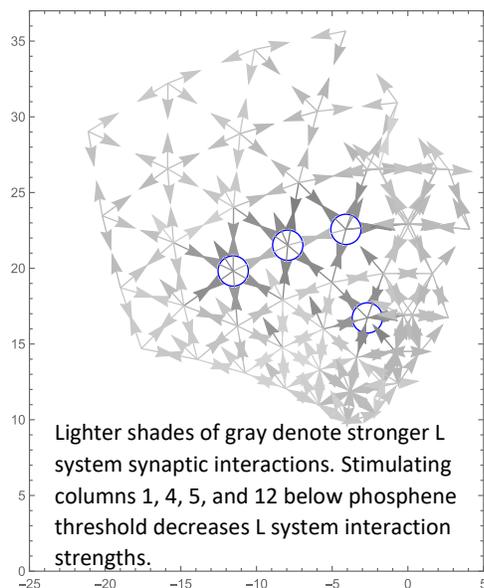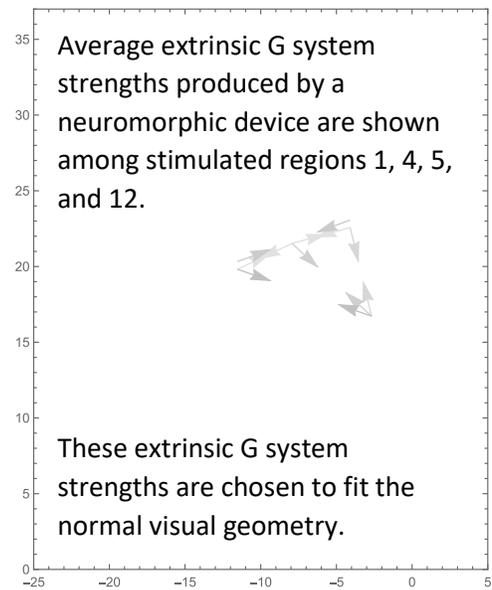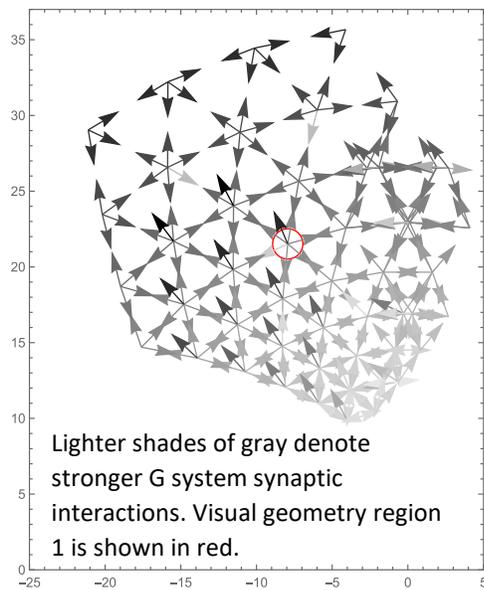We have completed simulations of a network spanning 49 regions that follow from the work reported in [Progress in Developing an Emulation of a Neuromorphic Device That Is Predicted to Enhance Existing Cortical Prosthetic Vision Technology by Engaging Desired Visual Geometries.](#) **These simulations include a neuromorphic device simulation and provide data that are essential for understanding how network spike frequency distributions coordinate with distributions of phosphenes in visual space.** A presentation describing a complete set of simulations is available at [Simulated spike frequency distributions coordinate with phosphenes | Zenodo](#). Specific adjustments to our neuromorphic device simulation are implied by the research that is included in this presentation. We are currently preparing new simulations that will bring us closer to an emulation of a device that is predicted to produce perception of continuous visual forms by engaging desired visual geometries.

An examination of average strengths of G system and L system synaptic interactions in the cortical prosthetic vision geometry suggests that spike frequency distributions should be depicted in the same geometry.

Lighter shades of gray denote stronger G system synaptic interactions. Visual geometry region 1 is shown in red.

Average extrinsic G system strengths produced by a neuromorphic device are shown among stimulated regions 1, 4, 5, and 12.

These extrinsic G system strengths are chosen to fit the normal visual geometry.

Lighter shades of gray denote stronger L system synaptic interactions. Stimulating columns 1, 4, 5, and 12 below phosphene threshold decreases L system interaction strengths.

Stimulating column 1 above phosphene threshold causes large decreases in L system synaptic strengths to and from this column.

