Electrophysiological correlates of size-distance integration

ABSTRACT:

Size constancy, i.e. the ability to achieve a stable experience of perceived size despite the fact that the image projected onto the retina varies continuously with viewing distance, is an integral aspect of our visual experience, critical to our successful interactions with the physical and social world. Yet, our understanding of how the brain achieves size constancy is still poor. The overarching goal of this project was to examine the temporal features of the neural processes underlying size constancy. By combining EEG and kinematic data, we aimed to unveil for the first time when (and where) the human brain achieves size constancy during perceptual and grasping tasks. In a series of studies, EEG and hand kinematics were recorded simultaneously while participants were asked to either manually estimate the perceived size of an object or to pick it up. The former task provides an explicit measure of size, whereas the latter (grip aperture) is used as an implicit measure. Viewing distance was manipulated directly, by placing objects of different sizes at varying distances, or indirectly, by using visual illusions. Findings revealed that early visual components, specifically P1, N2 and P2, were modulated according to size constancy principles: perceptually bigger objects elicited earlier latencies and greater amplitudes than the smaller ones, even when the stimuli subtended the same visual angle and therefore generated the same image on the retina. Interestingly, task (manual estimation vs. grasping) did not affect these early components. Our results suggest that size constancy for real objects occurs at the earliest cortical stages and that early visual processing does not change as a function of task demands.

Keywords

Perception-action systems, Size perception, Depth perception, ERP, Kinematics

Published Work:

Noviello, S., Songhorabadi, S. K., Deng, Z., Zheng, C., Chen, J., Pisani, A., Franchin, E., Pierotti, E., Tonolli, E., Monaco, S., Renoult, L., & Sperandio, I. (2024). Temporal features of size constancy for perception and action in a real-world setting: A combined EEG-kinematics study. *Neuropsychologia, 193,* 108746. https://doi.org/10.1016/j.neuropsychologia.2023.108746

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