A Velocity-Representation Model For MT Cells

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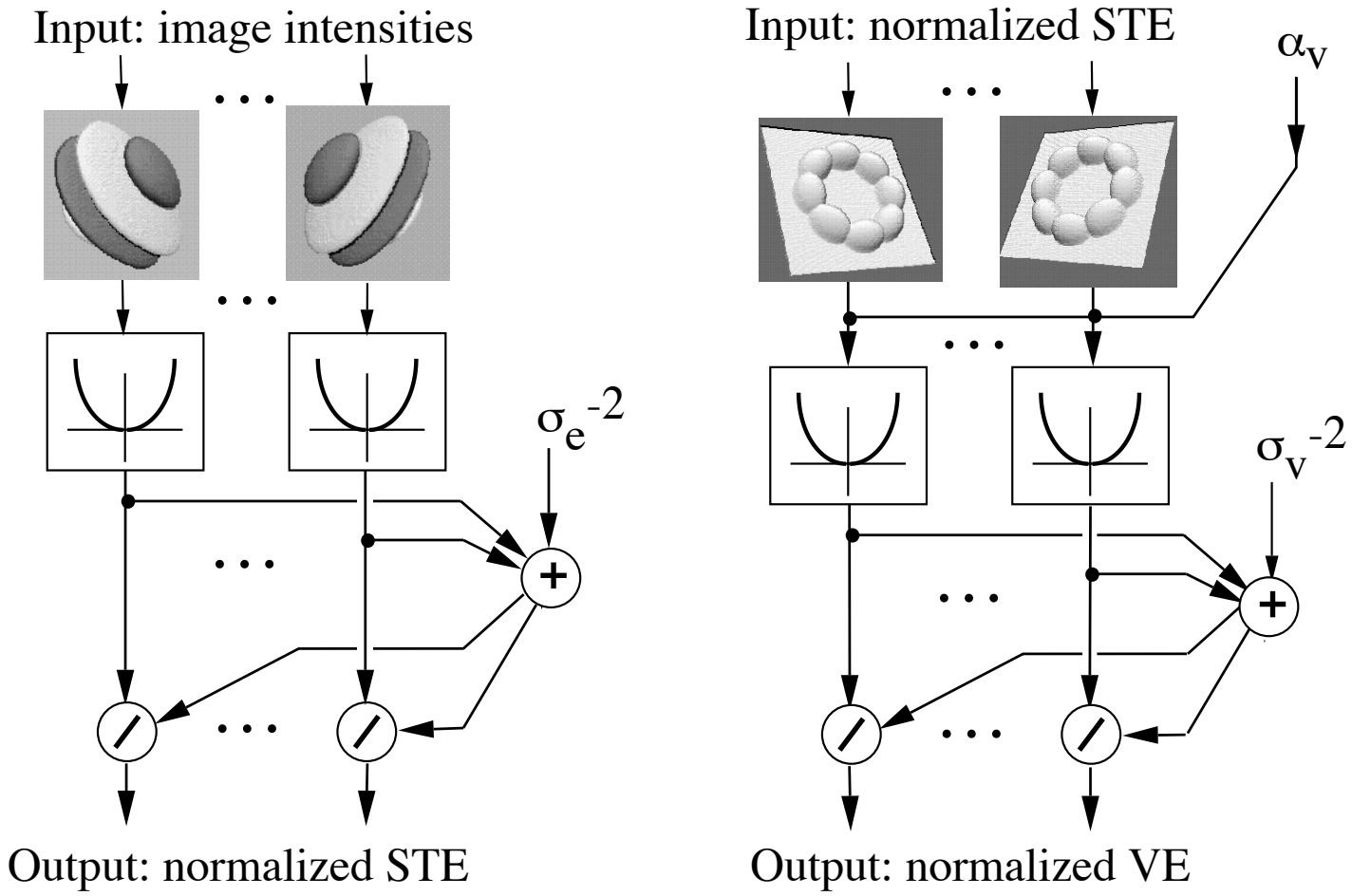
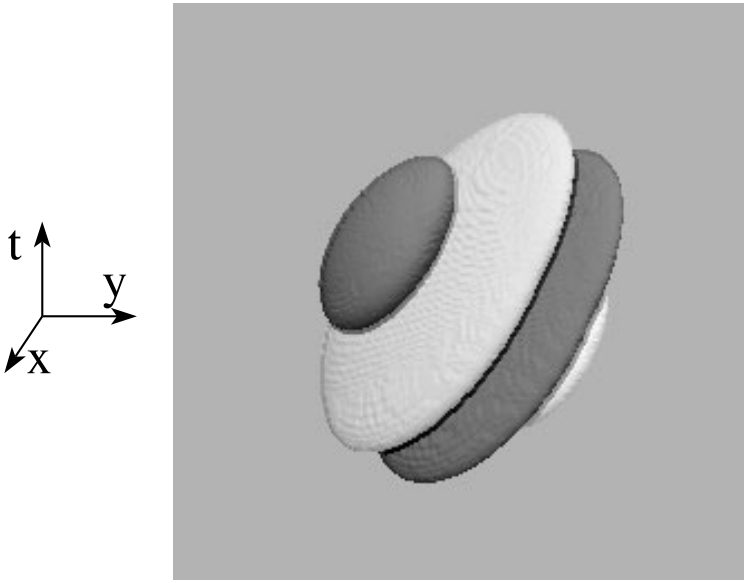


