MedicalXpress

How the brain sends eyeballs bouncing

November 7 2007

All vision, including reading this sentence, depends on a constant series of infinitesimal jumps by the eyeball that centers the retina on target objects—words or phrases in the case of reading. Such jumps, or saccades, are critical to vision because only the small central region of the retina, called the fovea, produces the clear image necessary for perception. Such saccades take place several times a second and are generated within a brain region known as the frontal eye field (FEF).

In studies with monkeys, Robert Schafer and Tirin Moore have taken an important step in understanding how circuitry of the FEF generates saccades—with the FEF's attentional circuitry governing the motor circuitry that produces saccades. The researchers published their findings in the November 8, 2007, issue of the journal *Neuron*, published by Cell Press.

In a preview of the paper in the same issue of Neuron, Stefan Everling wrote that the researchers' findings "are exciting, because they demonstrate that attention and action interact more closely in the FEF than previously thought, and they suggest a mechanism by which attention can modulate saccade motor commands." Everling is at the University of Western Ontario in Canada.

In their experiments, Schafer and Moore took advantage of a well-known optical phenomenon involving the influence of the motion of a drifting grating on saccades that target the grating. The moving grating causes a motion-induced bias of saccades; for example, if the eye makes a saccade to a grating that is drifting upward, that saccade to the grating

is biased to land higher than it would if the grating were stationary.

The researchers trained monkeys to shift their gaze to such moving gratings upon command, in return for a juice reward. During the experiments, the researchers used eyetracking to precisely measure the direction of the animals' gaze. After measuring how the saccades were influenced by the grating motion, the researchers then electrically "microstimulated" the FEF. They then analyzed how such microstimulation affected the saccades to moving gratings.

The researchers said their analyses "indicate that the attentional effects of microstimulation determine the metrics of concurrently planned saccades, causing them to be more strongly influenced by the visual target features." They wrote that even though the two roles of FEF circuitry—attention and motor—can be experimentally teased apart, "our results suggest that the saccadic role depends on the attentional role to select the features of the visual target and the best movement to foveate it."

Source: Cell Press

Citation: How the brain sends eyeballs bouncing (2007, November 7) retrieved 23 April 2024 from https://medicalxpress.com/news/2007-11-brain-eyeballs.html

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