

Henke, H.; Robinson, P. A.; Drysdale, P. M.; Loxley, P. N.

Spatiotemporally varying visual hallucinations: I. Corticothalamic theory. (English)

Zbl 1412.92038

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Summary: The thalamus is introduced to a recent model of the visual cortex to examine its effect on pattern formation in general and the generation of temporally oscillating patterns in particular. By successively adding more physiological details to a basic corticothalamic model, it is determined which features are responsible for which effects. In particular, with the addition of a thalamic population, several changes occur in the spatiotemporal power spectrum: power increases at resonances of the corticothalamic loop, while the loop acts as a spatiotemporal low-pass filter, and synaptic and dendritic dynamics temporally low-pass filter the activity more generally. Investigation of the effect of altering parameters and gains reveals new parameter regimes where activity that corresponds to hallucinations is induced by both spatially homogeneous and inhomogeneous temporally oscillating modes. This suggests that the thalamus and corticothalamic loops are essential components of a model of oscillating visual hallucinations.

For Part II, see [the authors, *J. Theor. Biol.* 357, 210-219 (2014); Zbl 1412.92037].

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