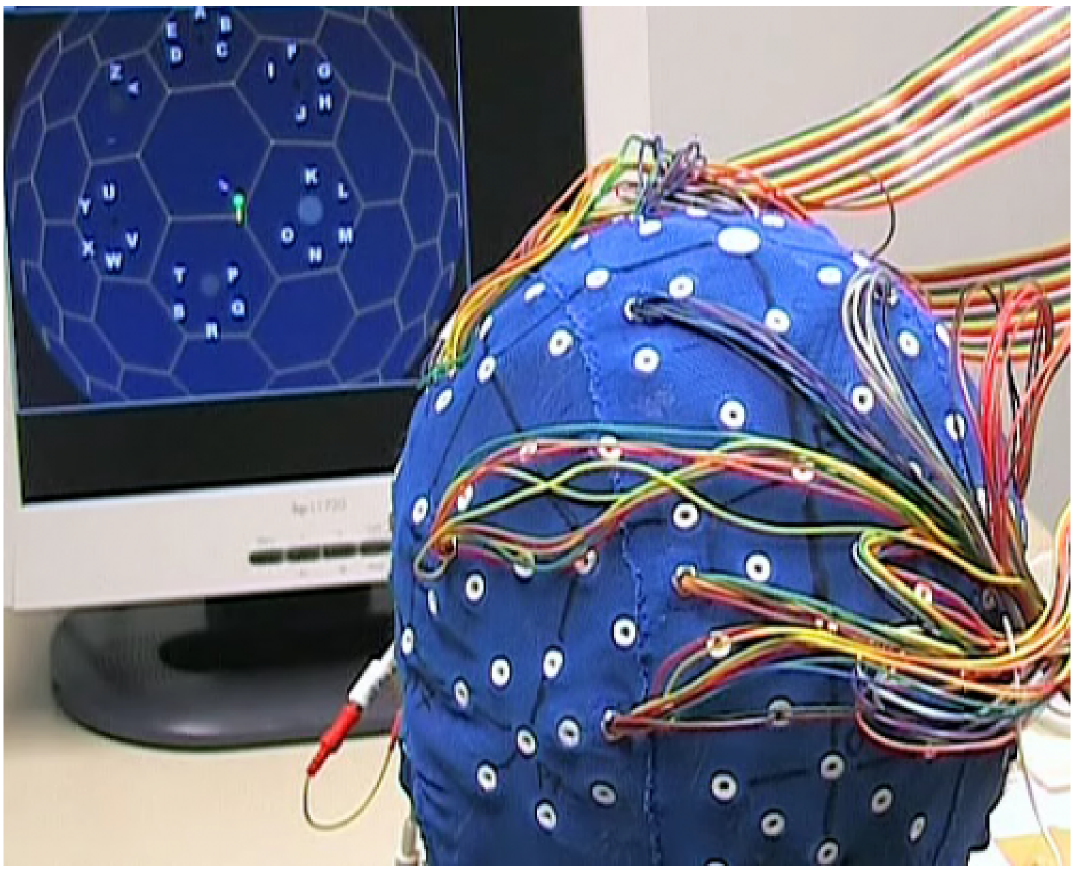
Researchers find people learn to use brain-computer interfaces the same way as other motor skills

