

## Neuroscience of free will: Does reaching for beer with robotic arm mean free will doesn't exist?

With the help of an electrode implanted in his brain, [Erik Sorto](#) can direct his robotic arm to calmly drink a beer. Some scientists and others think this means that “free will” doesn't really exist.

Sorto had not been able to use his arms or legs after an accident severed his spinal cord 12 years ago. Some patients with this injury get a surgical implants—electrodes that hook up nerves in the limbs to the motor cortex in the brain. By bypassing the spinal cord injury site, the electrodes can induce movement. Most of this action, however, is jerky and awkward and not timed very well as the patient is forced to concentrate on the vast number of small movements needed to just reach for something.

But [researchers at CalTech](#) tried something different with him. Instead of hooking up electrodes to the motor cortex, they choose another site in the brain: The posterior parietal cortex is another part of the brain that controls actions like limb movements, but it does so on a far more sophisticated level than the motor cortex. The posterior parietal is involved in the planning of movements, and much of this planning is unconscious. So, when the CalTech team implanted electrodes in Soto's posterior parietal, they found that they could predict movements before he actually made them. And once the brain signals doing the predicting were known, they could be used to smoothly move his limbs. Essentially, the electrode was helping him unconsciously decide to move his arms, hands and fingers. Which made beer drinking all the easier.

The fact that scientists can chart the brain's behavior [has led many](#) to revisit an old argument over the existence of free will. If we can predict a person's intentions just by picking up brain signals (and it took a computer two years to predict Sorto's), then how free are our minds? How many decisions that we make every day are truly under our conscious control? Is there really free will?

This philosophical, often theological, debate has raged for centuries. The neuroscience of free will probably started in the mid-1980s with experiments by the late [Benjamin Libet](#), a neuropsychologist at the University of California, San Francisco. Libet found this predictive behavior when studying participants who were watching a clock. He found that electroencephalogram readings recorded brain activity milliseconds before the participants consciously pointed to a dot on the clock. And neuroscientists have been [trying to translate](#) this predictive behavior ever since.

Much of this work and the debates surrounding it appear to depend on how one defines “free will.” [Some scientists](#) have concluded that any conscious or unconscious predictive activity means that there is no free will. But “part of what's driving some of these conclusions is the thought that free will has to be spiritual or involve souls or something,” Al Mele, a philosopher at Florida State University [told Nature](#).

Some philosophers look at free will as material, emanating like everything else from a physical basis. To them, the scientist's rejection of free will isn't important, because they think everything comes from brain activity anyway. Others are more concerned with determinism, the idea that everything is predestined and that we can't do much about our actions. This group looks at these neuroscience studies as predicting

individual actions, but not to a larger issue of whether we're here randomly, or for a purpose.

### **Free will “theory lite”**

Stepping down a few steps from an academic tower, scientists at [George State University](#) gauged what a group of undergraduate students thought of free will, and whether predictive activity in the brain undermined the idea. They didn't think it did. When asked about a hypothetical “cap” that would allow anybody to predict a person's decision, the students didn't feel that free will was threatened by knowing the decision in advance. The only issue with free will, the students felt, arose if a doctor or scientist could somehow manipulate the decision. The study's authors referred to this idea as “theory-lite” free will, which may be similar to some philosophers who don't see a disconnect between mental and neural activity.

The arguments and research do have implications beyond philosophy and basic neuroscience. And the CalTech team that put the implant in Sorto is looking about whether the same cortical area can direct more complicated tasks. But if free will is nothing more than “my brain made me do it,” this has a lot of implications for determine guilt in a criminal trial, or getting people to learn something new, or perhaps even preventing a war from breaking out. All much more complicated than reaching for a beer.

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