

Sensory Challenge Protocol: a pilot study of the Italian adaptation in undergraduate

Stefano Scatigna – PhD Student – e-mail stefano.scatigna@unifi.it

1 INTRODUCTION

Sensory Processing (SP) is defined as the capacity of the central nervous system to aggregate, process, and generate adequate responses to sensory stimuli (Dunn et al., 2001). SP shows **high variability across subjects** (Machingura et al., 2019), depending also on other **cognitive functions** such as **cognitive control** (Brown et al., 2021), and alterations are observed in several **neurodevelopmental disorders** (Galiana-Simal et al., 2020). SP is commonly assessed via indirect measures (e.g., questionnaires), which tend to be affected by subjective perspectives and to show low sensitivity to intersubject variability (De Los Reyes et al., 2019). Recently, new tools such as **Sensory Challenge Protocols (SCP)** have been developed to directly measure sensory responses to different stimuli varying in sensory modality and intensity (Gomez et al., 2017). With the long-term aim of adapting such paradigms to the Italian context and to neurodevelopmental conditions known to be vulnerable in sensory processing, studies aimed at testing the feasibility of such protocols are needed.

AIM

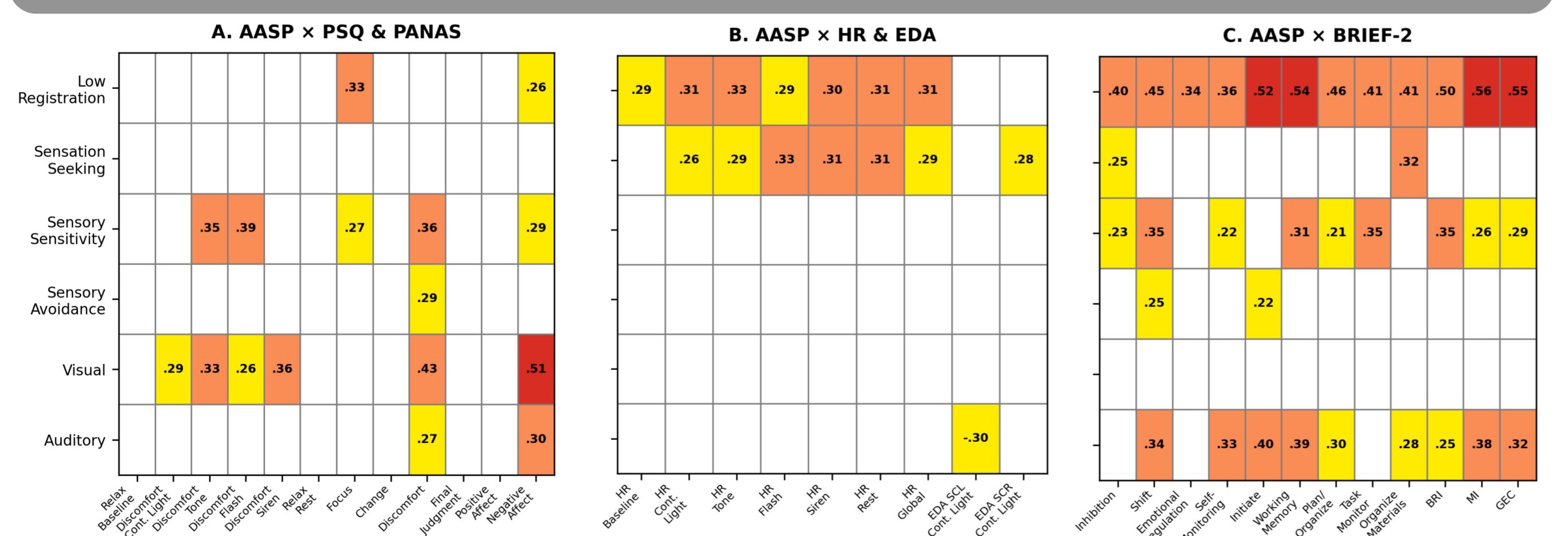
The main aim of the present study was the implementation and testing of a **Sensory Challenge Protocol** in university students. Secondly, given the established link between **sensory processing** and **cognitive control**, a further aim was to **investigate the relationship** between these two domains.

