Investigating sensitivity through the lens of parents: validation of the   
parent-report version of the Highly Sensitive Child scale

Supplementary material

21/10/2022

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**1 Study 1**

* 1. **Missing data**

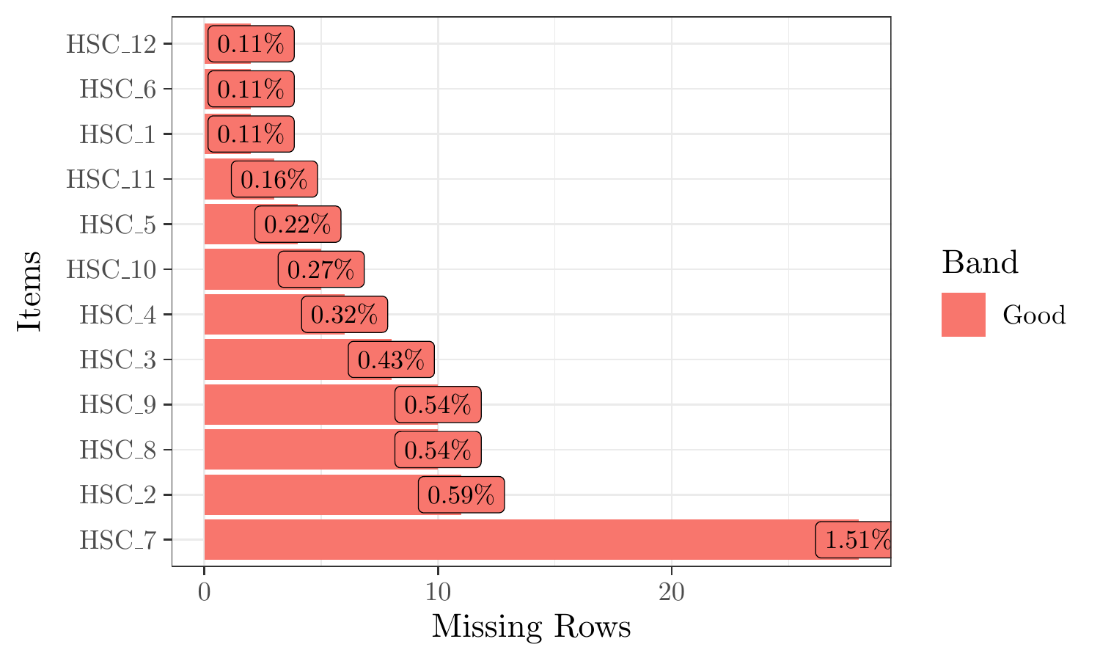


Figure S1: Frequency (and percentage) of missing values for each item.

The total sample is composed by 1857 subjects. In Figure S1 are represented the frequency and the percentage of missing values for each item of the HSC scale. Item 7 presented the highest percentage of missing values corresponding to 28 non responses; note that 27 of these non-responding subjects are in the preschool group.

Table S1 reports the frequency of missing values by subjects; there are only 84 subjects who did not complete the survey.

|  |  |
| --- | --- |
| missing | subjects |
| 0 | 1773 |
| 1 | 77 |
| 2 | 7 |

Table S1: Number of missing values by subject.

Given the low percentage of missing data, we decided to use a full information maximum likelihood approach for imputing missing data.

* 1. **Exploratory parallel analysis**

In Figure 1, results from an exploratory parallel analysis are reported. The three-factor solution seems to be a plausible solution.

