Comparison of Monkey's Frontal and Parietal Cortices in Visual Spatial Perception

Cong Zhang[1,2], Lin Wang[1,2], Mingsha Zhang[1,2]

[1]State Key Laboratory of Cognitive Neuroscience and Learning, China

[2]Division of Psychology, Beijing Normal University, China

Email: mingsha.zhang@bnu.edu.cn

Abstract:

Because the distribution of photo receptors on retina in primates is not unified，while viewing a natural scene, our eyes constantly jump (3-5 times/second) to ensure that the image of important object directly projects on the fovea. Although the eye movement plays a crucial role in receiving visual information, it makes trouble to visual stability because, following each eye movement, the retinotopic projections of stilled objects are displaced. However, despite the unstable retinal inputs, perceptually we see a continuous and stabilized visual environment. The dissociation between retinal inputs and visual perception indicates that, our spatial perception does not purely rely on the retinal inputs but is the result of integration of vision and non-vision modalities. One mechanism by which the brain accomplishes visual stability is by remapping visual receptive fields around the time of a saccade. In this process a neuron can not only be excited by a probe stimulus in the current receptive field (cRF), but also simultaneously by a probe stimulus in the spatial location that will be brought into the neuron's receptive field by the saccade (the future receptive field, fRF), even before the saccade begins. However, the spatiotemporal characteristics of visual receptive field remapping are inconsistent among previous studies, which confounds our understanding of the neural mechanisms underlying visual stability. To address this question, we recently explored the spatiotemporal features of visual receptive field remapping of single neuron in the lateral intraparietal cortex (LIP) and the frontal eye field (FEF) of same monkeys, while they were performing a visually-delayed saccade task. Our date show that the presaccadic expansion of VF in LIP predominately directing to the location of a neuron's cRF, whereas the presaccadic expansion of VF in FEF predominately directing to the location of saccadic target. Such results suggest the different role of these two brain areas in maintain of visual stability around the time of saccades.