June 11 2013, by Bob Yirka

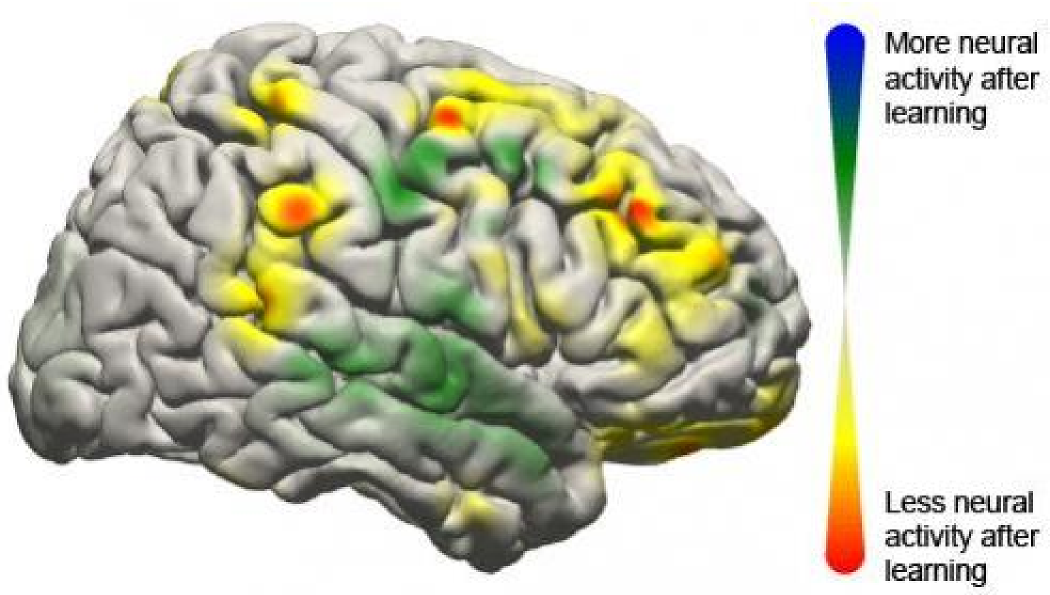


Brain computer interface. Credit: Glasgow University

(Medical Xpress)—Researchers at the University of Washington have found that people who learn to control an object on a computer screen using only their thoughts, do so in ways that are very similar to the ways people learn other motor skills. In their paper published in *Proceedings of the National Academy of Sciences*, the researchers describe how they monitored data from brain probes in epilepsy patients to learn more about how the human brain learns to control machines with thoughts.

For several years scientists have known that people are able to control devices using only their thoughts—probes listen for brain waves and react to discernible patterns. What's not been clear, however, is how the brain responds to such devices.

To find out more, the research team worked with another team that was investigating how epilepsy works in the human brain. Seven volunteers had already had brain probes implanted for long term study. Each of the volunteers was asked to control the path of a cursor as it moved from the left side of a computer screen to the right. As they did so the researchers recorded brain wave activity throughout the brain, initially focusing on data from the electrodes that exhibited the most increase in brain wave activity. As the patient controlled the cursor, the researchers could see that many parts of the brain lit up, indicating a large neural network was involved in the learning process. That was expected. What was new was that as the patients began to master mind-controlling the cursor, the entire network began to quiet—neural network activity decreased just as occurs when a person is learning something new that requires motor skills, such as riding a bicycle or playing guitar. This suggests that people learn to control external computer devices in much the same way as they learn how to do things with their bodies.



This image shows the changes that took place in the brain for all patients participating in the study using a brain-computer interface. Changes in activity were distributed widely throughout the brain. Credit: Jeremiah Wander, U. of Washington

There is one very large difference between the two types of learning processes, of course, and that is the type of feedback involved. When people learn to ride a skateboard, for example, they can feel what is happening. They use data coming in from their limbs as well as from their eyes. Moving a cursor across a screen or a wheelchair across a room using only thoughts means the person is relying on visual data alone to make adjustments. Still, knowing that people are learning in ways similar to other activities should be of use to researchers looking to create new devices for people to control with their minds.

More information: Distributed cortical adaptation during learning of a brain–computer interface task, *PNAS*, Published online before print June 10, 2013, doi: 10.1073/pnas.1221127110

Abstract
The majority of subjects who attempt to learn control of a brain–computer interface (BCI) can do so with adequate training. Much like when one learns to type or ride a bicycle, BCI users report transitioning from a deliberate, cognitively focused mindset to near automatic control as training progresses. What are the neural correlates of this process of BCI skill acquisition? Seven subjects were implanted with electrocorticography (ECoG) electrodes and had multiple opportunities to practice a 1D BCI task. As subjects became proficient, strong initial task-related activation was followed by lessening of activation in prefrontal cortex, premotor cortex, and posterior parietal cortex, areas that have previously been implicated in the cognitive phase of motor sequence learning and abstract task learning. These results demonstrate that, although the use of a BCI only requires modulation of a local population of neurons, a distributed network of cortical areas is involved in the acquisition of BCI proficiency.

Press release