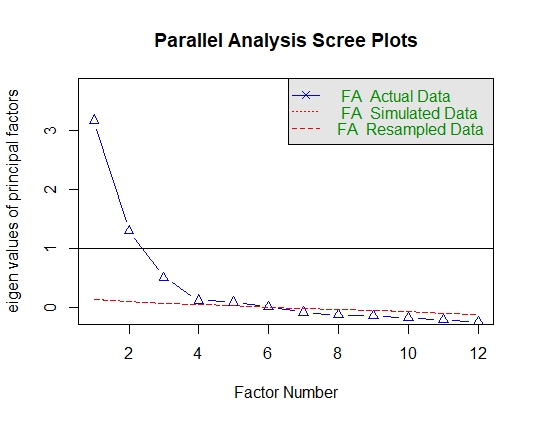


Figure 1. Exploratory parallel analysis

* 1. **CFA models on total sample with and without data imputation considering age as the grouping variable (*N* = 1857)**

In Table S2 are reported the fit indices obtained in the three compared models. On the top side, fit indices obtained by adopting the listwise deletion method are reported (*N =* 1773). On the bottom, fit indices obtained by imputing missing data with full information maximum likelihood approach (fiml) are reported. The bi-factor model showed the best fit indices and results obtained by adopting listwise and fiml are overall comparable.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Listwise | N | CFI | CFI Δ | TLI | RMSEA | SRMR |
| Bi-factor | 1773 | .95 |  | .92 | .07 [.06-.07] | .04 |
| Three-factor | 1773 | .94 | .01 | .92 | .07 [.06-.07] | .05 |
| One-factor | 1773 | .67 | .27 | .60 | .14 [.14-.15] | .12 |
| With data imputation | N | CFI | CFI Δ | TLI | RMSEA | SRMR |
| Bi-factor | 1857 | .95 |  | .92 | .07 [.06 - .07] | .04 |
| Three-factor | 1857 | .93 | .02 | .91 | .07 [.06 - .08] | .05 |
| One-factor | 1857 | .67 | .26 | .59 | .15 [.14 - .15] | .11 |

Table S2. Fit indices and comparison of the CFA models on the total sample. On the top, fit indices without data imputation are showed. On the bottom, fit indices of CFA with data imputation using FIML are showed. N = sample size, CFI = Comparative fit index, CFI Δ = CFI difference, TLI = Tucker-Lewis index, RMSEA = Root mean square error of approximation [and 95% confidence interval], SRMR = standardized root mean square residual.

* 1. **Factor loadings and residual variances of the bi-factor model in the preschool group**

In boxes S1 (page 5) and S2 (page 6) are reported the factor loadings and the residual variances, respectively, of the bi-factor model for preschool group. For each estimated parameter are reported also the standard error (Std.Err), the *z*-value (z-value), the *p*-value (P(>|z|)). Important to note, a negative variance was found for item 7 limited to the preschool group.

|  |
| --- |
| Group 1 [1]:  Latent Variables:  Estimate Std.Err z-value P(>|z|)  EOEb =~  HSC\_4 1.245 0.053 23.482 0.000  HSC\_6 1.336 0.047 28.526 0.000  HSC\_8 1.324 0.047 28.209 0.000  HSC\_9 0.784 0.055 14.371 0.000  HSC\_12 0.821 0.061 13.430 0.000  LSTb =~  HSC\_2 0.032 0.022 1.428 0.153  HSC\_7 -34.690 23.376 -1.484 0.138  HSC\_11 0.021 0.015 1.337 0.181  AESb =~  HSC\_1 0.669 0.058 11.534 0.000  HSC\_3 0.873 0.050 17.511 0.000  HSC\_5 0.786 0.053 14.762 0.000  HSC\_10 0.947 0.051 18.444 0.000  HSPb =~  HSC\_1 0.340 0.053 6.395 0.000  HSC\_2 1.507 0.069 21.847 0.000  HSC\_3 0.382 0.046 8.352 0.000  HSC\_4 0.581 0.063 9.168 0.000  HSC\_5 0.278 0.049 5.685 0.000  HSC\_6 0.644 0.058 11.056 0.000  HSC\_7 1.273 0.140 9.066 0.000  HSC\_8 0.655 0.058 11.325 0.000  HSC\_9 0.562 0.057 9.801 0.000  HSC\_10 0.382 0.046 8.313 0.000  HSC\_11 1.595 0.071 22.485 0.000  HSC\_12 0.449 0.066 6.803 0.000 |

