3-D brain centers pinpointed

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In studies with monkeys, researchers have identified in detail the brain regions responsible for the unique ability of primates, including humans, to process visual 3D shapes to guide their sophisticated manipulation of objects.

Specifically, the researchers delineated regions of the parietal cortex responsible for extracting 3D information by integrating disparities in information from the two eyes. Such integration is critical to perceiving three dimensions, because each eye receives only a two-dimensional projection of an image on the retina.

Led by Guy Orban of Katholieke Universiteit Leuven, the researchers published their findings in the August 2, 2007, issue of the journal *Neuron*, published by Cell Press.

The researchers performed experiments in which they required monkeys to fixate on computer images of objects projected on a screen. As the animals watched the objects, the researchers scanned their brains using magnetic resonance imaging. This widely used technique involves using harmless magnetic fields and radio waves to measure blood flow in brain regions, which reveals brain activity in those regions.

In one set of experiments, the researchers presented images of connected lines, like partially unfolded paper clips, that could be perceived as three-dimensional structures. The researchers studied the influence of motion on 3D perception by presenting the connected-line images only to one eye and “moving” the objects.

The researchers' analysis of activity in regions of the parietal cortex during these experiment revealed that two areas—called the anterior intraparietal cortex and the lateral intraparietal cortex—were specifically sensitive only to depth structure.

In a second experiment, the researchers presented to the monkeys computer images that simulated small, complex objects. Perception of the three-dimensionality of small objects is central to primates' ability to grasp and manipulate with their hands. The researchers' analysis of the animals' brain activity revealed that the same intraparietal regions are also uniquely sensitive to the depth structure and two-dimensional shape of such objects.

"This study goes beyond previous imaging studies by demonstrating not only that different parietal areas process distinct aspects of visual 3D space in line with their involvement in distinct sensorimotor functions, but also that 3D shape features are specifically represented in anterior intraparietal regions, where such information is required for the efficient control of hand manipulation tasks," concluded the researchers.

Source: Cell Press