

NEUROSCIENCE

Can't Touch This Feeling

Primates can now move and sense the textures of objects using only their thoughts

When real brains operate in the real world, it's a two-way street. Electrical activity in the brain's motor cortex speeds down the spinal cord to the part of the body to be moved; tactile sensations from the skin simultaneously zip through the spinal cord and into the brain's somatosensory cortex. The two actions are virtually inseparable: absent the feel of a floor under your feet, it's awfully difficult to walk properly, and lacking the tactile sensation of a coffee mug, your brain cannot sense how tightly your fingers should grasp it. Until now, attempts to help paralyzed patients move a prosthetic have addressed only half of our interaction with the world. A new study offers hope of expanding that capacity.

Scientists led by Miguel Nicolelis, professor of neurobiology at Duke University Medical Center, have reported the first-ever demonstration in which a primate brain not only moved a "virtual body" (an avatar hand on a computer screen) but also received electric signals encoding the feel of virtual objects the avatar touched—and did so clearly enough to texturally distinguish the objects. If the technology, detailed in the journal *Nature*, works in people, it would change the lives of paralyzed patients. (*Scientific American* is part of Nature Publishing Group.) They would not only be able to walk and move their arms and hands, Nicolelis says, but also to feel the texture of objects they hold or touch and to sense the terrain they tread on.

Other research groups are working on similar advances. At the University of Pittsburgh, neuroscientists led by Andrew Schwartz have begun recruiting patients paralyzed by spinal cord injury into a similar trial that would allow them to "feel" the environment around them thanks to electrodes in the somatosensory cortex that receive information from a robot arm.

Nicolelis hopes to bring his research to fruition by 2014, when he plans to unveil the first "wearable robot" at the opening game of soccer's World Cup in his home country of Brazil. Think *Iron Man*, a full-body, exoskeletonlike prosthetic. Its interface will be controlled by neural implants that capture signals from the motor cortex to move legs, hands, fingers and everything else. And it will be studded with sensors that relay tactile information about the outside world to the somatosensory cortex. Buoyed by the advances so far, Nicolelis predicts that the device will be ready in time. "It's our moon shot," he says. —Sharon Begley

Macaque monkey