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Looking at vision and behavior from visual cortex

Abstract:

Most of what we know on primary visual cortex (V1) comes from experiments performed while animals are static, often under anesthesia. Yet visual cortex is typically used by awake animals while they actively navigate an environment. We are therefore studying how visual processing in mouse V1 is affected by wakefulness, locomotion, and navigation. Our results indicate that wakefulness enhances synaptic inhibition, abolishing the balance of excitation and inhibition typically seen in V1 under anesthesia. Inhibition, or rather disinhibition, plays a particularly strong role during locomotion: it profoundly alters spatial integration, reducing the surround suppression that is common in V1 neurons of stationary animals. Finally, navigation powerfully modulates V1 signals, in a way that is ideally suited to code for the visual stimuli created by locomotion in the environment. These results indicate that visual processing in mouse V1 is profoundly affected by wakefulness, locomotion, and navigation, providing clues as to how sensory cortex integrates external signals that come from the environment with internal signals about brain and behavioral state.