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Poster presentation

Synchrony in thalamic inputs enhances propagation of activity through cortical layers

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Sensory input enters the cortex via the thalamocortical (TC) projection, where it elicits large postsynaptic potentials in layer 4 neurons [1]. Interestingly, the TC connections account for only ~15% of synapses onto these neurons. It has been therefore controversially discussed how thalamic input can drive the cortex. Strong TC synapses have been one suggestion to ensure the strength of the TC projection ("strong-synapse model"). Another possibility is that the excitation from single thalamic fibers are weak but get amplified by recurrent excitatory feedback in layer 4 ("amplifier model"). Bruno and Sakmann [2] recently provided new evidence that individual TC synapses *in vivo* are weak and only produce small excitatory postsynaptic potentials. However, they suggested that thalamic input can activate the cortex due to the synchronous firing and that cortical amplification is not required. This would support the "synchrony model" proposed by correlation analysis [3].

Here, we studied the effect of correlation in the TC input, with weak synapses, to the responses of a layered cortical network model. The connectivity of the layered network was taken from Binzegger et al. 2004 [4]. The network was simulated using NEST [5] with the Python interface PyNN [6] to enable interoperability with different simulators. The sensory input to layer 4 was modelled by a simple retino-geniculate model of the transformation of light into spike trains [7], which was implemented by leaky integrate-and-fire model neurons.

We found that introducing correlation into TC inputs enhanced the likelihood to produce responses in layer 4 and improved the activity propagation across layers. In addition, we compared the response of the cortical network to different noise conditions and obtained contrast response functions which were in accordance with neurophysiological observations.

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