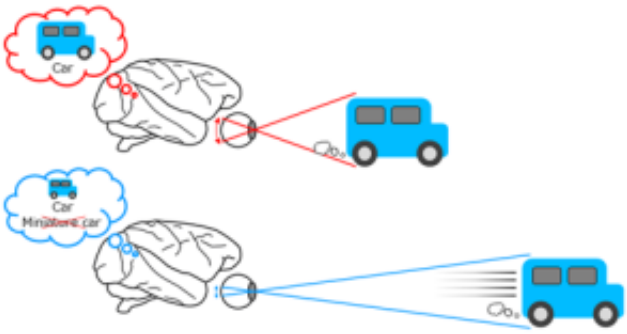
Why does the size of an object look the same despite changes in viewing distance?

Among the things we experience in daily life, nothing appears to be simpler than perceiving the sizes of visual objects. *“A large object occupies a large surface area on the retina and looks large. That’s it.”*. However, contrary to this intuitive impression, size perception involves complex neural processes, and is not determined solely by the size of object images projected onto the retina.



Size constancy
We perceive the size of an object relatively unchanged regardless of changes in distance, hence, in the size of its retinal image

A notable example is that we perceive the size of an object to be the same, despite changes in the size of its retinal image caused by changes in viewing distance. When we see a car moving away from us, we perceive the car as gradually distancing away from us, and not gradually shrinking in size, although the retinal image size of the car changes in a similar way in both cases. This phenomenon, called size constancy, occurs because our brains combine image size and distance information. The importance of distance information in size perception has been known for a long time, since the time of Claudius Ptolemaeus (also known as Ptolemy) in ancient Rome. Yet, where and how the computation for size constancy is performed in the brain remained so far poorly understood.

Ichiro Fujita at Osaka University and his former graduate student Shingo Tanaka now at Tamagawa University clarified that neurons in area V4, one of the visual cortical areas implicated in object recognition, express the size of objects in their activity by integrating information of the image size and distance information. When we view an object from different distances, the size of its projection onto the retina changes: the retinal image becomes larger when an object is located at a nearer position and becomes smaller when the object is located at a distant position. If

neurons encode the size of an object, their preference for retinal image size should systematically vary with the observer-to-object distance. That is, these neurons should prefer a larger image when an object is located at a nearer position, and a smaller image when it is located at a more distant position. Fujita and Tanaka demonstrated that V4 neurons exhibit exactly this property. By signaling information about the actual object size, not simply the retinal image size, these neurons can provide a mechanism for size constancy, shedding light on a mystery that has puzzled philosophers and scientists for more than 2000 years.

Ichiro Fujita

Publication

Computation of Object Size in Visual Cortical Area V4 as a Neural Basis for Size Constancy..
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