Box S1. Estimated factor loadings of the Bi-factor model, preschool group (N = 1066). Std.Err = Standard error, P(>|z|) = p-value.

|  |
| --- |
| Variances:  Estimate Std.Err z-value P(>|z|)  .HSC\_4 1.531 0.084 18.333 0.000  .HSC\_6 0.890 0.063 14.016 0.000  .HSC\_8 0.934 0.064 14.524 0.000  .HSC\_9 2.122 0.098 21.639 0.000  .HSC\_12 2.734 0.125 21.920 0.000  .HSC\_2 1.473 0.158 9.322 0.000  .HSC\_7 -1200.124 1621.778 -0.740 0.459  .HSC\_11 1.368 0.172 7.952 0.000  .HSC\_1 2.085 0.101 20.659 0.000  .HSC\_3 1.076 0.074 14.595 0.000  .HSC\_5 1.589 0.085 18.693 0.000  .HSC\_10 1.032 0.080 12.966 0.000  EOEb 1.000  LSTb 1.000  AESb 1.000  HSPb 1.000 |

Box S2: Estimated residual variances of the Bi-factor model, preschool group (*N* = 1066). Std.Err = Standard error, P(>|z|) = p-value.

* 1. **Factor loadings and residual variances of the bi-factor model in the school group**

In boxes S3 (page 7) and S4 (page 8) are reported the factor loadings and the residual variances, respectively, of the bi-factor model for school-age group. For each estimated parameter are reported also the standard error (Std.Err), the *z*-value (z-value), the *p*-value (P(>|z|)).

|  |
| --- |
| Group 2 [2]:  Latent Variables:  Estimate Std.Err z-value P(>|z|)  EOEb =~  HSC\_4 0.776 0.108 7.173 0.000  HSC\_6 1.080 0.103 10.432 0.000  HSC\_8 1.070 0.117 9.114 0.000  HSC\_9 0.008 0.130 0.065 0.948  HSC\_12 -0.024 0.147 -0.163 0.871  LSTb =~  HSC\_2 1.044 0.221 4.731 0.000  HSC\_7 0.338 0.125 2.712 0.007  HSC\_11 0.948 0.212 4.472 0.000  AESb =~  HSC\_1 0.559 0.069 8.096 0.000  HSC\_3 0.685 0.069 9.859 0.000  HSC\_5 0.970 0.067 14.470 0.000  HSC\_10 1.138 0.071 15.980 0.000  HSPb =~  HSC\_1 0.113 0.070 1.620 0.105  HSC\_2 0.808 0.089 9.070 0.000  HSC\_3 0.307 0.067 4.597 0.000  HSC\_4 1.139 0.090 12.705 0.000  HSC\_5 0.334 0.068 4.915 0.000  HSC\_6 1.074 0.103 10.462 0.000  HSC\_7 0.748 0.098 7.624 0.000  HSC\_8 1.260 0.103 12.235 0.000  HSC\_9 1.035 0.075 13.838 0.000  HSC\_10 0.300 0.066 4.525 0.000  HSC\_11 1.159 0.085 13.684 0.000  HSC\_12 1.090 0.089 12.313 0.000 |

Box S3. Estimated factor loadings of the bi-factor model, school-age group (N = 791). Std.Err = Standard error, P(>|z|) = p-value.

|  |
| --- |
| Variances:  Estimate Std.Err z-value P(>|z|)  .HSC\_4 1.480 0.089 16.644 0.000  .HSC\_6 0.961 0.101 9.533 0.000  .HSC\_8 0.745 0.092 8.063 0.000  .HSC\_9 1.720 0.137 12.508 0.000  .HSC\_12 2.775 0.194 14.268 0.000  .HSC\_2 2.153 0.447 4.817 0.000  .HSC\_7 3.814 0.202 18.852 0.000  .HSC\_11 1.222 0.357 3.425 0.001  .HSC\_1 2.204 0.120 18.403 0.000  .HSC\_3 1.954 0.115 17.002 0.000  .HSC\_5 1.477 0.112 13.163 0.000  .HSC\_10 1.069 0.132 8.104 0.000  EOEb 1.000  LSTb 1.000  AESb 1.000  HSPb 1.000 |

Box S4: Estimated residual variances of the Bi-factor model, school-age group (*N* = 791). Std.Err = Standard error, P(>|z|) = p-value.

