($\chi^2(185) = 475.43$; $p < .001$; CFI = .925; RMSEA = .048 [.043, .053]). The standardized factor loadings are shown in Figure 2 (p. 121). The strength of all factor loadings, except item 12, was found to be adequate. The correlation between latent variables indicates a strong relationship between them but does not indicate multicollinearity. To sum up, taking into account the satisfactory fit coefficients of the model to the data and the appropriate factor loadings, the two-factor model identified through exploration can be considered satisfactory.

Figure 2

Graphical Representation of the Measurement Model With Standardized Factor Loadings
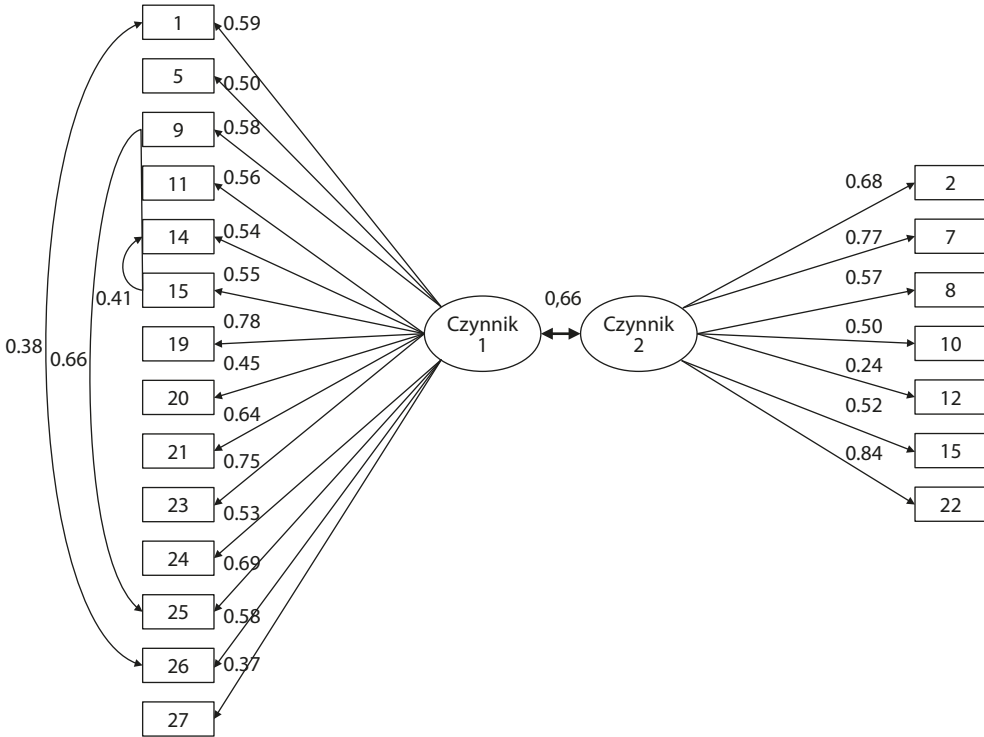
Psychometric Properties of Scales – Reliability and Validity

Contrary to the claims of Aron and Aron (1997) that the HSPS measures a unidimensional construct, the results obtained indicate a two-factor structure that distinguishes overstimulation (NS) and depth of processing (GP). The names of the factors were taken from Elaine Aron's book, in which she explains the construct of high sensitivity of sensory processing. Depth of processing means the way of processing information, which involves referring to previously acquired data, combining and integrating them with newly incoming data, noticing similarities and differences, and considering various options when making decisions. Overstimulation is related to the depth of processing and refers to the ease of feeling overwhelmed by too many stimuli. It results from the way information is processed, the number of details noticed, small details, and the perception of stimuli as too intense or long-lasting (Aron, 2017).

Positive interdependencies among these factors, as well as the entire scale, are consistent with the general structure of the SPS and the suggestions and assumptions of the authors of the original tool.

Based on the results of the CFA analysis, a two-factor solution was adopted and their correlations with the NEO-FFI results were calculated (Table 3). In the analyses of the HSPS and NEO-FFI scales, all results turned out to be statistically significant. Both factors, but overstimulation most strongly, were significantly associated with neuroticism, as was the full HSPS scale. There was also a moderate relationship between the full scale and conscientiousness and a weak correlation between the depth of processing scale and conscientiousness. Surprisingly, there was a relatively high correlation between openness to experience and the depth of processing scale, while the correlation with the full scale was much lower. Extraversion was negatively correlated with both the full scale and each of the dimensions – most strongly with overstimulation. Agreeableness had a slight or weak correlation with the HSPS dimensions.

