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Spatiotemporal dynamics of pattern formation in the primary visual cortex and hallucinations. (English) [Zbl 1342.92032](#)

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Summary: The existence of visual hallucinations with prominent temporal oscillations is well documented in conditions such as Charles Bonnett syndrome. To explore these phenomena, a continuum model of cortical activity that includes additional physiological features of axonal propagation and synapto-dendritic time constants, is used to study the generation of hallucinations featuring both temporal and spatial oscillations. A detailed comparison of the physiological features of this model with those of two others used previously in the modeling of hallucinations is made, and differences, particularly regarding temporal dynamics, relevant to pattern formation are analyzed. Linear analysis and numerical calculation are then employed to examine the pattern forming behavior of this new model for two different forms of spatiotemporal coupling between neurons. Numerical calculations reveal an oscillating mode whose frequency depends on synaptic, dendritic, and axonal time constants not previously simultaneously included in such analyses. Its properties are qualitatively consistent with descriptions of a number of physiological disorders and conditions with temporal dynamics, but the analysis implies that corticothalamic effects will need to be incorporated to treat the consequences quantitatively.

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MSC:

[92C15](#) Developmental biology, pattern formation

[92C20](#) Neural biology

[92C50](#) Medical applications (general)

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