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A new look at recognizing what people see

Scientists have long struggled to determine how the brain sorts out its jumble of visual information to recognize objects. Many studies have indicated that the brain dedicates separate regions, or modules, to the identification of different objects that meet the eye. For example, studies of stroke patients have linked damage in particular brain regions to specific deficits in visual abilities, such as recognizing faces.

A new study, however, suggests that broad regions of the brain sometimes work together to make sense of what people see. Alumit Ishai and her coworkers at the National Institute of Mental Health in Bethesda, Md., used magnetic resonance imaging (MRI) to track brain activity as volunteers viewed photos or line drawings of three types of objects: human faces, houses, and chairs.

The researchers had predicted that houses and chairs would activate the same areas in the temporal cortex, whereas faces would activate another module. "The motivation for the study was the dual-system hypothesis, that faces have a special neural machinery that is different from the general mechanism that processes all other objects," says Ishai. "When we analyzed the data, we had a big surprise."

The MRI images revealed that each object activated different hot spots in the ventral temporal cortex, the part of the brain widely believed to be involved in recognizing objects sensed by the eye. Houses most strongly activated an area called the medial fusiform gyrus, whereas the hot spot for chairs was the inferior temporal gyrus. A third area, the lateral fusiform gyrus, lit up brightest in response to faces, the researchers report in the Aug. 3 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

The researchers also found a significant amount of activity shared between these regions. Although the medial fusiform gyrus responded most strongly to images of houses, chairs also prompted appreciable activity in this region. Likewise, the areas that lit up brightest in response to chairs or faces were also stimulated by houses. This finding, the researchers say, suggests that recognizing images triggers activity across multiple areas of the brain rather than in discrete, specialized modules.

Nonetheless, Ishai's group did find indications that face recognition is more localized than is recognition of other objects. They observed less shared activity between the region most strongly activated by faces and each of the others than they observed between the regions best activated by houses and by chairs.

The amount of attention volunteers paid to objects made less difference in the results for faces than it did for houses and chairs. This suggests that faces may spark recognition more automatically than other objects do.

"I think, in general, the motivation for the [research] is exactly right and very important," comments Nancy Kanwisher of the Massachusetts Institute of Technology. "Given all the evidence that there is some degree of specialization in the visual pathways, it's important to ask whether you find specialization for any old category."

However, Kanwisher suggests, Ishai's group may be "slightly downplaying the degree of specialization" in the temporal cortex. "Even a module that is specialized for processing just one kind of object would still be expected to engage partially on other kinds of objects, so the distributed responses reported by Ishai do not strongly argue against a modular view," she contends.

"This is an important paper because it tackles a very simple but very fundamental question about how the brain represents knowledge," remarks Martha Farah of the University of Pennsylvania in Philadelphia. "There is no more fundamental question in cognitive neuroscience than how a bunch of neurons can implement knowledge."

—S. Carpenter