1. **Study 2**

**2.1. Bivariate zero-order and partial associations without data imputation**

In Table S3 (page 10) are reported bivariate zero-order and partial correlations adopting listwise deletion method among HSC-PR total scale and its factors and temperamental dimensions.

|  | Mean (*SD*) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 HSC-PR | 4.58(.89) | — |  |  |  |  |  |  |  |  |  |  |
| 2 HSC-PR – no item 7 | 4.51(.90) | .98 | — |  |  |  |  |  |  |  |  |  |
| 3 HSC-EOE | 3.61(1.30) | .82 | .83 | — |  |  |  |  |  |  |  |  |
| 4 HSC-LST | 4.53(1.55) | .79 | .72 | .46 | — |  |  |  |  |  |  |  |
| 5 HSC-LST – no item 7 | 4.18(1.84) | .73 | .74 | .44 | .90 | — |  |  |  |  |  |  |
| 6 HSC-AES | 5.82(.88) | .43 | .45 | .01 | .20 | .18 | — |  |  |  |  |  |
| 7 CBQ-NA | 4.21(1.03) | .37 | .38 | .45 (.42) | .15 (-.07) | .13 | .09 (.06) | — |  |  |  |  |
| 8 CBQ-EXTR | 4.60(.85) | -.28 | -.28 | -.23 (-.11) | -.28 (-.20) | -.32 | -.02 (.04) | .02 | — |  |  |  |
| 9 CBQ-EC | 5.65(.76) | .35 | .35 | .08 (-.08) | .29 (.21) | .28 | .51 (.46) | .05 | -.24 | — |  |  |
| 10 Gender |  | .13 | .12 | .05 | .08 | .06 | .18 | .06 | -.16 | .27 | — |  |
| 11 Age |  | .10 | .09 | .07 | .14 | .13 | .00 | .03 | -.16 | .17 | .10 | — |

Table S3. Bivariate zero-order and partial correlations (in brackets) adopting listwise deletion method (*N =* 204).   
In brackets are showed partial correlations between HSC-PR subscales and temperament dimensions.   
HSC-PR = Highly Sensitive Child scale Parent-Report Total Score; HSC-PR - no item 7 = Highly Sensitive Child scale Total Score excluding item 7; HSC-EOE = Ease of Excitation; HSC-LST = Low Sensitivity Threshold; HSC-LST – no item 7 = Low Sensitivity Threshold excluding item 7; HSC-AES = Aesthetic Sensitivity; CBQ-EC = Effortful Control; CBQ-EXTR = Surgency/Extraversion; CBQ-NA = Negative Affect. Gender: 1 = male, 2 = female. According to Cohen (1988, 1992): trivial associations: *r* lower than *r* =.10; moderate associations: *r* = 25-45; strong association: *r* equal to or higher than .50.

# Used R packages

DataExplorer. Boxuan Cui (2020). DataExplorer: Automate Data Exploration and Treatment.  
R package version 0.8.2. [https://CRAN.R-project.org/package=DataExplorer](https://cran.r-project.org/package=DataExplorer)

lavaan. Yves Rosseel (2012). lavaan: An R Package for Structural Equation Modeling. Journal of Statistical Software, 48(2), 1-36. URL h[ttps://www.jstatsoft.org/v48/i02/.](http://www.jstatsoft.org/v48/i02/)

R. R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL h[ttps://www.R-project.org/.](http://www.R-project.org/)

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(2019). xtable: Export Tables to LaTeX or HTML. R package version 1.84. [https://CRAN.R-](https://cran.r-/)[project.org/package=xtable](http://project.org/package=xtable)