**Direction discrimination task**

* Reaction-time task: Monkey saccades to indicate motion direction as soon as it is certain.
* Other version of task had fixed viewing duration.
Random-dot display

100%  

30%  

5%  

0%  

Wednesday, April 10, 13
Psychophysics: Percent correct and reaction time

\[ p = 1 - \frac{1}{2} e^{-\left(\frac{C}{\alpha}\right)^\beta} \]

\* Weibull function fits with \( \alpha = 7.1 \) and \( \beta = 1.4 - 1.7 \)
LIP neuron responses (RT)

- Spike trains aligned to saccade; stimulus onset indicated by claret; only correct choices shown
- Spike rate builds up when target is in cell’s RF
- RT is longer when coherence is low

Roitman & Schadlen '02
Responses are aligned to stimulus onset (left) or saccade (right).

Dotted lines are outside RF.
The goal of this modeling exercise is to investigate how well integration of sensory signals can account for behavioral and physiological measurements obtained using the random-dot motion task. We address this question by simulating the responses from two brain regions: the middle temporal area (MT or V5) and the lateral intraparietal area (LIP) (Fig. 3). Each of the possible eye movement responses. The decision is made when the activity of one of the LIP ensembles exceeds a critical value, that is, when the evidence reaches a threshold.

The model furnishes several no

doesn't specify how neurons achieve the key computations: difference, integration, and threshold.
There are two pyramidal cell populations (groups A and B) with strong recurrent excitatory connections that compete through feedback inhibition from interneurons.
Coin-tossing with neurons

At zero-coherence, either group could win, depending on random fluctuations in input strength as well as added noise.
RT is longer and more variable when coherence is low. Neurometric threshold is 8.4 or 10.4% coherence for RT and 1s delay, respectively.
Mean-field reduction results in a two-variable model amenable to analysis. The mean-field approach simplifies FI curves and constant NS cells. Only NMDA dynamics lead to a two-variable model with 8 equations, which is amenable to analysis. Wong & Wang '06.
2D model fits the data

Experimental data

Spiking neuronal network model

Reduced two-variable model

Wong & Wang '06
2D model’s phase-plane

Middle stable point becomes a saddle-point, which defines a boundary between two other stable points' basins of attraction.

Wong & Wang '06
Role of increasing coherence

At sufficiently high coherence, the trajectory always goes to the favored attractor.

At even higher coherences, the unfavored attractor disappears.

Wong & Wang ’06
Bifurcation diagram

Monostable: 1 stable point

Bistable: 2 stable points

Competition: No hysteresis

Wong & Wang ’06
Next week

* Balanced networks