

Proprioception calibrates object size constancy for grasping but not perception in limited viewing conditions

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Journal of Vision August 2017, Vol.17, 15. doi:<https://doi.org/10.1167/17.10.15>

Abstract

Observers typically perceive an object as being the same size even when it is viewed at different distances. What is seldom appreciated, however, is that people also use the same grip aperture when grasping an object positioned at different viewing distances in peripersonal space. Perceptual size constancy has been shown to depend on a range of distance cues, each of which will be weighted differently in different viewing conditions. What is not known, however, is whether or not the same distance cues (and the same cue weighting) are used to calibrate size constancy for grasping. To address this question, participants were asked either to grasp or to manually estimate (using their right hand) the size of spheres presented at different distances in a full-viewing condition (light on, binocular viewing) or in a limited-viewing condition (light off, monocular viewing through a 1 mm hole). In the full-viewing condition, participants showed size constancy in both tasks. In the limited-viewing condition, participants no longer showed size constancy, opening their hand wider when the object was closer in both tasks. This suggests that binocular and other visual cues contribute to size constancy in both grasping and perceptual tasks. We then asked participants to perform the same tasks while their left hand was holding a pedestal under the sphere. Remarkably, the proprioceptive cues from holding the pedestal with their left hand dramatically restored size constancy in the grasping task but not in the manual estimation task. These results suggest that proprioceptive information can support size constancy in grasping when visual distance cues are severely limited, but such cues are not sufficient to support size constancy in perception.

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