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Presentation Abstract

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Presentation Title: Surround suppression across neuronal classes in area MT suggests an inhibition-stabilized network

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Authors: ***M. A. LOPES**[1,2], M. JADI[1], T. D. ALBRIGHT[1], T. J. SEJNOWSKI[1], G. R. STONER[1];
[1]Salk Inst. For Biol. Studies, LA JOLLA, CA; [2]Sch. of Med., Univ. of Coimbra, Coimbra, Portugal

Abstract: Neurons in cortical area MT generally have suppressive surrounds: the addition of a surround stimulus to a stimulus within the classical receptive field often result in a decrease in neuronal activity. A model proposed by Huang et al. (2008) is consistent with the widely held assumption that surround suppression arises from an increase in inhibition. However, in an investigation of surround suppression in area V1, Ozeki et al. (2009) reported evidence that suppression occurs as a result of withdrawal of excitation. This behavior is consistent with an inhibition-stabilized network (ISN), a connectivity regime characterized by strong recurrent excitation balanced by feedback inhibition (Tsodyks, et al, 1997). We have recently created ISN and non-ISN models of surround interactions in directionally tuned neurons in area MT and examined their contrasting predictions (Jadi et al. 2011). Our results were consistent with the earlier studies of simpler ISN and non-ISN models. Non-ISN models such as Huang et al.'s predict that excitatory neurons should exhibit surround suppression whereas inhibitory neurons should exhibit surround facilitation. Conversely, ISN models predict that both excitatory and inhibitory neurons should exhibit surround suppression. To test these predictions, we recorded responses of neurons in area MT of macaque monkeys while presenting either center-only or center-plus-surround motion stimuli. Spikes recorded from each neuron were aligned by their troughs and averaged. The duration of a spike was measured as the time between the trough and the peak. Neurons were then classified into putative excitatory and inhibitory populations based on spike duration (Barthó et al. 2004). This yielded a bimodal distribution into inhibitory

(narrow-spiking; duration < 200μs; n=26) and excitatory (broad-spiking; duration > 200μs; n=46) neurons. We found that both narrow-spiking and broad-spiking neurons were significantly suppressed by the addition of a surround stimulus to a stimulus in the RF center (t-test; p=0.004 and p<<0.001, respectively). We also found no difference in the degree of suppression between these two classes (ANOVA; p=0.1905). Our findings thus suggest that the center-surround network in area MT operates in the ISN regime rather than the non-ISN regime.

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