The Role of LIP in Advanced Preparation for Express Saccade Revealed by Computational Model

***Bing Li[1,2], Jing Guang[1.2] and Mingsha Zhang[1]**

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

[2] Institute of Neuroscience, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences, and University of Chinese Academy of Sciences, Shanghai, China

***E-mail: bing8707@mail.bnu.edu.cn**

The reaction time (latency) of our responsive movements to the external stimuli varies, even when the task conditions are identical. A typical example is, in a gap saccade task, the reaction time of saccades toward the same target shows bimodal distribution, i.e. express saccade with shorter reaction time and regular saccade with longer reaction time [1,2]. Previous studies indicated that the occurrence of express saccade might be caused by the advanced preparation of oculomotor program [3]. The build-up activities of neurons in superior colliculus (SC) [4] and lateral intraparietal cortex (LIP) [5] were considered as the neuronal representations of this advanced preparation for express saccade. However, the neural circuitry for express saccade generation is still unclear. In the present work, we built a mean field model [6], which was composed by six elements, bilateral hemispheres of LIP, caudal parts of SC and rostral parts of SC. The connection between each element was according to the previous anatomical [7] and electrophysiological [8] results. We assumed that the motor preparation signal was transformed from LIP to the caudal part of SC, since the initiation of build-up activity and the separation of build-up activity between express and regular saccade were earlier in LIP than in SC [4,5]. The results of simulation reproduced the experiment observations very well, including bimodal distribution of saccade reaction time, neuronal activities in LIP and in SC. These results suggested a basic network for express saccade generation, in which LIP was in the upstream of SC in motor preparation.

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