NATURE | NEWS

Toy helicopter guided by power of thought

Technology to pilot aircraft with brainwaves offers promise for prosthetics.

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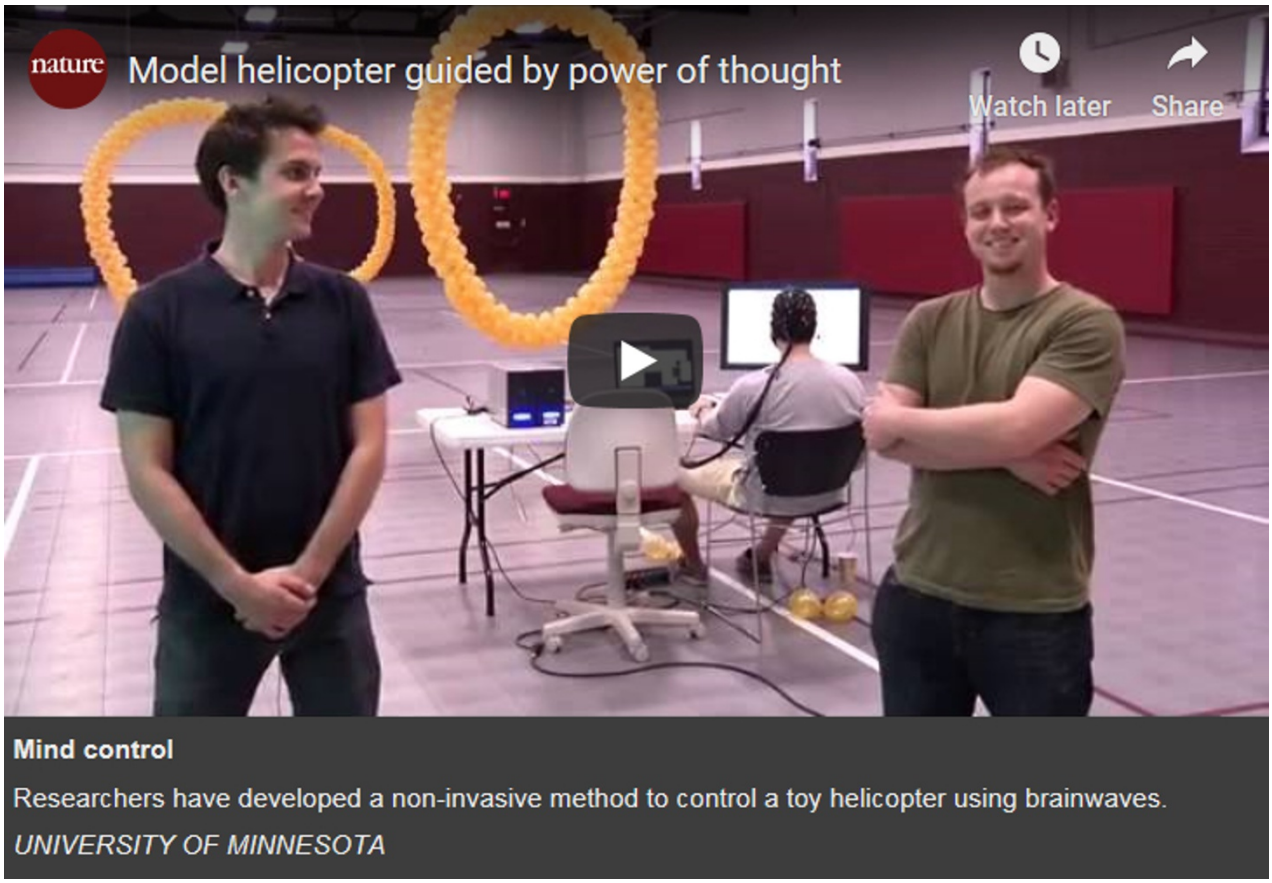

Mind control

Researchers have developed a non-invasive method to control a toy helicopter using brainwaves.

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A model helicopter can now be steered through an obstacle course by thought alone, researchers report today in the *Journal of Neural Engineering*. The aircraft's pilot operates it remotely using a cap of electrodes to detect brainwaves that are translated into commands.[1]

Ultimately, the developers of the mind-controlled copter hope to adapt their technology for directing artificial robotic limbs and other medical devices. Today's best neural prosthetics require electrodes to be implanted in the body and are thus reserved for quadriplegics and others with disabilities severe enough justify invasive surgery.

"We want to develop something non-invasive that can benefit lots of people, not just a limited number of patients," says Bin He, a biomedical engineer at the University of Minnesota in Minneapolis, whose new results build on his previous work with a virtual thought-controlled helicopter.[2]

But He's mechanical whirlybird isn't the first vehicle to be flown by the brain. In 2010 a team at the University of Illinois at Urbana-Champaign reported an unmanned aircraft that flies a fixed altitude but adjusts its heading to the left or right in response to a user's thoughts.[3]

The new chopper goes a step further. It can be guided up and down, as well as left or right, and it offers more precise control. To move it in a particular direction, a user imagines clenching his or her hands — the left one to go left, for instance, or both to go up. That mental image alters brain activity in the motor cortex. Changes in the strength and frequency of signals recorded by electrodes on the scalp using electroencephalography (EEG), and deciphered by a computer program, reveal the pilot's intent.

Using the Force

Fine-tuning this brain–machine interface required long hours of flight school. Would-be pilots first learned to move a cursor on a computer screen in one dimension, then in two. Some flunked out, unable to provide a signal clear enough for the computer to spot. Developer He suspects a lack of mind-body awareness may be to blame for the dropouts; his previous work showed that people who meditate or practice yoga more easily learn to mentally manipulate cursors.

In this case, five subjects who graduated moved the helicopter while watching a live video feed from an on-board camera. As the vehicle slowly glided forward, they steered it through a series of large foam rings — about one-fourth as many, on average, as someone using a keyboard controller could when navigating the same course.

"This is among the most provocative demonstrations of using EEG for motor control," says neuroscientist Todd Coleman of the University of California, San Diego.

The University of Minnesota team already has an EEG-controlled robotic arm in the works that can move in two dimensions. But the researchers will need to figure out how to extract even more information from EEG signals to compete with state-of-the-art prosthetics controlled by implanted electrodes.

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References

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