3 RESULTS

DESCRIPTIVE STATISTICS

	<i>M (SD)</i>	Skewness	Kurtosis
SENSORY PROCESSING (AASP)			
Low Registration	32.0 (8.10)	0.68	0.59
Sensation Seeking	46.6 (6.39)	-0.06	0.79
Sensory Sensitivity	40.2 (7.81)	0.19	0.38
Sensation Avoiding	36.6 (7.05)	0.27	-0.12
Visual Processing	25.7 (4.57)	0.21	-0.57
Auditory Processing	28.5 (6.05)	0.53	-0.63
EXECUTIVE FUNCTION (BRIEF-A)			
Behavior Regulation Index	50.2 (10.62)	0.02	0.21
Metacognition Index	50.2 (11.69)	0.86	0.6
Global Executive Composite	50.1 (11.10)	0.43	0.57
SUBJECTIVE EXPERIENCE QUESTIONNAIRES (PSQ & PANAS)			
Global Discomfort [1-10]	3.53 (2.34)	0.6	-0.85
Focus Difficulties [1-5]	2.70 (1.98)	0.12	0.9
Positive Affect (PANAS)	31.90 (6.51)	-0.004	0.48
Negative Affect (PANAS)	14.90 (5.56)	1.35	1.18

CORRELATIONS (ρ)



HR measures did not significantly correlate with post-stimulation subjective ratings or EF (BRIEF-A) ($p > 0.05$). EDA measures showed weak correlations with post-questionnaire variables: SCL ($p = -0.34$ - -0.26) and SCR ($p = 0.26$ - 0.27). Reported Focus Difficulties during the stimulation paradigm (PSQ) correlated with all BRIEF-A scales and composite indices ($p = 0.36$ - 0.65), while discomfort correlated with Inhibition and Material Organization ($p = 0.26$ - 0.29).

Brown, T., Swain, E., Lyons, C., Chu, E., & Taylor, J. (2021). The relationship between children's sensory processing and executive functioning: An explanatory study. *Journal of Korean Society of Occupational Therapy*, 29(1), 135-147. <https://doi.org/10.4459/kjot.2021.29.1.10>

De Los Reyes, A., Lerner, M.D., Keeley, L.M., Weber, R.J., Drabick, D.A.G., Rabnowitz, J., & Goodman, K.L. (2019). Improving interpretability of subjective assessments about psychological phenomena: A review and cross-cultural meta-analysis. *Review of General Psychology*, 23, 293-319. <https://doi.org/10.1037/0033-295X.23.3.293>

Dunn, L.W. (2001). The sensations of everyday life. *American Journal of Occupational Therapy*, 55(6), 608-620. <https://doi.org/10.5014/ajot.55.6.608>

Galiana-Simal, A., Vela-Romero, M., Romero-Vela, V.M., Oliver-Terero, N., García-Olmo, V., Benito-Castellanos, P.J., Muñoz-Martínez, V., & Beato-Fernández, L. (2020). Sensory processing disorder: Key points of a frequent alteration in neurodevelopmental disorders. *Cognit. Medicine*, 7, 173-190. <https://doi.org/10.1080/2331205X.2020.1736829>

Gomez, I.N., Li, C.Y.Y., Morato, M.T., Chan, C.C.H., & Tsang, H.W.H. (2017). Behavioural and autonomic regulation of response to sensory stimuli among children: A systematic review of relationship and methodology. *Biomed Research International*, 2017, 2629310. <https://doi.org/10.1155/2017/2629310>

McIntosh, T., Bear, G., Leterrier, E., & Green, J. (2018). An exploratory study of sensory processing patterns and their association with demographic factors in healthy students. *Irish Journal of Occupational Therapy*, 48(1-2), 1-16. <https://doi.org/10.1080/IJOT.12.2018.0225>

McIntosh, D.N., Miller, L.J., Siny, V., & Hagerman, R. (1999). Sensory-modulation disruption, electrodermal responses, and functional behaviors. *Developmental Medicine and Child Neurology*, 41, 608-615. <https://doi.org/10.1111/j.1469-8749.1999.tb0064.x>

Schaaf, R.C., Miller, L.J., Seawell, D., & O'Keefe, S. (2003). Children with disturbances in sensory processing: A pilot study examining the role of the parasympathetic nervous system. *American Journal of Occupational Therapy*, 57, 442-449. <https://doi.org/10.5014/ajot.57.4.442>

2 METHOD

POPULATION

Sixty female university students ($N = 60$; $M = 25.3$ years, $SD = 5.12$, range = 21–44) with typical development were recruited from the University of Florence, Italy. Exclusion criteria: photosensitive epilepsy, severe sensory impairments, or marked pre-existing sensory hypersensitivity.