Two stages of computation, corresponding to:

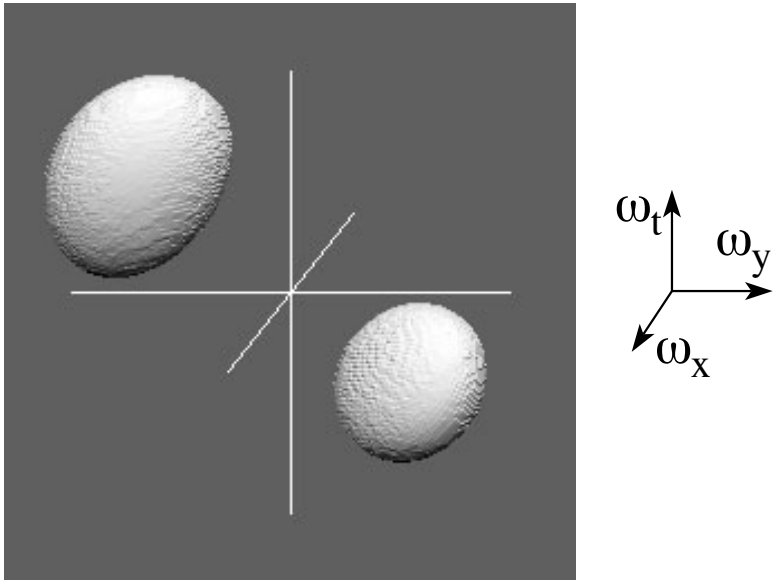
1. V1 “simple” cells (tuned for Spatio-Temporal Energy).
2. MT “pattern” cells (tuned for “Velocity Energy”).

Stage I

Space-Time Weighting

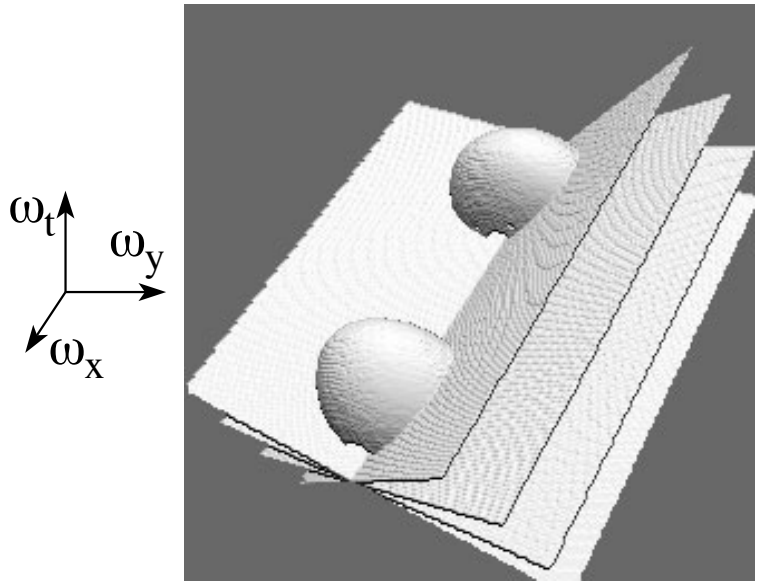


Fourier Tuning



- Combines image intensities via space-time oriented linear filters.
- Tuning: localized in the Fourier domain.
- A population of these mechanisms provides a distributed representation of spatio-temporal energy (STE).

