Why does the world appear stable while our eyes move?

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Whenever we shift our gaze, attention is directed to a new target. This shift in attention causes a brief compression of visual space, according to a study published February 15 in the open-access journal *PLoS Computational Biology*.

The team of researchers from the University of Münster, Germany, describes a model of brain function in which eye movement signals are used to boost the neural representation of objects located at the future eye position. This boost comes at the expense of a temporary loss of spatial accuracy. This research shows a direct correlation between visual perception and eye movement control.

Humans move their eyes 2-3 times a second without noticing. Each gaze shift triggers a host of internal brain processes with very delicate timing. The gaze shift is preceded by a brief shift of attention towards the new gaze target so that visual processing at the target area improves some 50 milliseconds before the eye itself looks at the target. This preceding improvement increases the sensitivity of visual neurons in many brain areas, which then respond more strongly to stimuli near the gaze target just prior to the gaze movement.

Using a detailed neuro-computational model of the representation of the visual world in cortical maps, the researchers investigated the consequences of these sensitivity changes to the perception of spatial location. Their results showed that objects presented just before the eye movement appear to lie at the gaze target rather than at their true spatial

location, akin to a compression of visual space. Moreover, this model explains a peculiar finding that neurons in some brain areas appear to move their receptive field, i.e. the visual direction to which they respond, prior to eye movement. Analysis of the net effect of all receptive field changes in the model shows that the brain dynamically recruits cells for processing visual information around the target. This increase in processing capacity presumably allows one to perceive details of the object before looking at it, therefore making the world appear stable while we move our eyes.

This new model prompts many predictions that can guide experimental research – one step towards theory driven brain research. The model also paves the way to develop novel concepts for artificial vision systems.

Citation: Hamker FH, Zirnsak M, Calow D, Lappe M (2008) The peri-saccadic perception of objects and space. PLoS Comput Biol 4(2): e31. doi:10.1371/journal.pcbi.0040031 (compbiol.plosjournals.org/perl … journal.pcbi.0040031)

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