EVALUATION PROTOCOL

- Adolescent/Adult Sensory Profile (AASP; 60 items)** assessing four sensory processing patterns (Sensory Avoidance, Sensation Seeking, Sensory Sensitivity and Low Registration, Visual and Auditory Global Response).
- Behavior Rating Inventory of Executive Function—Adult Version (BRIEF-A; 75 items)** comprises nine scales assessing executive functioning, yielding three composite scores: Behavior Regulation Index (BRI), Metacognition Index (MI), and Global Executive Composite (GEC).
- Positive and Negative Affect Schedule (PANAS; 20 items)** for positive and negative affective state during the Sensory Challenge Protocol (SCP).
- Post-Stimulation Questionnaire (PSQ; 10-item)** evaluating subjective experience during (discomfort, focus and relax) during the SCP.



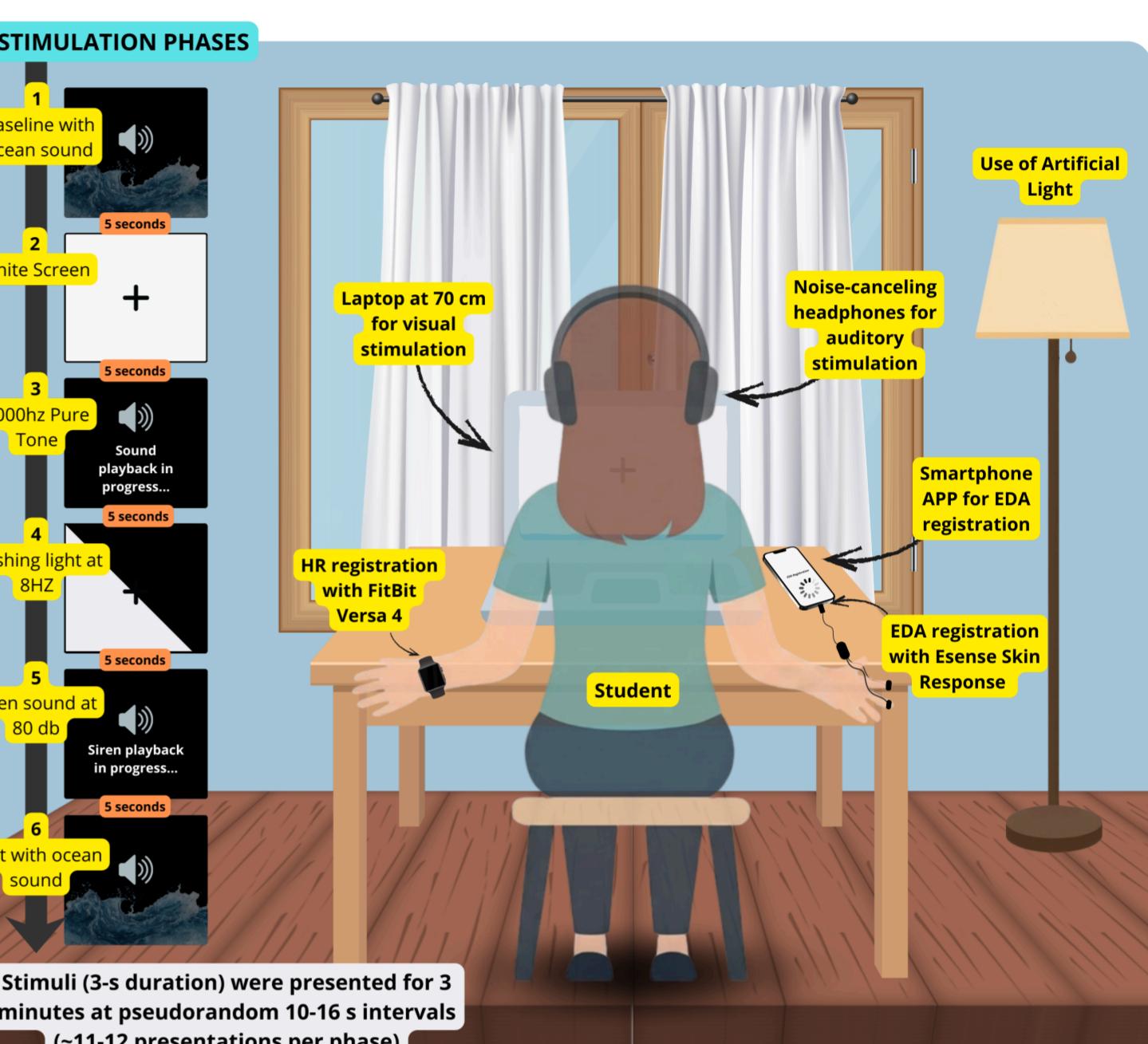
FITBIT VERSA 4 (HR)

