TEMPORAL AND KINEMATIC FEATURES OF SIZE CONSTANCY DURING PERCEPTION AND ACTION

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Background: As we watch a train depart from a platform at a railway station, the size of its image on the retina gets smaller as it moves further away from us. Although the train is shrinking on our retina, we perceive it as exactly the same size, but just moving further from us. This perceptual rescaling of size to counteract the natural shrinkage of an object's retinal image with increasing distance is known as size constancy. Size constancy is critical not only to our perceptual experience, but also to our successful interactions with the physical and social world. Yet, our understanding of when and where the complex integration between size and distance information takes place remains unknown.

Aims: 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.

Method: We recorded event-related potentials (ERPs) in conjunction with kinematics while participants (N=16) were asked to either manually estimate the perceived size of an object (perceptual task) or to pick it up (grasping task). Small and big disks were placed at near and far distances, respectively, in order to subtend the same visual angle on the retina in one study. In another study, viewing distance was manipulated indirectly by means of visual illusions: a small disk was presented either in the upper or lower part of a Ponzo display. Participants (N=16) were asked to maintain their gaze steadily on a fixation point throughout the experiment. Meanwhile, EEG was recorded from a 64-scalp electrodes system and their hand was tracked with a motion capture system.

Results: We found earlier latencies and greater amplitudes in response to perceptually bigger than smaller objects of matched retinal size, regardless of the task. In line with the ERP results, manual estimates and peak grip apertures were larger for objects that were perceived as bigger. We also found task-related differences at later stages of processing from a cluster of central electrodes, whereby the mean amplitude of the P2 component was greater for manual estimation than grasping.

Conclusions: These findings provide novel evidence 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: size-distance scaling; grip constancy; size estimation; EEG; kinematics.

Publications:

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