

gions. The rest of the cells tested responded to contrast-defined borders, as expected, but weakly or not at all to the illusory borders.

The work shows, Shapley says, that some V1 cells can respond to borders and not just to contrast differences and indicates a previously unsuspected role for these cells in contour and form processing. "If the findings hold up, it suggests that V1 processing is more complex than we thought, that more is going on than just a simple filtering based on orientation, motion, and color," agrees Lewis and Clark's Meyer.

As for why Shapley's group found that some V1 cells can respond to borders, while his group didn't, von der Heydt suggests it's because he used a different type of pattern. In contrast to the texture borders tested by the New York group, the illusory contours in von der Heydt's patterns appeared in gaps of empty space between visual elements. It's possible, he asserts, that V1 cells do not respond to the gap type of contour, although this remains to be proven. Indeed, says vision scientist Norma Graham of Columbia University, the patterns employed by Shapley are a "more powerful tool" for trying to understand how cells see contour because they enable researchers to gather precise data that can help verify or refute various models of how the visual system works.

In any event, the existence of a novel class of contour-sensitive cells in V1 suggests to Shapley a new cellular mechanism for how the brain processes information about forms in the initial stages of seeing. He proposes that V1 contains at least two types of cells, each with a different function in perceiving forms against a visual background. The classic V1 cells enable us to perceive local areas of contrast within an object or across its border with the background. The novel cell type, meanwhile, may be responsible for our ability to see an object's contours, whether or not there is contrast difference between the object and its background.

Shapley tailored his proposed mechanism, he says, to fit with the natural way people perceive an object's borders, which are seen separately from its brightness or shading. "If you have an object with a gradation in contrast across it, the brightness of the object tends to be determined by the local contrast across the border. But the object stands out from the background independent of what the local brightness is," he explains.

The findings of Shapley's team reveal a new beginning for the process by which the brain extracts forms from visual scenes. But what happens later on—how strips of contour are integrated into perception of a whole object—remains a mystery. "What we've seen in neurons are just signals that indicated pieces of a certain orientation and location," von der Heydt says. "As yet, we don't have evidence for the perception of a whole figure such as a closed rectangle," an analysis with

which Shapley agrees. "We have no idea about that at all—at least, from a physiological point of view."

He speculates, nevertheless, that the new visual work may also be related to sensory processing generally. "We see that there are these very sophisticated and specific wiring tasks being performed," notes Shapley. He suggests that similarly specific processes may be operating to cull out relevant features from

other sensory "spaces," such as those we perceive by listening to, or touching, the world. But, of course, tracing out the exact tasks performed at each stage of sensory processing will take much more probing of the brain.

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## PALEOANTHROPOLOGY

### An About-Face for Modern Human Origins

When the Chinese and American anthropologists looked at two 350,000-year-old skulls found recently in China, the two researchers had a flash of self-recognition: The unusually complete skulls have flattened faces that look remarkably like those of modern humans—even though some of the skulls' other features appear sufficiently ancient that they have been classified as belonging to *Homo erectus*, a primitive hominid that spread from Africa at least 1 million years ago. And those modern-looking features have stirred up a controversy: They prompted archeologist Li Tianyuan of the Hubei Institute of Archeology and Dennis Etlar, a paleoanthropologist who is a doctoral candidate at the University of California, Berkeley, to propose in the 4 June *Nature* that ancient hominids living in Asia could have been among the ancestors of modern humans.

The suggestion is controversial because it flies in the face of a leading, albeit embattled, theory that modern humans evolved only in Africa as recently as 150,000 years ago. According to this "Out of Africa" hypothesis, early modern *Homo sapiens* left Africa about 100,000 years ago, rapidly moving around the globe and displacing other, more archaic hominids in Europe and Asia. This theory, based on fossils and the analysis of mitochondrial DNA, already suffered a major blow earlier this year when problems were found with the way the genetic data were analyzed (*Science*, 7 February, pages 686 and 737). And now come Li and Etlar with the claim that the recently discovered skulls provide fossilized evidence to support another theory—that modern humans evolved in several places through much of the Old World, including Asia.

The new fossils, which were excavated in 1989 and 1990 near the Han River in Yunxian in Hubei province, were found crushed in sediments that are tough to date. Based on preliminary indications from associated fauna, however, Chinese archeologists have determined that they are at least 350,000 years old, which would make them the most complete skulls of such great age ever found in Asia.

Last year, Li traveled to Berkeley to compare them with casts of fossils of similar age. While he was there, he teamed up with Etlar,



**Flat face.** A skull from China may shed light on the evolution of modern humans.

who went to China in the summer of 1991 to study the skulls with Li. They concluded that the shape of one of the skulls and its long, low cranial vault made it *Homo erectus*. But "the facial structure is much more modern looking than what you see in hominids that were living at the same time in Africa and Europe," says Etlar. "This shows that modern features were emerging in different parts of the world."

Not so fast, say some other paleoanthropologists. "I'm skeptical of their claim across the board," says *Homo erectus* expert Philip Rightmire of the State University of New York at Binghamton, a leading proponent of the Out of Africa theory. The dating is poor, he claims, and the specimens need more preparation, such as cleaning and putting the crushed pieces together in a proper reconstruction.

Equally skeptical is another proponent of the Out of Africa hypothesis, paleoanthropologist Christopher Stringer of the Natural History Museum in London. Stringer says that "modern" features described by Li and Etlar also appear in African fossils of equal age. "I would say the facial features they're talking about are primitive," he asserts. Such flattened features also are found in the Nduetu hominid fossil from Tanzania, a specimen from Thomas Quarry in northern Africa, and an upper jaw from Broken Hill in Zambia, he says. More work must be done on the Chinese skulls before claims can be made about their unique modern features, he says: "It's very important material, but I think it's far too early to say if it really changes the arguments about the origins of modern humans."

—Ann Gibbons