Seeing color in 'blindsight'

October 27 2008

By manipulating the brain noninvasively in a new way with magnetic stimulation, researchers have shown that they can restore some experience of color where before there was no visual awareness whatsoever. They report their findings in the October 28th issue of *Current Biology*, a Cell Press publication.

The researchers made their discovery while studying a patient known as GY, who lacks vision in half of his visual field as a result of damage in one hemisphere of the primary visual cortex (a brain region also known as V1). That part of the brain had been considered absolutely essential for visual awareness, a notion that is challenged by the current findings, according to Juha Silvanto of the University of Essex.

"The implication is that even though [lesions in this part of the brain] abolish visual awareness, it can be restored," Silvanto said. "The neural processes that make V1 critical may be taken over by other brain regions—not automatically, but you can make it happen."

In the portion of his visual field controlled by the damaged part of the brain, GY has a condition called blindsight. This phenomenon can occur when people do not consciously see as a consequence of a V1 lesion. However, when forced to guess which way a moving object they "observed" was traveling, for instance, they get it right most of the time. In other words, despite the fact that they do not experience vision, they nonetheless continue to detect things around them.

In the new study, the researchers applied a method called transcranial

magnetic stimulation (TMS) to GY's primary visual cortex. By stimulating both the normal and the damaged hemispheres of the brain, the method can induce visions of flashes of light (or phosphenes) in the blind fields of people like GY.

This method has previously been used in a general way to stimulate entire brain regions. In the new study, Silvanto's team developed a more targeted method to activate particular neurons with TMS by taking advantage of a trend that had been seen before: TMS preferentially activates those neurons that were less active to begin with.

They asked GY to look at a screen in the color red for a time; this adapts the brain to the color red, leaving the neurons responsible for the experience of red to become less active. They then applied TMS to GY's damaged and intact visual processing centers. The result: he saw the color red.

"This was the first time this patient [consciously] experienced a colored visual percept in his blind field," Silvanto said.

"In summary," the researchers wrote, "our results show that in the absence of V1, color perception may be possible via the intact hemisphere."

The more targeted TMS method the team developed is also an important technical advance for cognitive neuroscience, Silvanto added. "Now we can target the stimulation at specific populations of neurons," he said. "It makes the resolution of the technique much higher."

Source: Cell Press