



# We know what you're thinking: Scientists test brain-to-brain communication

By

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What if you could communicate with another person only using your mind? The concept might sound far-fetched, but a team of neuroscientists and robotics engineers have inched the possibility of brain-to-brain communication away from the science fiction of "Star Trek's" Vulcan mind meld and closer to reality. In a recent study published in *PLOS ONE*, the international team of researchers from Starlab Barcelona in Spain and Strasbourg, France-based Axilum Robotics facilitated computer-mediated brain-to-brain transmissions of simple salutations like "hola" and "ciao" between participants 5,000 miles away from one another.

The researchers used electroencephalogram (EEG) and image-guided transcranial magnetic stimulation (TMS) technologies to transmit the greetings between test subjects from India to France in one study and from Spain to France in another.

In the studies, electrodes were attached to a participant's scalp on the "emitter" end. That person would 'think' a greeting like "hola," and that information – gleaned through electrical currents read by the EEG technology – would be translated to binary code (a sequence of 1s and 0s) and then emailed to the receiver's destination. The person on the receiving end would get the transmissions as a series of phosphenes, or flashes of light, seen in their peripheral vision. The light was received in a numerical sequence, with each "flash" corresponding to a different letter.

The four participants who were part of the study were all part of the research team, and were each carefully trained to read the signals that were being transmitted.

"It's not exactly a straightforward thing," said Alvaro Pascual-Leone, a co-author of the study and director of the Berenson-Allen Center for Noninvasive Brain Stimulation at the Beth Israel Deaconess Medical Center in Boston. "Our mind wanders, somebody walks by, or something disrupts you and the strain of thought is lost. So, we really needed focused, attentive emitters to make this work."

The study took a couple of years of trial and error in order to get it right, Pascual-Leone, who is also a professor at Harvard Medical School, told FoxNews.com. This involved training the test subjects and testing the reliability of the robotics and technology involved.

The collaboration between the Starlab team, which was lead by its CEO Giulio Ruffini – the study's first author – and Axilum Robotics came from a need to ensure that the repetitive process of testing and retesting of the non-invasive brain readings could be as precise as possible.

In order to ensure this accuracy, Pascual-Leone's team approached Axilum Robotics because it had previously developed the first-ever robot designed for TMS, wrote the robotics company's CEO Michel Berg in an email to FoxNews.com. Given that a TMS coil needs to be specifically positioned in order for a test subject to read the phosphenes, or light flashes, Berg wrote that robotics technology was the best choice for this research since "doing this by hand is not sufficiently precise."

Pascual-Leone emphasized that the simple brain transmissions do not make way for mind-reading. Meant as a simulation to test the possibility of effective brain-to-brain communication, the study does hint at the possibility of what Pascual-Leone said could one day be a breakthrough in communications across multiple fields.

"I'm a neurologist, so the benefits of this always seemed evident. Brain-to-brain communications could help nations that have problems communicating or perceiving one another," Pascual-Leone said. "It can also help people who cannot talk, who have some form of paralysis."

While there are obvious benefits to this kind of communications innovation, Pascual-Leone cited some potential ethical dilemmas that come from technology that enables direct "conversations" between minds.

"The potentially ethically delicate issues have to be addressed. It brings up questions of influencing the thought processes of individuals, which always enters a grey area," he said. "Or think of how it could be used in war, where you might want to 'talk' without generating sound. It could lead to some dangers."

Of course, all of this is highly speculative, and Pascual-Leone reiterated that people are far-removed from the possibility of mind control.

"I don't think this is some utopian ideal of minds speaking with one another. We are in the very early stages of this principle," Pascual-Leone said. "The information that we have at our disposal nowadays is growing exponentially. It's a huge change. I think this fits into the huge shifts in ways we communicate and share all of this information."

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