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Sparse coding models demonstrate some non-classical receptive field effects

Mengchen Zhu[1*], Christopher J Rozell[2]

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Non-classical receptive field (nCRF) effects include several response properties in V1 neurons not explained by a linear-nonlinear (LN) receptive field model, but instead requiring significant interactions between V1 neurons. Using a sparse coding model [1,2] and bar and grating stimuli, simulated physiology experiments were carried out that replicated several nCRF phenomena reported previously in neurophysiology experiments. These include: end-stopping [3] (Fig. 1), contrast invariance of orientation tuning [4] (Fig. 2), radius, orientation, and contrast tunings of surround suppression [5,6] (Figs. 3, 4, 5). The results suggest that a sparse coding model can explain many of the nonlinear effects in V1 cells, and is therefore a reasonable candidate for a functional model of striate cortex.

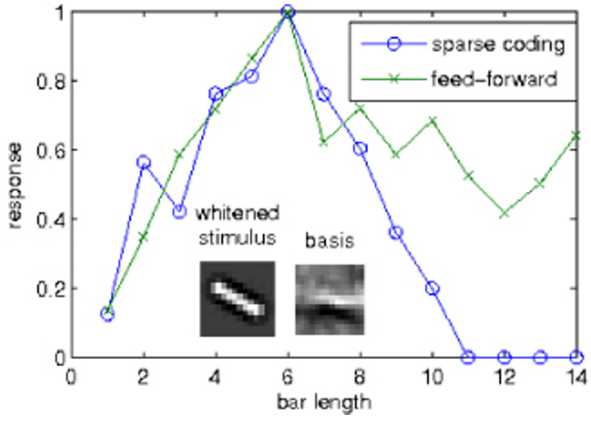

Figure 1 End-stopping. Comparison with a LN model.

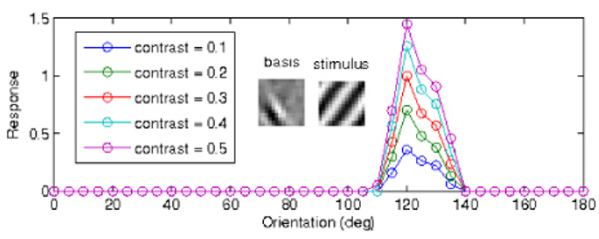

Figure 2 Contrast invariance of orientation tuning.

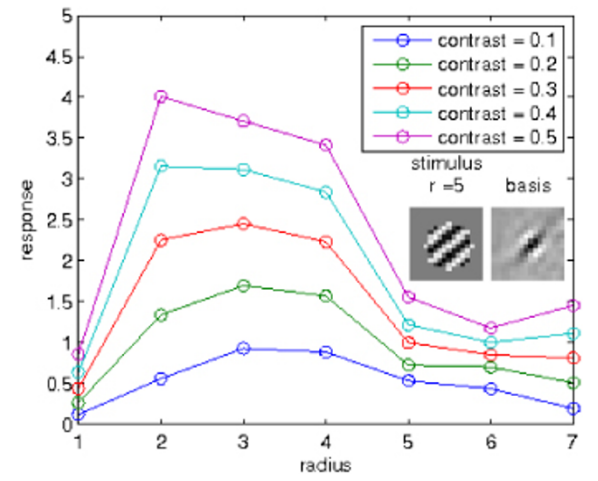

Figure 3 Surround suppression at different contrasts.

Author details
[1]Department of Biomedical Engineering, Georgia Institute of Technology, Atlanta, GA 30332, USA . [2]Department of Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA 30332, USA.

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* Correspondence: mczhu@gatech.edu
[1]Department of Biomedical Engineering, Georgia Institute of Technology, Atlanta, GA 30332, USA

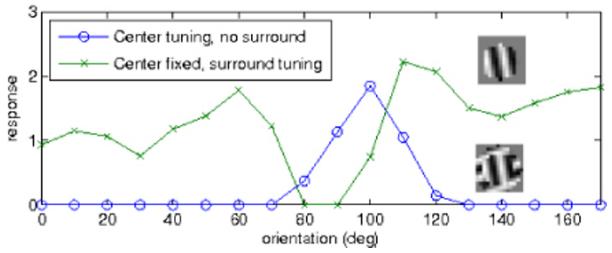

Figure 4 Orientation tuning of surround suppression.

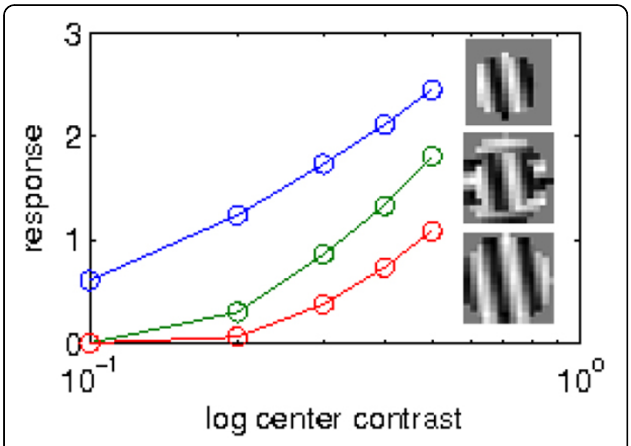

Figure 5 Surround orientation influences contrast tuning.

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