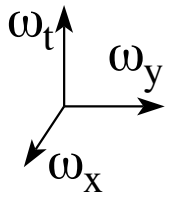
Stage I is *Not* Velocity-Tuned

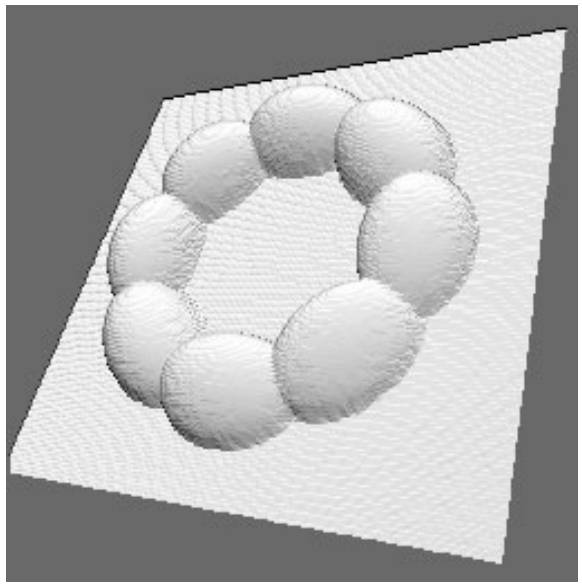


- Power spectrum of a translating 2D pattern lies on a tilted plane.
- A model V1 unit will respond to *many* such planes.

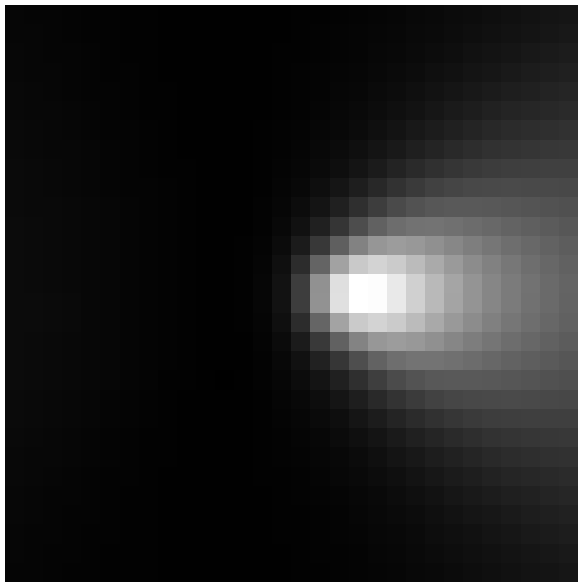
Stage II

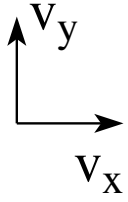
STE weighting





Velocity Tuning





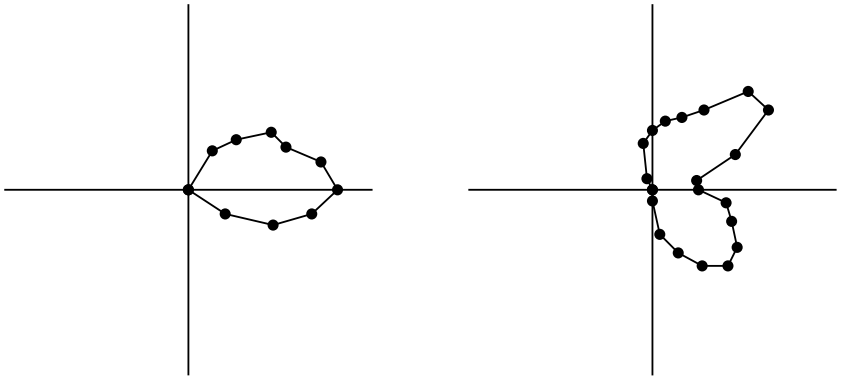
- Combines outputs of V1 units tuned for different orientations.
- Tuning: localized in the image-velocity domain.
- A population of these mechanisms provides a distributed representation of velocity.

