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Title: Changes of visual response properties in area MT due to eye movements
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Abstract:
Humans perform about three eye movements a second. Each of these eye movements changes the physical image on the retina, but despite them we perceive the visual world as perceptual stable. Researchers showed that the visibility of targets presented around fast eye movements is reduced (saccadic suppression) and their perceived localizations are altered. Our goal is to understand the neural computations underlying these effects and generally perceptual stability.

We created a stimulus to map out the receptive field (RF) properties of cells in the middle temporal area (MT) of a macaque monkey. The monkey observed randomly positioned, flickering bars, which were spatially low-pass filtered, while performing fixation or optokinetic nystagmus (OKN). The OKN was induced by a random dot pattern that moved either to the left or to the right and filled the entire screen. In the analysis we corrected for eye position and used reverse correlation to determine the RF kernels in retinal coordinates.

The data revealed that some MT cells clearly shift their RFs during the slow phase of OKN in the direction of the movement. We calculated the width of the spike waveforms of each neuron, and found a strong correlation between the width and the RF shift of the cells. Cells with narrow spikes, likely to be interneurons, show only none ore small shifts, while cells with broad spikes, probably projection neurons, show strong shifts.

We also found that the firing rates of the neurons are strongly modulated around the time of the fast phase of OKN. While some neurons decrease their firing rates, others boost them. For a lot of neurons these strong changes start right at saccade onset or even slightly before, which rules out that the retinal signal change induced by the eye movement causes the altering of the rate. We couldn’t find any dependencies between these variations and the spike waveform width. Therefore, they are probably independent of cell type. We hypothesize that they play an important role in saccadic suppression.

These new results indicate that area MT is heavily involved in the calculations, which provide us with a stable visual world despite eye movements. The local interneurons could be responsible for the altering of the RFs of projection cells, so that they shift their RF in the direction of the eye movement. We speculate that the reason for the shifting RFs may be to predict the future input coming from the eye.