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Preservation of size constancy for action, but not perception, in a patient with bilateral occipital lesions

Irene Sperandio; Robert Whitwell; Philippe A. Chouinard; Melvyn A. Goodale

+ Author Affiliations

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Abstract

Size constancy is not only necessary for maintaining perceptual stability of the visual world but it is also critical for goal-directed actions such as grasping an object. To grasp an object successfully, one must pre-shape the hand to match the real size of the object even though the retinal image size will vary as a function of viewing distance. The neural mechanisms that underlie size constancy for perception and action are poorly understood. We therefore carried out two experiments with patient M.C., who has large bilateral occipital lesions. In the first experiment, we measured M.C.'s ability to estimate the perceived size and distance of a series of filled black circles that differed in physical size. The stimuli were positioned at varying distances such that their retinal image size was either matched or differed systematically. M.C.'s size and distance estimates were poorly scaled to the physical size of the stimuli and were correlated instead with the retinal image size of the stimuli. Would M.C.'s grasps be similarly governed by retinal image size? We asked M.C. to manually estimate or to reach out and pick up Efron blocks positioned at different distances. As expected, M.C.'s manual estimates were poorly scaled to object width yet well correlated with their retinal image size. But when M.C. reached out to pick up the objects, her grip aperture scaled to object width at all distances while her hand velocity scaled to object distance. Importantly, her grip aperture was not governed by the retinal image size as one would expect if M.C.'s visuomotor system relies on

conscious percepts. Taken together, our results strongly suggest that the neural mechanisms that underlie size constancy for perception and action are distinct, and lend further support for models of visual function that separate conscious visual perception from action.

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