Model Parameters

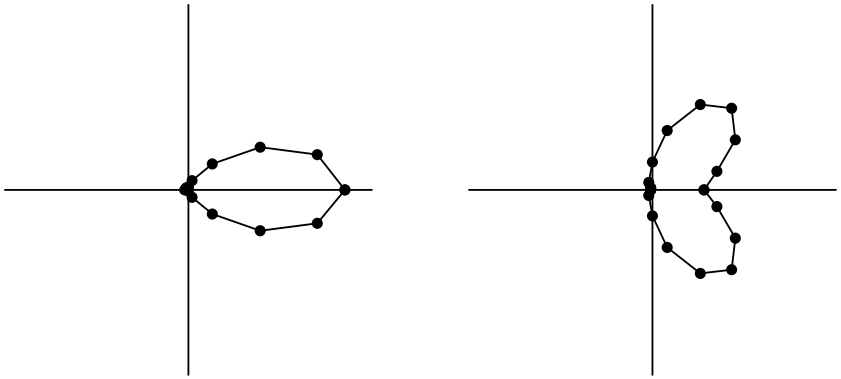
1. Stage I:
   - "Coverage" of Fourier domain.
   - "Order" of filters.
   - Semi-saturation constant, σ_e.
2. Stage II:
   - "Coverage" of velocity domain.
   - Resting firing rate, α_v.
   - Semi-saturation constant, σ_v.