A correspondence between the distributions of spike frequencies on columns of the network and the distribution of phosphenes on the visual geometry can be visualized using iso-frequency contour plots in which each line is drawn through a frequency of excitatory neuron spikes. The plots shown here depict distributions of mean excitatory neuron spike frequency from 10-second simulations in which the network was excited by spikes at 40 per second.
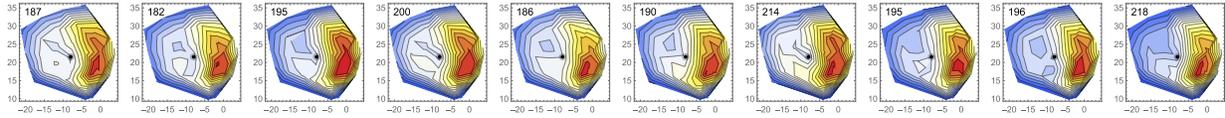

Ten, 1-second plots are shown for a network-only simulation in which above phosphene threshold is delivered to column 1, which is marked with a black disk. Colors are chosen from a temperature map in which higher frequencies are depicted with red hues. The maximum frequency is shown in the upper left corner of each plot.
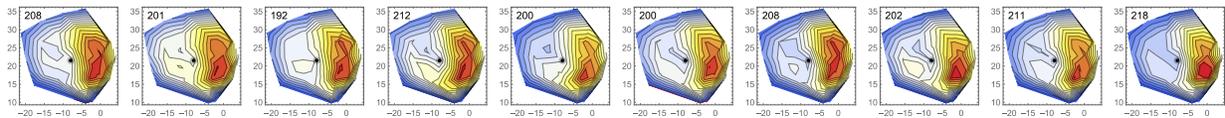

Ten, 1-second plots are shown for a simulation in which the amplitude of above phosphene threshold stimulation to column 1 is modulated by a neuromorphic device. Stimulation amplitude is dependent on population recordings from columns 1, 4, 5, and 12. The contribution of each population to the neuromorphic device is determined by extrinsic G system synaptic strengths.

There is a striking pattern of contour lines that originate from the stimulated column. Such patterns are made clear in enlarged plots.
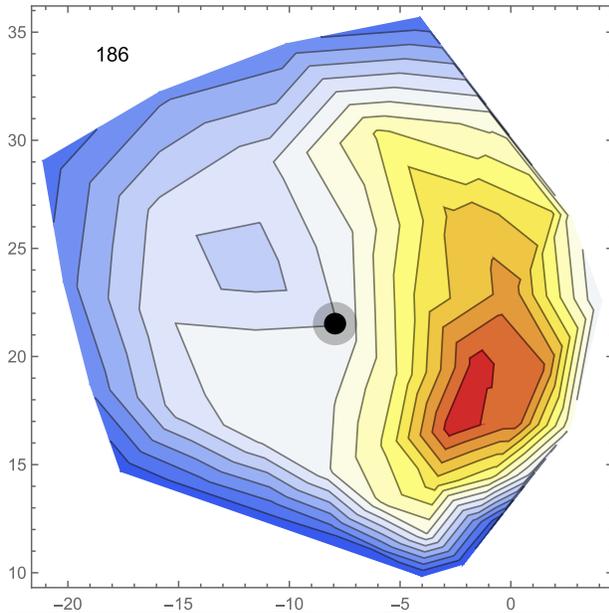
Second 5 of the network-only simulation.
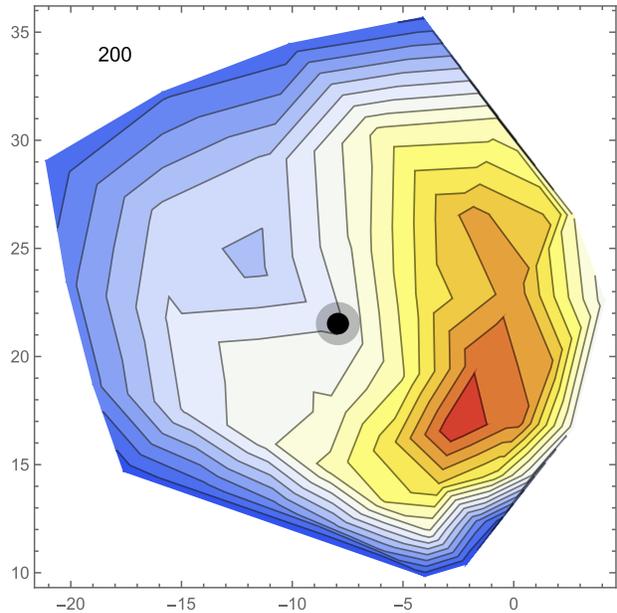
Second 5 of the neuromorphic device simulation.