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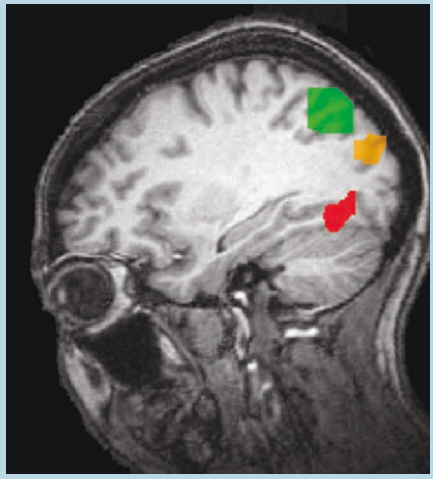
Total recall



The importance of visual short-term memory is clear to anyone who has ever played the children's card game that requires players to identify identical face-down cards at different locations. Visual short-term memory is the temporary buffer that stores visual information. Behavioral studies indicate that this buffer can store up to four objects, but more recent evidence indicates that the maximum number of objects that can be stored becomes smaller as object complexity increases. It is therefore unclear whether visual short-term memory capacity is limited to a fixed number of objects or if it is variable.

In a paper in *Nature* ('Dissociable neural mechanisms supporting visual short-term memory for objects', doi:10.1038/nature04262), Yaoda Xu and Marvin Chun resolve this controversy by using functional magnetic resonance imaging (fMRI) to dissociate object representations in parietal and occipital cortices. Observers were asked to detect a change in a simple or complex shape feature in the same set of objects. The number of objects in a set was varied. Observers did better when they had to detect a change in a simple feature and also when the number of objects was small. The authors found a similar interaction in the superior intraparietal sulcus (green in the picture) and the lateral occipital cortex (red), which tracked behavioral performance, but only for simple shape features, not complex ones. In contrast, activation in the inferior parietal sulcus (orange) tracked overall performance based only on the number of objects seen, regardless of whether observers judged simple or complex shape features. In control experiments, the authors ruled out perceptual processing limitations and spatial location as an explanation for these results, and also correlated the observed activity with the encoding and maintenance phases of visual short-term memory.

These results indicate that there are differing representations for visual short-term memory in the brain. Whereas the inferior parietal sulcus representation is fixed by the number of objects, object representation in the superior parietal sulcus and the lateral occipital cortex varies according to the complexity of the objects being held in visual short-term memory. The inferior parietal sulcus representation is thus likely to be the mechanism determining the maximum number of objects that can be held in visual short-term memory and may determine capacity limitations in tasks such as subitizing and multiple object tracking. The superior parietal sulcus and lateral occipital cortex representation are more likely to contain detailed representations of objects. These results demonstrate that visual short-term memory capacity is determined both by object number and by object complexity.

Charvy Narain

Perceived size matters

Philipp Sterzer & Geraint Rees

Activity in early visual processing areas is often thought to reflect physical input from the retina, rather than conscious perception. A new study now finds that activity in V1 corresponds to perceived rather than actual object size.

Try this quick do-it-yourself experiment: look at an illuminated light bulb for a few seconds and then view the afterimage on your hand and finally on a nearby wall. The afterimage seems bigger as the surface on which it is viewed becomes farther away. This illusion[1], reported by Emmert over one hundred years ago, demonstrates one of the most intriguing aspects of vision: even when objects cast exactly the same size pattern of light on the retina, they appear to be markedly different in size when viewed at different distances. In going from retinal image to conscious perception, the visual system is therefore able to factor in perceived distance to change how big something looks.

Exactly how the visual system achieves this feat remains unclear. It was traditionally assumed that early visual processing areas primarily reflect the physical input from the retina, whereas activity in higher-order areas more closely resembles conscious perception. Such an account would hold that the perceived size of an object would more closely match activity in higher visual

The authors are in the Wellcome Department of Imaging Neuroscience, Institute of Neurology, University College London, 12 Queen Square, London WC1N 3BG, UK and at the Institute of Cognitive Neuroscience, University College London, 17 Queen Square, London WC1N 3AR, UK.
e-mail: g.rees@fil.ion.ucl.ac.uk