

Interaction between word processing and low-level visual representation in autistic college students

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Keywords: embodiment cognition, autism spectrum disorder, visual perception, continuous flash suppression.

Embodiment cognition has recently been used to explain several cognitive-behavioral aspects of autism spectrum disorder (ASD) (Crespi & Dinsdale, 2019; Delafield-Butt et al., 2021; Eigsti, 2013; Moseley & Pulvermüller, 2018; Kilroy et al., 2021). Various investigations establish that sensorimotor difficulties are linked to social communication problems exhibited by ASD (Batool & Shehzad, 2018; Conson et al., 2015; Fanghella et al., 2022; Hellendoorn et al., 2014; Hellendoorn et al., 2015; Hildebrandt, Koch & Fuchs 2016; Peleg et al., 2018). However, it is still necessary to determine to what extent the interaction between sensorimotor mechanisms and language processing is affected in people with ASD (Hannant, 2018). One scope of the embodiment perspective of language and cognition suggests that word processing is involved in constructing low-level visual representations (Ostarek & Huettig, 2017) in typical development (TD) people. In this sense, this research aimed to determine if the relationship between word processing and low-level visual representation is present in ASD. For this, we use the experimental paradigm of continuous flash suppression based on binocular rivalry (Pournaghdali & Schwartz, 2020). 19 ASD and 22 typical development (TD) college students participated in this study. Participants with ASD were evaluated with the standardized diagnostic instruments ADOS-2 and ADI-R. Each participant had to observe a series of images of masked objects under the effect of continuous flash suppression in conjunction with the presentation of oral words that could be congruent or incongruent with the objects in the masked images. We analyzed detection rates in a mixed model, including the congruent/incongruent condition and ASD/TD group as fixed effects. Each participant and each experimental item were considered as random effects. We also analyzed reaction times in a mixed model with the same fixed and random effects as in the previous model. The preliminary results of the detection rates showed an interaction effect between the congruent/incongruent condition and the ASD/DT group (SE= 0.007; df 4173.525; t=2.078; p=0.038). No interaction effects were observed on reaction time. TD group had a 50% hit rate in the congruent and 45% in the incongruent conditions. The ASD group had a 54% hit rate in the congruent and 55% in the incongruent conditions. These results imply that the oral word congruent condition facilitated the object recognition hit rate in TD. This effect was not observed in the ASD group. According to our results, people with high-functioning ASD lack an effect of word processing on the construction of low-level visual perceptual representations. This supports the conclusion of Hannant (2018) that people with ASD struggle to construct an embodied representation of language.

References

- Batool, H., & Shehzad, W. 2018. Why do Sensory Experiences in Autism Vary? An Explanation from Cognitive Linguistics. *International Journal of English Linguistics*, 8(1), 54-70.
- Conson, M., Mazzarella, E., Esposito, D., Grossi, D., Marino, N., Massagli, A., & Frolli, A. 2015. Put myself into your place: Embodied simulation and perspective taking in autism spectrum disorders. *Autism Research*, 8(4), 454-466. <https://doi.org/10.1002/aur.1460>
- Crespi, B., & Dinsdale, N. 2019. Autism and psychosis as diametrical disorders of embodiment. *Evolution, Medicine, and Public Health*, 2019(1), 121-138. <https://doi.org/10.1093/emph/eoz021>
- Delafield-Butt, J., Dunbar, P., & Trevarthen, C. 2021. Disruption to Embodiment in Autism, and Its Repair. In N. Papaneophytou & U. Das (Eds.), *Emerging Programs for Autism Spectrum Disorder*. Academic Press.
- Eigsti, I. M. 2013. A review of embodiment in autism spectrum disorders. *Frontiers in psychology*, 4, 1-10. <https://doi.org/10.3389/fpsyg.2013.00224>
- Fanghella, M., Gaigg, S. B., Candidi, M., Forster, B., & Calvo-Merino, B. 2022. Somatosensory evoked potentials reveal reduced embodiment of emotions in autism. *Journal of Neuroscience*, 42(11), 2298-2312. <https://doi.org/10.1523/JNEUROSCI.0706-21.2022>
- Hannant, P. (2018). Receptive language is associated with visual perception in typically developing children and sensorimotor skills in autism spectrum conditions. *Human movement science*, 58, 297-306. <https://doi.org/10.1016/j.humov.2018.03.005>

- Hellendoorn, A., Langstraat, I., Wijnroks, L., Buitelaar, J. K., van Daalen, E., & Leseman, P. 2014. The relationship between atypical visual processing and social skills in young children with autism. *Research in developmental disabilities*, 35(2), 423-428. <https://doi.org/10.1016/j.ridd.2013.11.012>
- Hellendoorn, A., Wijnroks, L., Van Daalen, E., Dietz, C., Buitelaar, J. K., & Leseman, P. 2015. Motor functioning, exploration, visuospatial cognition and language development in preschool children with autism. *Research in developmental disabilities*, 39, 32-42. <https://doi.org/10.1016/j.ridd.2014.12.033>
- Hildebrandt, M. K., Koch, S. C., & Fuchs, T. 2016. We Dance and Find Each Other: Effects of dance/movement therapy on negative symptoms in autism spectrum disorder. *Behavioral Sciences*, 6(4), 24. <https://doi.org/10.3390/bs6040024>
- Kilroy, E., Harrison, L., Butera, C., Jayashankar, A., Cermak, S., Kaplan, J., ... & Aziz - Zadeh, L. (2021). Unique deficit in embodied simulation in autism: An fMRI study comparing autism and developmental coordination disorder. *Human brain mapping*, 42(5), 1532-1546. <https://doi.org/10.1002/hbm.25312>
- Moseley, R. L., & Pulvermueller, F. 2018. What can autism teach us about the role of sensorimotor systems in higher cognition? New clues from studies on language, action semantics, and abstract emotional concept processing. *Cortex*, 100, 149-190. <https://doi.org/10.1016/j.cortex.2017.11.019>
- Ostarek, M., & Huettig, F. 2017. Spoken words can make the invisible visible—Testing the involvement of low-level visual representations in spoken word processing. *Journal of Experimental Psychology: Human Perception and Performance*, 43(3), 499. <https://doi.org/10.1037/xhp0000313>
- Peleg, O., Ozer, R., Norman, T., & Segal, O. (2018). Perceptual simulations during sentence comprehension: A comparison between typical adolescents and adolescents with autism spectrum disorder. *Journal of Neurolinguistics*, 45, 36-44. <https://doi.org/10.1016/j.jneuroling.2017.08.003>
- Pournaghдали, A., & Schwartz, B. L. 2020. Continuous flash suppression: Known and unknowns. *Psychonomic Bulletin & Review*, 27(6), 1071-1103. <https://doi.org/10.3758/s13423-020-01771-2>