Table 3

Correlations Between the HSPS Scale and the NEO-FFI

	Overstimulation	Depth of processing	SPS Scale
Extraversion	−.480**	−.106**	−.396**
Neuroticism	.640**	.321**	.599**
Conscientiousness	−.069	.249	.470
Agreeableness	.075**	.160**	.118**
Openness	.168**	.512**	.325**

** $p < .01$

The authors of the theory claim that sensitive sensory processing has often been confused with neuroticism (Howarth, 1986), fearfulness (Gray, 1991), and reactivity (Strelau, 1983). Contributing to this is the assumption that both sensitive and fearful people respond to stimuli in cautious ways that may lead to avoidance. Highly sensitive people are also more aware of their surroundings and have a lower arousal threshold, which may constitute grounds for assuming that they may be more emotional and more prone to worry. Moreover, research results indicate that high sensitivity is not identical with neuroticism, but related to it (Aron & Aron, 1997). Negative emotionality was most strongly associated with the overstimulation scale, which is the tendency to be overwhelmed by external and internal stimuli. However, the correlation of neuroticism with the depth of processing scale was relatively small.

Aron and Aron (1997) argued that SPS is related to, but distinct from, introversion.

Considering that the Big Five personality theory, on which the NEO-FFI tool was based, assumes that extraversion-introversion is on a continuum, a negative relationship between SPS and extraversion was expected. This assumption was

completely confirmed. Extraversion negatively correlated with each of the HSPS dimensions, most strongly with overstimulation. The entire HSPS scale was moderately negatively related to extraversion. These results confirm the assumptions of the authors of the tool that high sensitivity is associated with introversion.

Reliability

Overall, satisfactory reliability results were obtained, indicating good internal consistency of the test. The reliability of the entire 22-item scale was α = .90, while the reliability of the overstimulation scale (subscale) was α = .88, and the reliability of the depth of processing scale (subscale) was α = .78.

Gender Differences

Gender differences were examined using the Student's t-test for independent groups. The results turned out to be significant and indicate that women are more often characterized by high sensitivity (M = 123.8; SD = 14.58) than men (M = 100.56; SD = 19.39), $t(545)$ = 21.08; $p < .05$, d = 1.448. The strength of this effect is great. This is consistent with the results of other studies conducted by Aron and Aron (1997) and Smolewska et al. (2006).

Discussion

The aim was to examine the psychometric properties of the adaptation of the Highly Sensitive Person Scale in the Polish population. The results of this study did not confirm the one-factor structure described by the authors in one of the first studies by Aron and Aron (1997). It was also impossible to confirm the three-factor solution suggested by Smolewska et al. (2006), which was supported by subsequent studies by Aron and Aron (2010) and Both et al. (2015). The factor analysis of the full version of the HSPS showed that several items had weak and inconsistent factor loadings and were therefore removed. Baryła-Matejczuk and a team of researchers attempted to create a Polish version of the HSPS, the result of their 2021 research is a short scale consisting of 10 questions. The authors considered a five-factor structure, but ultimately the results indicated that the three-factor solution of the scale with 10 items explains 43.94% of the variance in the results (Baryła-Matejczuk et al., 2023).

The overstimulation factor listed in this study contains almost all of the same items as the factor listed in other studies called ease of excitation or low sensory threshold. This is an element that remains constant in most studies on the structure of HSPS. Therefore, it can be assumed that regardless of the name, this factor is a basic component of SPS that is not dependent on factors related to the social environment. The second factor, depth of processing, also

had many of the same items as the factor mentioned in other studies called aesthetic sensitivity. However, it was not as consistent as with the overstimulation factor. Moreover, some items included in the depth of processing factor in other studies were often removed. However, due to the correlation between the factors and taking into account the theoretical assumptions of a one-factor solution for the HSPS, it is worth considering sensory processing sensitivity as one coherent construct and not using the subscales separately.

The studies conducted so far using the HSPS scale differed in sample size and homogeneity, which may be a factor limiting the possibility of comparing results from other studies (Ershova et al., 2018; Grimen & Diseth, 2016; Konrad & Herzberg, 2017; May et al., 2020). Analyzes of the properties of the scale and its components in studies conducted in various cultures indicate their importance for the manifestations of the discussed trait. Comparing the presented results obtained in the process of adapting the tool with other adaptations is not easy, because their authors introduced various modifications, such as deleting test items or entire factors or introducing new factors. The research results so far indicate that there is variability in the way high sensitivity is experienced depending on the social and/or cultural environment (and gender), which justifies the need to continue research on the construct of high sensitivity depending on the cultural or social context and biological factors (Greven et al., 2019) or their interactions. This necessity is also justified by the functioning of many people on the Internet and "immersion" in virtual reality, which radically changes the developmental context and determinants of psychological health.

The study was conducted on a relatively large sample of 1,360 adults of various ages. Almost 65% of the respondents were in a romantic relationship. However, the limitation of the study was the gender disproportion, as only less than 28% of the respondents were men. In future research, it is worth equalizing the gender ratio in the sample and examining the relationship of the construct of sensory processing sensitivity with other measures of personality and temperament as well as its developmental changes, and it is also worth taking into account the control of negative affect. It should be noted, however, that the terminology related to the sensitivity of sensory processing requires a unified way of understanding, including clarification of the basic issue, namely whether it is an element of personality or temperament (Baryła-Matejczuk et al., 2022). The authors of the scale originally suggested (as emphasized in the introduction) that it is a personality construct (Aron & Aron, 1997), while in recent studies, the sensitivity of sensory processing is presented as a temperamental feature (Aron et al., 2005; Jagiellowicz et al., 2016; May & Pitman, 2021; Tillmann et al., 2021).

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