Direction Tuning: Stage I

Movshon et al., 1983



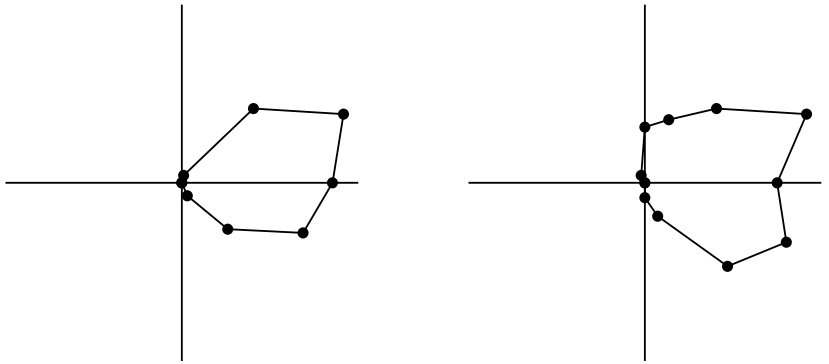
Model



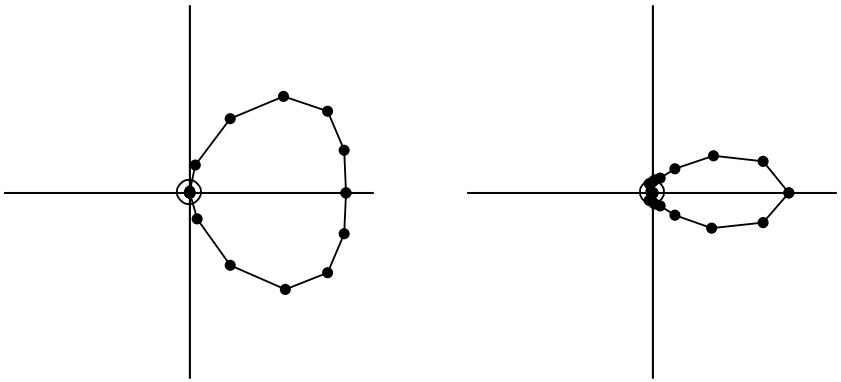
gratings plaids

Direction Tuning: Stage II

Movshon et al., 1983

