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Researchers find learning in the visual brain

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A team of researchers from the University of Minnesota's College of Liberal Arts and College of Science and Engineering have found that an early part of the brain's visual system rewires itself when people are trained to perceive patterns, and have shown for the first time that this neural learning appears to be independent of higher order conscious visual processing.

The researchers' findings could help shape training programs for people who must learn to detect subtle patterns quickly, such as doctors reading X-rays or air traffic controllers monitoring radars. In addition, they appear to offer a resolution to a long-standing controversy surrounding the learning capabilities of the brain's early (or low-level) visual processing system.

The study by lead author Stephen Engel, a psychology professor in the College of Liberal Arts, is published in the Nov. 10 issue of the Journal of Neuroscience.

"We've basically shown that learning can happen in the earliest stages of visual processing in the brain," Engel said.

The researchers looked at how well subjects could identify a faint pattern of bars on a computer screen that continuously decreased in faintness. They found that over a period of 30 days, subjects were able to recognize fainter and fainter patterns. Before and after this training, they measured brain responses using EEG, which records electrical activity along the scalp produced by the firing of neurons within the

brain.

"We discovered that learning actually increased the strength of the EEG signal," Engel said. "Critically, the learning was visible in the initial EEG response that arose after a subject saw one of these patterns. Even a tiny fraction of a second after a pattern was flashed, subjects showed bigger responses in their brain."

In other words, this part of the brain shows local "plasticity," or flexibility, that seems independent of higher order processing, such as conscious visual processing or changes in visual attention. Such higher order processing would take time to occur and so its effects would not be seen in the earliest part of the EEG response.

Engel says these finding may also help adults with visual deficits such as lazy eye by accelerating the development of training procedures to improve the eye's capabilities.

More information: "Perceptual Learning Increases the Strength of the Earliest Signals in Visual Cortex," *Journal of Neuroscience*.

Provided by University of Minnesota