

Why is an object's size perceived the same regardless of changes in distance?

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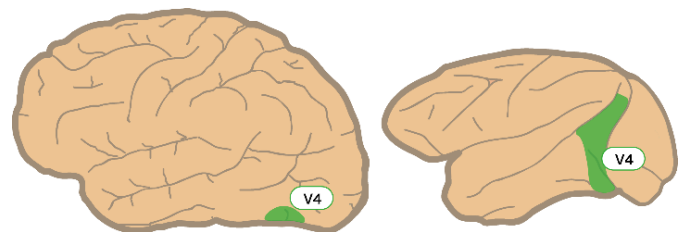
A distance cue affects perception of the object size.
Credit: Osaka University

A group of researchers at Osaka University found that neurons in the monkey visual cortical area V4, one of the areas in the visual cortex, calculate the size of an object based on information on its retinal image size and the distance from the object.

The neural mechanism for the perceptual phenomenon in which size was perceived to be stable even if the distance from the [object](#) changed (known as size constancy) was unknown. Many neurons in the [visual cortex](#) change their activity according to the size of visual stimulus. It was believed that neurons responded to the size of the image formed on the eye (retinal image); however, size constancy (Figure 1) cannot be achieved by such cells alone.

Ichiro Fujita and Shingo Tanaka, then student in the doctoral course of Graduate School of Frontier Biosciences, Osaka University, examined if there were cells that express not the retinal image size, but the size of the object itself. The group analyzed neuron activity in the monkey's visual cortical area V4 (in Figure 2) and found that cells in this area integrated information about retinal image size and the distance from the object to calculate the size of the object.

When an object is far away, its retinal image size becomes small, and when the object is near, its retinal image size becomes big. If neurons respond to the same retinal image size, even if the distance from the object changes, they are supposed to react to retinal image size. In contrast, if [neurons](#) convey information about object size, they are expected to react to the small retinal image when the object is far away and to react to the big retinal image when the object is near. Fujita and Tanaka found that most cells in the visual cortical area V4 reacted well to small stimuli when the stimuli were presented far away and reacted to big stimuli when stimuli were near. This is the property of a cell that expresses object size should have. This group's experiment verified that cells in the visual cortical area V4 do not react to the [retinal image](#) size but to the size of the object. These [cells](#) are thought to contribute to constancy of the perceived size regardless of changes in [distance](#) by conveying certain information about the object's size.



Visual cortical area V4 in humans (left) and monkeys (right) are shown. Credit: Osaka University

This group's achievements clarified the neural basis of size constancy and are expected to be helpful in improving 3D image-recognition techniques and understanding causes of diseases manifesting [size](#) perception disorder.

The results were published in the *Journal of*

Neuroscience website on August 26, 2015.

Provided by Osaka University

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