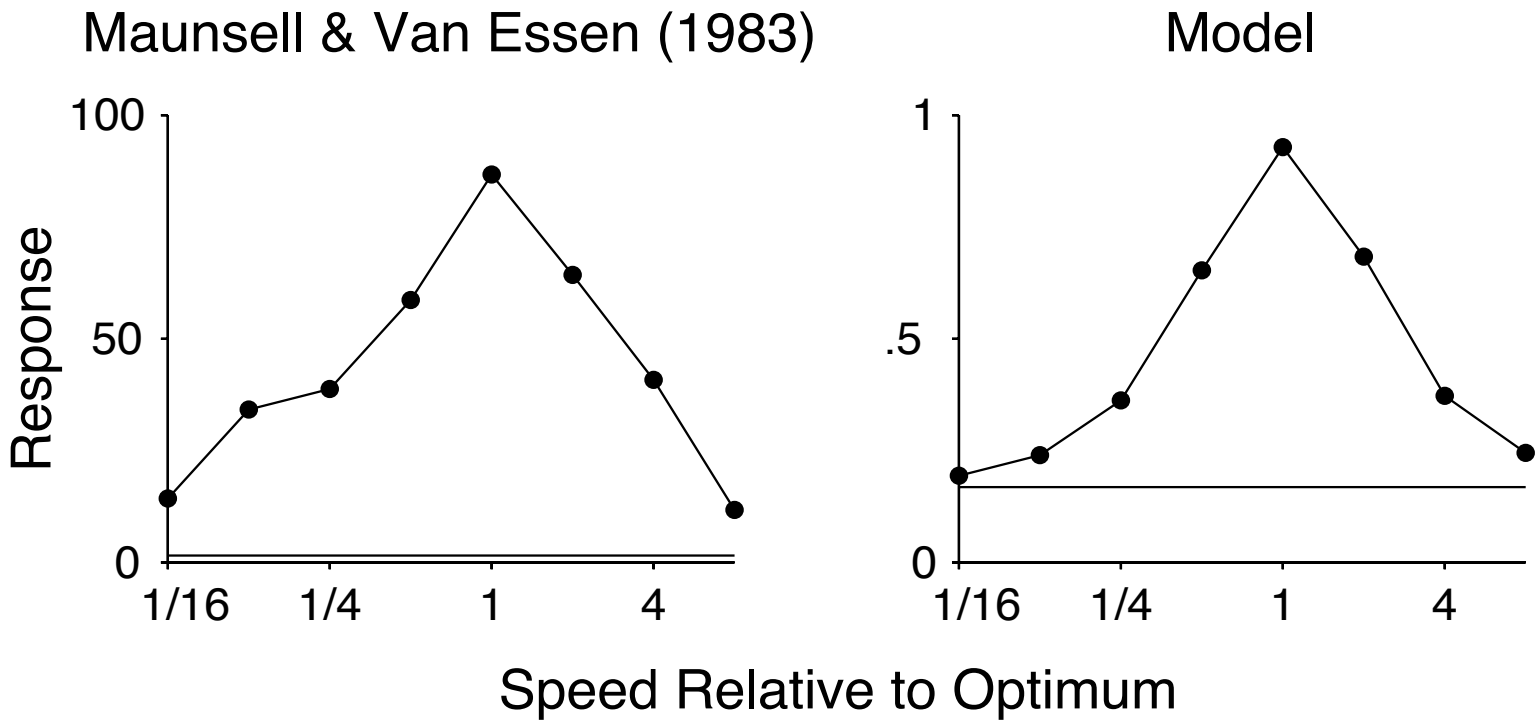


Model

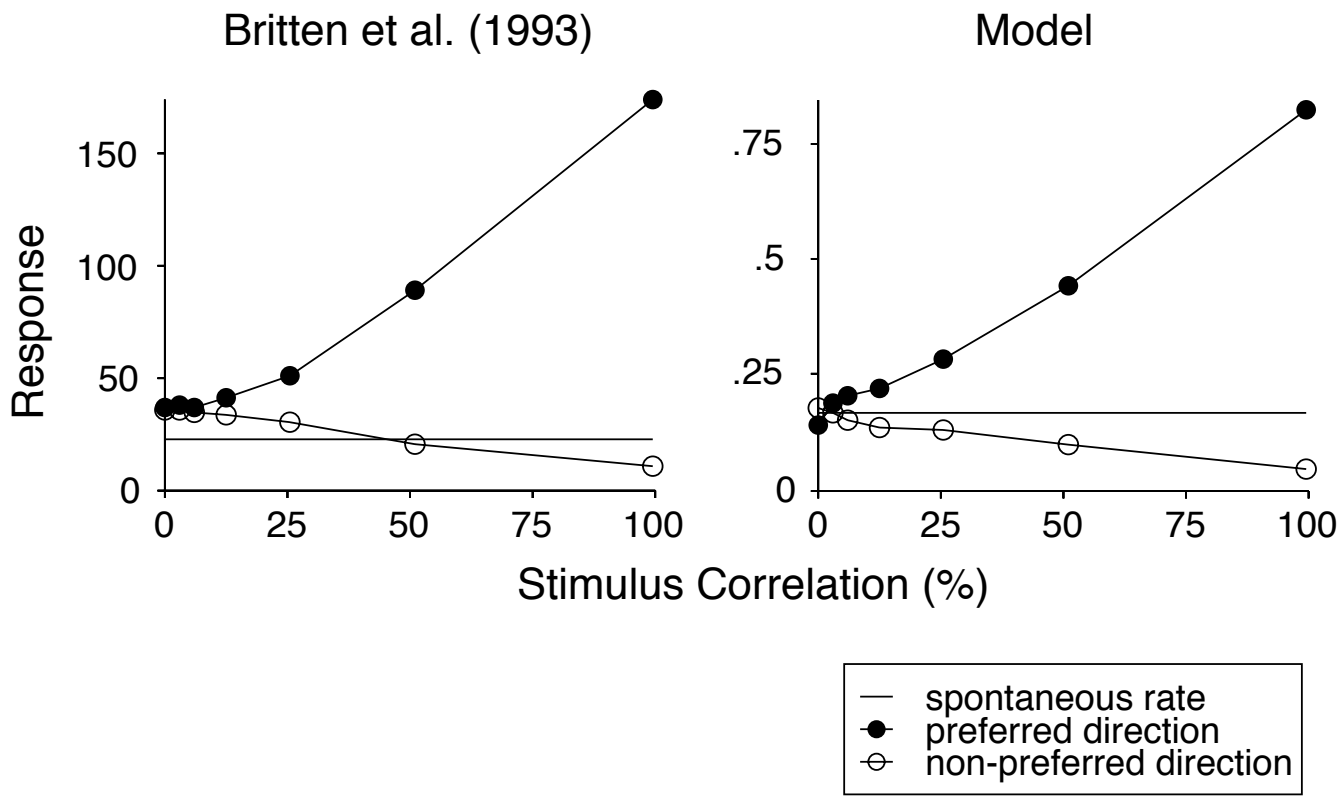


gratings plaids

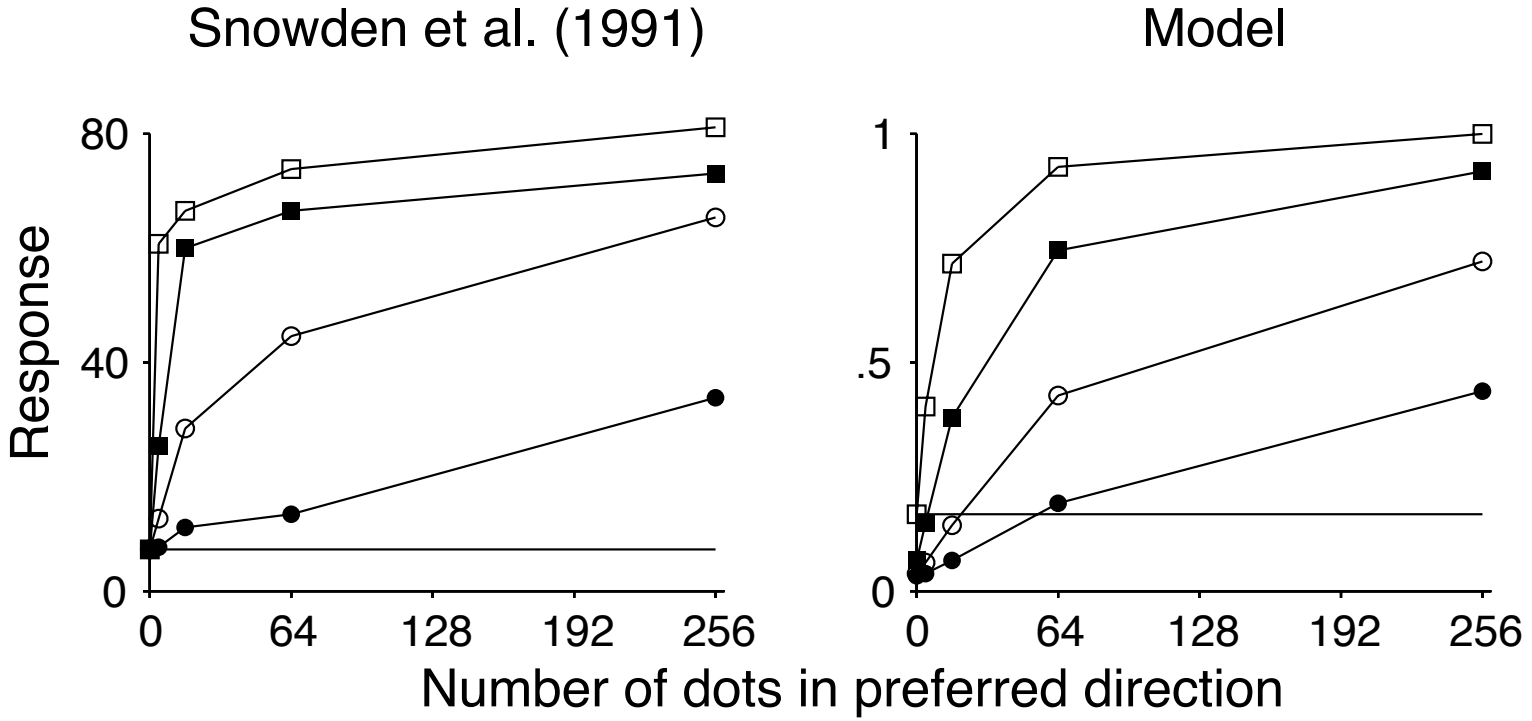
Speed Tuning



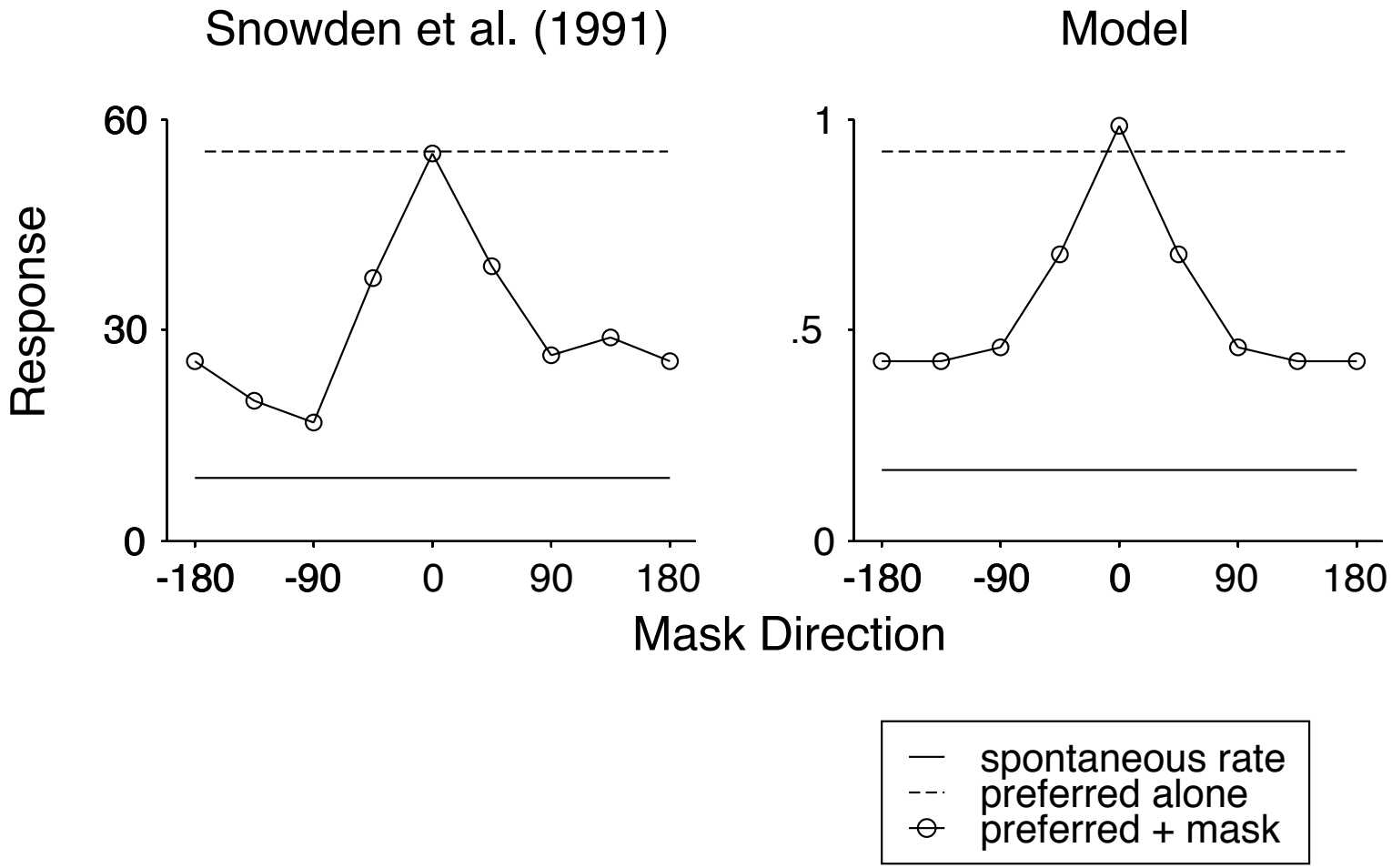
Correlation Response Function



