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Presentation Abstract

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Presentation Title:	Effects of network symmetries on neural tuning properties.
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Abstract:	The goal of this study was to examine the effects of local connectivity on rate models of neural circuits in visual cortex. In its working regime, the network responded with similar responses over a broad range of parameters. It has been suggested that the local circuitry of the visual cortex operates at the edge of an instability where the network exhibits self-sustained stationary and oscillatory activity (Tsodyks et al., 1997; Ben-Yishai, 1995; Stimberg et al., 2009). In this regime, the inhibitory and excitatory connections are tightly balanced and dominate the thalamic input. Columns of these local circuits are also orderly in the primary visual cortex of cats and monkeys and are organized in a pinwheel structure. Although, the connections are locally homogeneous (Kenet et al., 2003; Marino-et al., 2005), the pinwheel structure and the thalamic input interact to produce a non-ambiguous cortical representation of the stimulus. We studied the responses of orientation-tuned neurons to drifting gratings. In particular, we investigated the impact of the pinwheel structure on single cell responses. We assumed for simplicity that the pinwheels are organized in a square lattice, though similar results were obtained for other geometries. The parameters of the network were chosen to place the network close to a static instability, consistent with experimental measurements (Marino et al., 2005). In this state, depending on the spatial extent of the local connectivity and the f-I curve of the populations, the network displayed an intrinsic orientation preference at low contrast levels because of the pinwheel geometry. However, as the contrast increased above a contrast threshold, the cortical responses became more consistent with the stimulus orientation. This prediction can be tested with psychophysical stimuli across a range of contrasts near the perceptual threshold. Finally, when we included long-range connections with propagation delays, the

results were qualitatively similar.

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PINWHEEL

CONTRAST

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