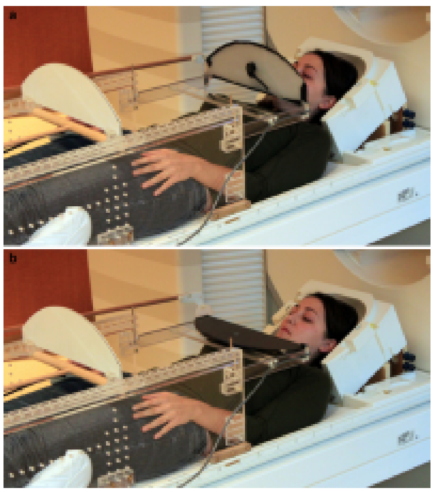
New research advances understanding of size perception

March 12 2012



Apparatus used in the fMRI experiment. A) Induction of an afterimage by means of a bright light attached on the back of a foldable screen; B) The subject projected the afterimage upon a surface placed at different distances from the subject's eyes.

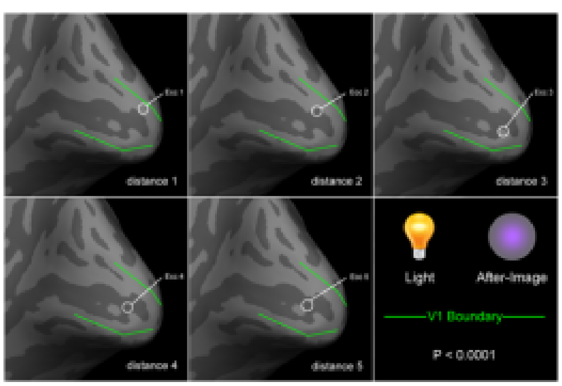
Neuroscientists from Western University have taken the all-important first step towards understanding the neural basis of size constancy or the ability to see an object as having the same size despite the fact that its image on the retina changes constantly with viewing distance.

The findings were revealed this week by Nature Neuroscience in a study titled, "Retinotopic activity in V1 reflects the perceived and not the retinal size of an afterimage."

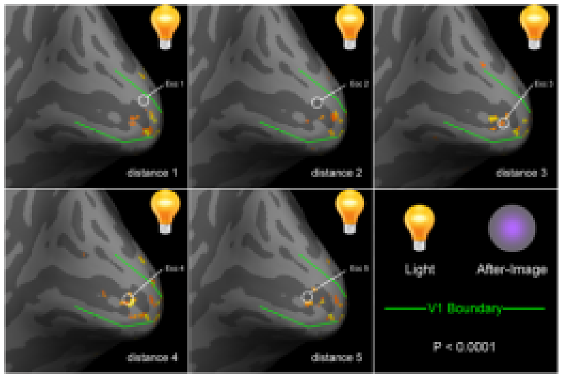
"If we look at a car driving away from us, its image on our retina gets smaller and smaller -- yet we don't see the car as shrinking in size but rather as staying the same size. This is size constancy," explains Melvyn A. Goodale, Canada Research Chair in Visual Neuroscience and Director of Western's Brain and Mind Institute.

The test that Goodale and his colleagues Irene Sperandio and Philippe Chouinard employed was asking subjects to stare at a light long enough to create an 'afterimage' on the retina.

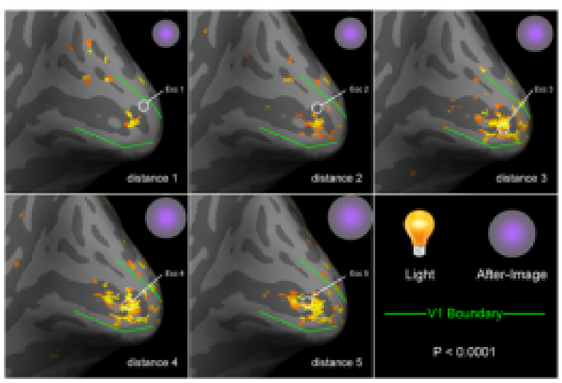
As the test subject ‘projected' an afterimage onto surfaces at different viewing distances, his or her brain was scanned in Western's 3T fMRI (functional magnetic resonance imaging) scanner. As expected, people reported that the further the surface on which they saw the afterimage, the larger the afterimage appeared to be. Remarkably, the brain scans revealed that this difference in the perceived size of the afterimage was playing out very early in the visual pathway – in a brain area that that is typically thought to reflect only what is happening on the retina.



Frame_0. Primary visual cortex at rest (there is no activation).



Frame_1. Activity in primary visual cortex in response to the light.



Frame_2. Activity in primary visual cortex in response to the afterimage.

Take the test: 'Project' your own afterimage

"We found that activation in the primary visual cortex (V1), which is an area located in the back of the brain that receives inputs from the eyes, was affected by the apparent size of the afterimage even though the information coming from the retina was always the same," says Goodale. "This suggests that V1 is a possible neural substrate for size-distance scaling."

Goodale says if the human brain didn’t invoke size constancy; the world would appear to be a very strange place indeed, with objects expanding as we moved closer to them and shrinking as we moved away.

"To maintain a stable visual world, we need to know how far away objects are from us so that our brain can make the appropriate adjustments to the size of the image coming from the retina," says Goodale. "Findings from this research are relevant not only for understanding how our brain represents the size of an object but also to understand medical conditions, such as Alice in Wonderland Syndrome, where patients experience visual distortions in which the world gets oddly smaller or bigger."

Goodale suggests that the principles illuminated by this work can also be usefully applied to computer-based recognition devices and artificial visual systems that use brain implants.

Provided by Northwestern University

Citation: New research advances understanding of size perception (2012, March 12) retrieved 26 April 2024 from https://medicalxpress.com/news/2012-03-advances-size-perception.html