

# Complementary functions of saccadic, position/drift, and extraretinal responses to eye movements in V1 neurons

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Eye movements are important for many aspects of visual awareness, but their contribution to visibility and stable perception during natural vision is not well understood. We investigated the effects of fixational and small voluntary eye movements on the activity of single V1 neurons in alert behaving monkeys. Visually-driven responses to eye movements could be separated into three categories: transient post-saccadic, sustained position/drift, and mixed, that are correlated with receptive field properties of respective neurons. Although bursts of spikes occur in many cells after abrupt stimulus movements caused by saccades, most cells also exhibit sustained firing in the intersaccadic drift periods if the stimulus remains on the receptive field, and some cells do not respond to saccades and have only sustained responses during drifts. These results suggest complementary functions for the two types of visual activation. Transient post-saccadic bursts signal abrupt change or motion in the receptive field and can be utilized to detect salient stimulus features like edges irrespective of the current spatial position, and may help to maintain perceptual stability. Inter-saccadic discharge encodes stimulus position and conveys information about spatial details of a visual scene.

In addition to the main visually-driven component, fixational and voluntary eye movements are accompanied by extraretinal effects that modulate ongoing firing in absence of visual stimulus. The extraretinal signal is biphasic: weak post-saccadic inhibition followed by slow enhancement. These signals may contribute to saccadic suppression as well as enhancement of stimulus visibility and discrimination following the saccades, by facilitating efficient updating of the scene.

Supported by NIH EY12243.