Response vs. Number of Dots

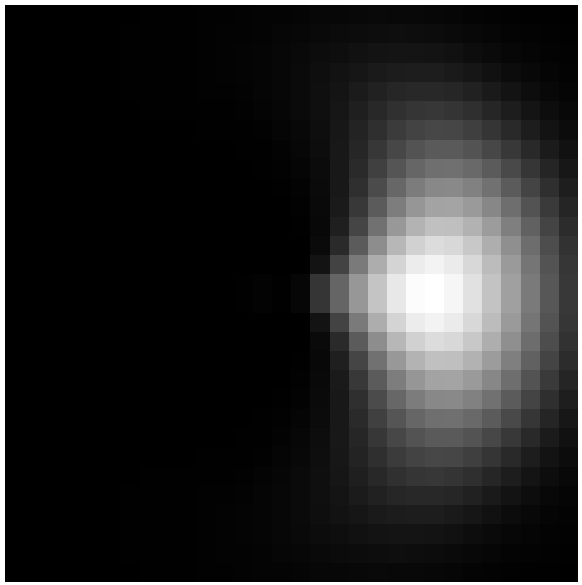


Non-Preferred Suppression

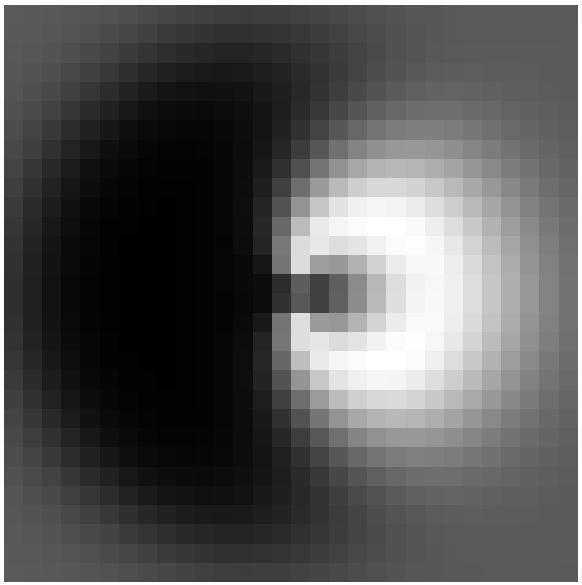


Model Behavior: Gratings

Stage I



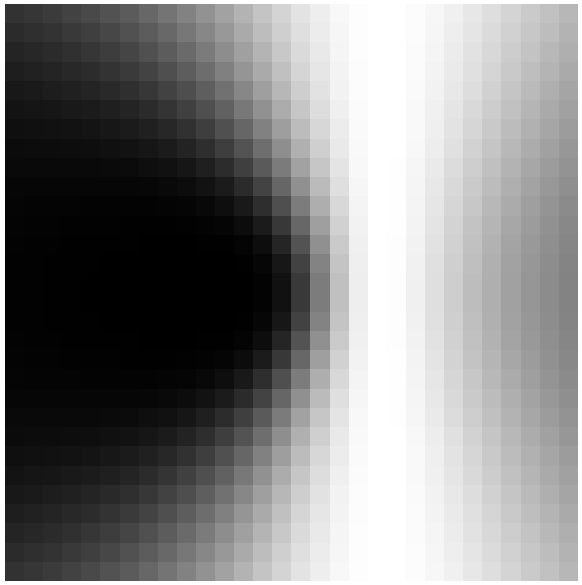
Stage II



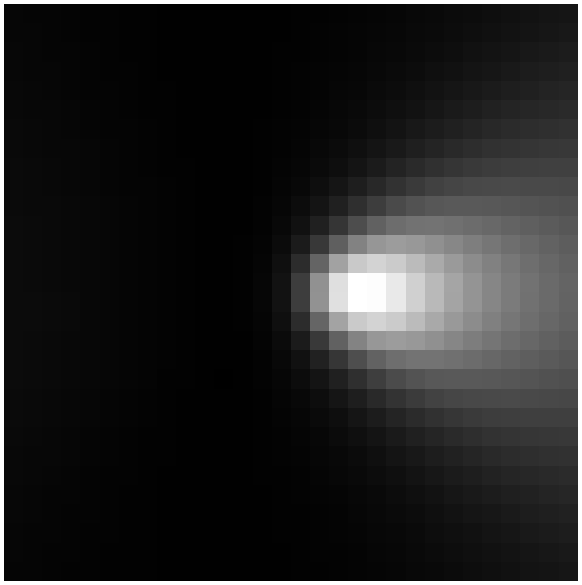
Mean response plotted as a function of grating normal velocity.

Model Behavior: Random Dots

Stage I



Stage II



Mean response plotted as a function of dot drift velocity.