Heart rate data were cleaned to remove artifacts and interpolate brief gaps. Analysis windows required $\geq 80\%$ valid data coverage.



ESENSE SKIN RESPONSE (EDA)

Electrodermal activity was decomposed into **tonic** (SCL) and **phasic** (SCR) components ($\geq 80\%$ valid data required).



SENSORY CHALLENGE PROTOCOL (SCP)

The protocol was adapted from the **Sensory Challenge Protocol (SCP)**; McIntosh et al., 1999; Schaaf et al., 2003), previously used in populations aged 2-19 years, with modifications informed by Gomez et al. (2017). Key features included: (1) **computerized delivery** via PsychoPy (~19 minutes) enabling portable setup; (2) **Baseline-Stimulation-Rest** structure with relaxing ocean waves during baseline/rest phases; (3) **continuous visual stimulation** (180s white screen) alongside intermittent audiovisual presentations; (4) **audiovisual-only stimulation** (eliminating tactile, olfactory, vestibular modalities); (5) **shortened intersensory intervals** (5s vs. 20s); (6) **standardized 180s analysis windows per phase** (excluding initial 5s stabilization); and (7) **noise-cancelling headphones** vs. laboratory speakers. Physiological devices (eSense, Fitbit) recorded continuously, with post-hoc synchronization using PsychoPy **timestamps for precise phase alignment**.

PROTOCOL ADHERENCE

Eighty-five university students participated at the Sensory Challenge Protocol. Twenty-five (29.4%) participants were excluded due to missing or incomplete psychophysiological data: 16 with incomplete data on both EDA and HR measures, 6 with incomplete EDA data only, and 3 with incomplete HR data only, resulting in a final sample of 60 participants.

All participants completed the experimental protocol without interruption. No participant requested a break, assistance, or early termination during the Sensory Challenge Protocol administration, demonstrating 100% protocol adherence and indicating that the procedure was well-tolerated by university students.

4 DISCUSSIONS

This study evaluated the feasibility of the **Sensory Challenge Protocol (SCP)** in university students. The protocol was well-tolerated and participants reported positive experiences. We examined links between self-reported SP (AASP) and subjective experiences during the SCP (PSQ and PANAS). PSQ and PANAS are related to SP patterns, particularly visual processing. HR associated with Low Registration and Sensation Seeking across SCP phases, while EDA showed weak links with SP profiles. The secondary aim investigated the SP-EF relationship. Post-stimulation experiences related to EF measures (BRIEF-A), and self-reported EF associated with SP. Low Registration linked with all BRIEF-A scales, confirming the EF-SP relationship (Scatigna et al., under review, 2025).

Future Directions. This protocol could extend to children with neurodevelopmental disorders to examine SP through direct assessment. Psychophysiological patterns linked to sensory discomfort may inform sensory-inclusive design of university spaces adapted to students' SP profiles, reducing academic distress.



Researching with Conscience:
Ethics as the Foundation of Knowledge
10-12th December 2025

FOR
LIL
PSI
EVENTI