Breakthroughs

THE BRAIN

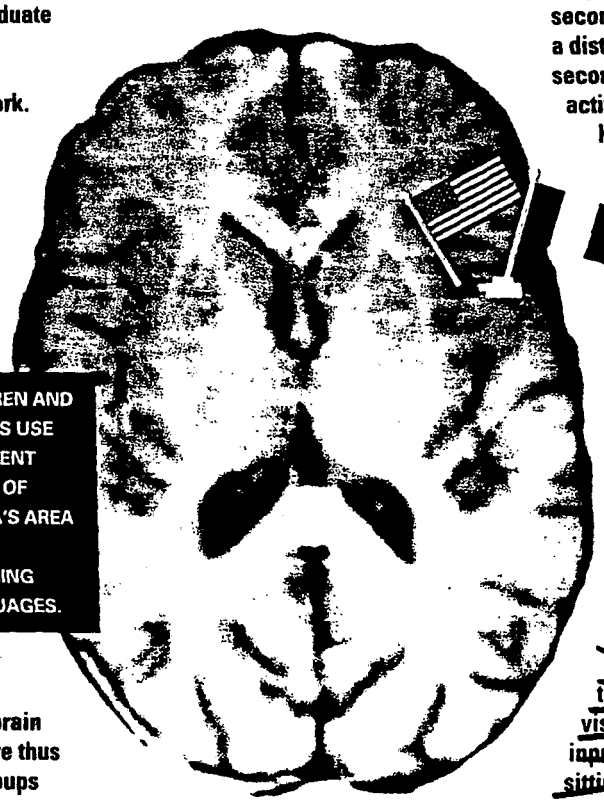
The Bilingual Brain

WHEN KARL KIM immigrated to the United States from Korea as a teenager ten years ago, he had a hard time learning English. Now he speaks it fluently, and recently he had a unique opportunity to see how our brains adapt to a second language. Kim is a graduate student in the lab of Joy Hirsch, a neuroscientist at Memorial Sloan-Kettering Cancer Center in New York. He and Hirsch have recently found evidence that children and adults don't use the same parts of the brain when learning a second language.

The researchers used an instrument called a functional magnetic resonance imager to study the brains of two groups of bilingual people. One group consisted of those who had learned a second language as children. The other consisted of people who, like Kim, learned their second language later in life. When placed inside the MRI scanner, which allowed Kim and Hirsch to see which parts of the brain were getting more blood and were thus more active, people from both groups were asked to think about what they had done the day before, first in one language and then the other. (They couldn't speak out loud, because any movement would disrupt the scanning.)

Kim and Hirsch looked specifically at two language centers in the brain—Broca's area, in the left frontal part, which is believed to manage speech production, and Wernicke's area, in the rear of the brain, thought to process the meaning of language. Both groups of people, Kim and Hirsch found, used the same part of Wernicke's area no matter what language they were speaking. But their use of Broca's area differed.

People who learned a second language as children used the same region in Broca's area for both languages. But those who learned a second language later in life made use of a distinct region in Broca's area for their second language—near the one activated for their native tongue.



CHILDREN AND ADULTS USE DIFFERENT PARTS OF BROCA'S AREA WHEN LEARNING LANGUAGES.

How does Hirsch explain this difference? "When language is being hard-wired during development," says Hirsch, "the brain may intertwine sounds and structures from all languages into the same area." But once that wiring is complete, the management of a new language, with new sounds and structures, must be taken over by a different part of the brain.

A second possibility is simply that we may acquire languages differently as children than we do as adults "If you watch mothers or family members teaching an infant to speak," says Hirsch, "it's very tactile, it's very auditory, it's very visual. There are a lot of different inputs. And that's very different from sitting in a high school class."

Robot Nomad of the Desert

While NASA's Sojourner robot spent its summer exploring Mars, another plucky robot was being put through its paces on tough terrain here on Earth. On June 18, Nomad—a truck-size robot developed by engineers at Carnegie Mellon and NASA—embarked on a trek across Chile's barren Atacama Desert. The 1,600-pound four-wheeled machine was driven by operators in the United States via a satellite link and covered 133 miles during its month-and-a-half-long journey. Speeds peaked at around a mile an hour. Nomad wasn't built for speed, though. It was designed to test a number of new technologies for planetary exploration, including a camera capable of sending 360-degree video images to operators back home, sensors and metal detectors for uncovering meteorites, and a new navigational system called "safeguarded teleoperation." "Nomad is operated remotely, but it detects the terrain coming up, and if there is anything dangerous, it will steer around it or stop," says graduate student Martin Martin of Carnegie Mellon. To avoid the expense of solar panels, Nomad's batteries were charged by a gasoline generator, which handlers refueled every night. Solar panels would replace those generators on a real space mission. D