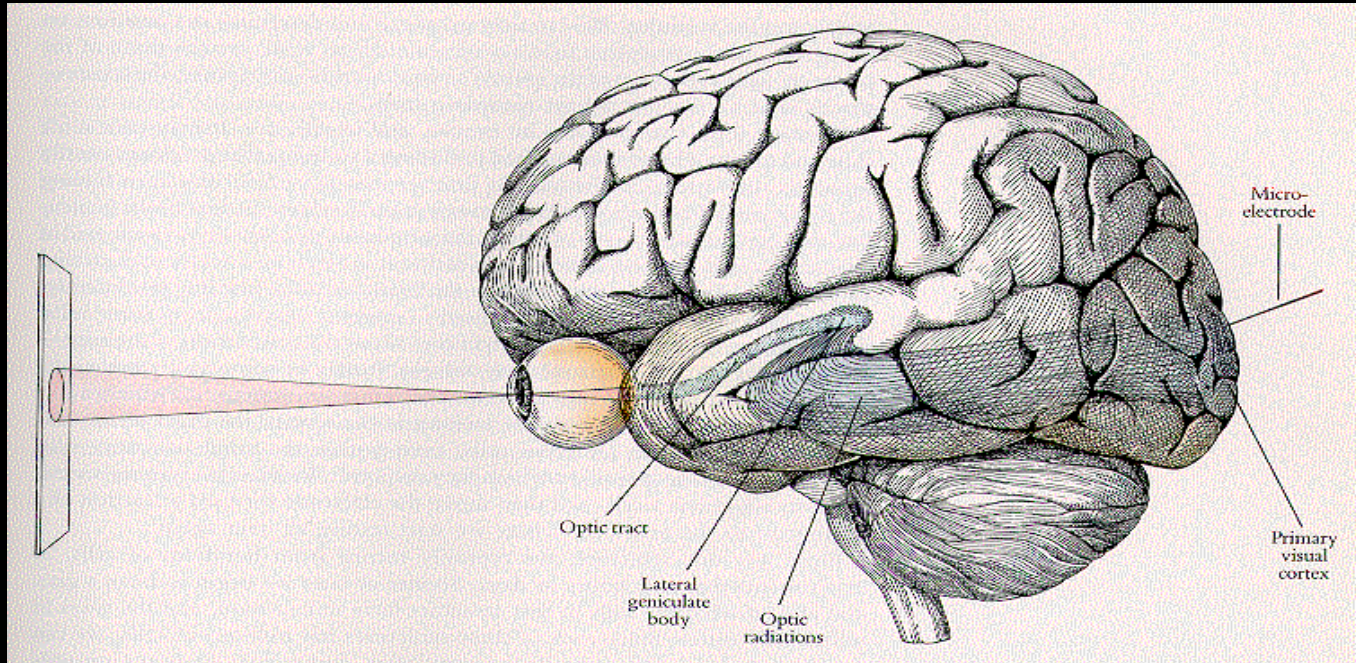
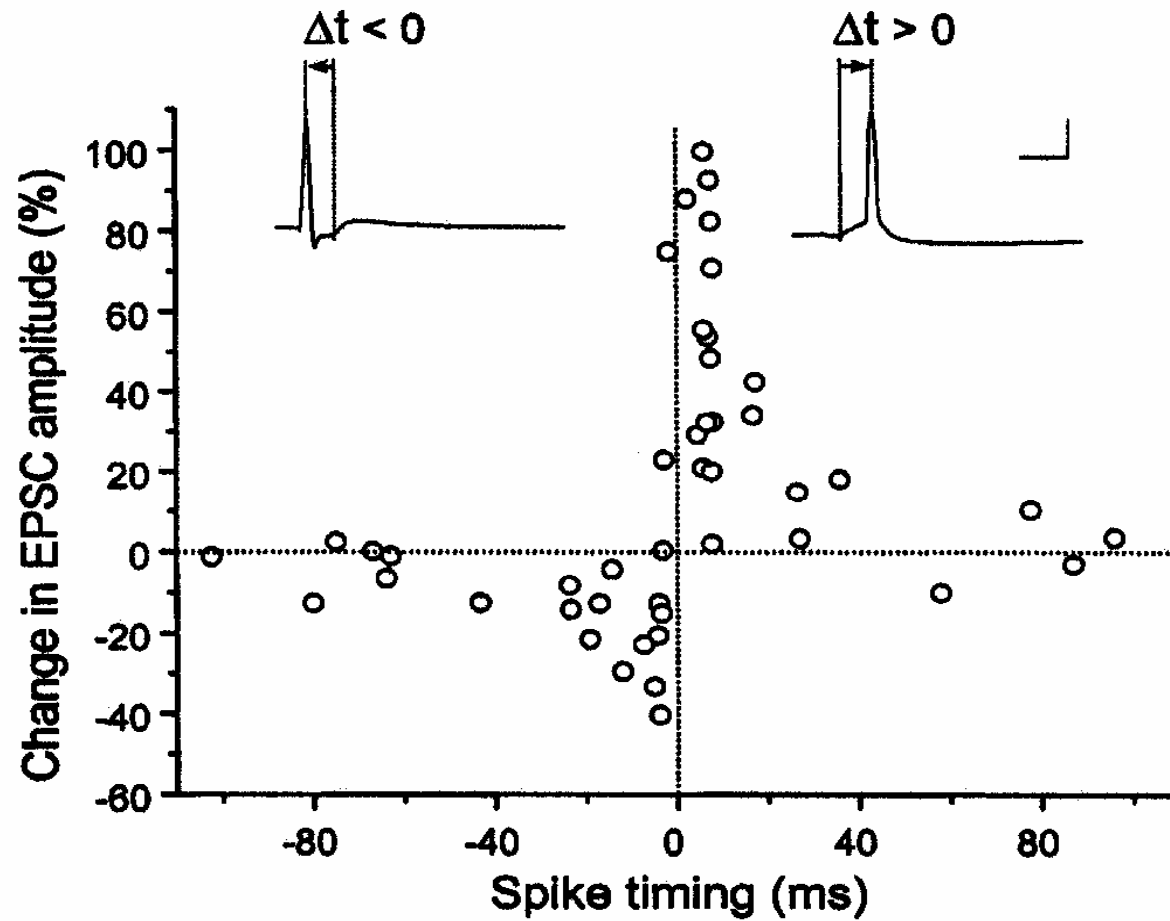
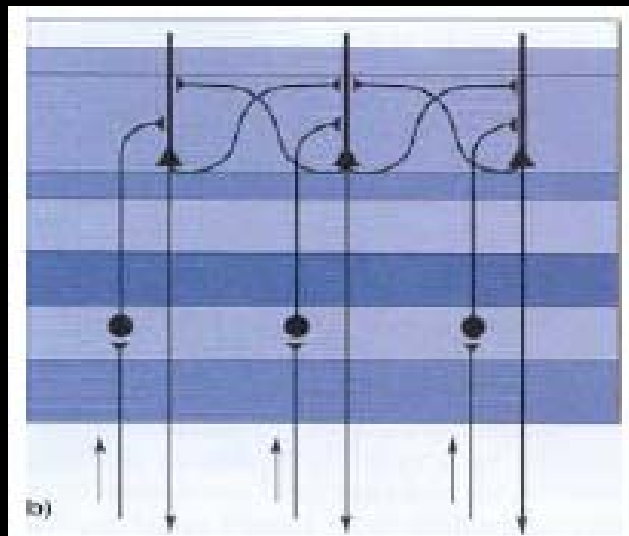


# Plasticity in the visual cortex

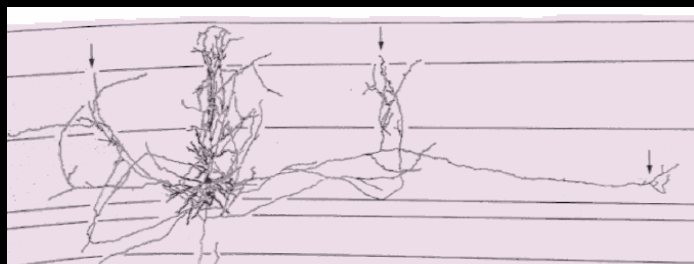


# Spike timing-dependent synaptic plasticity (STDP)

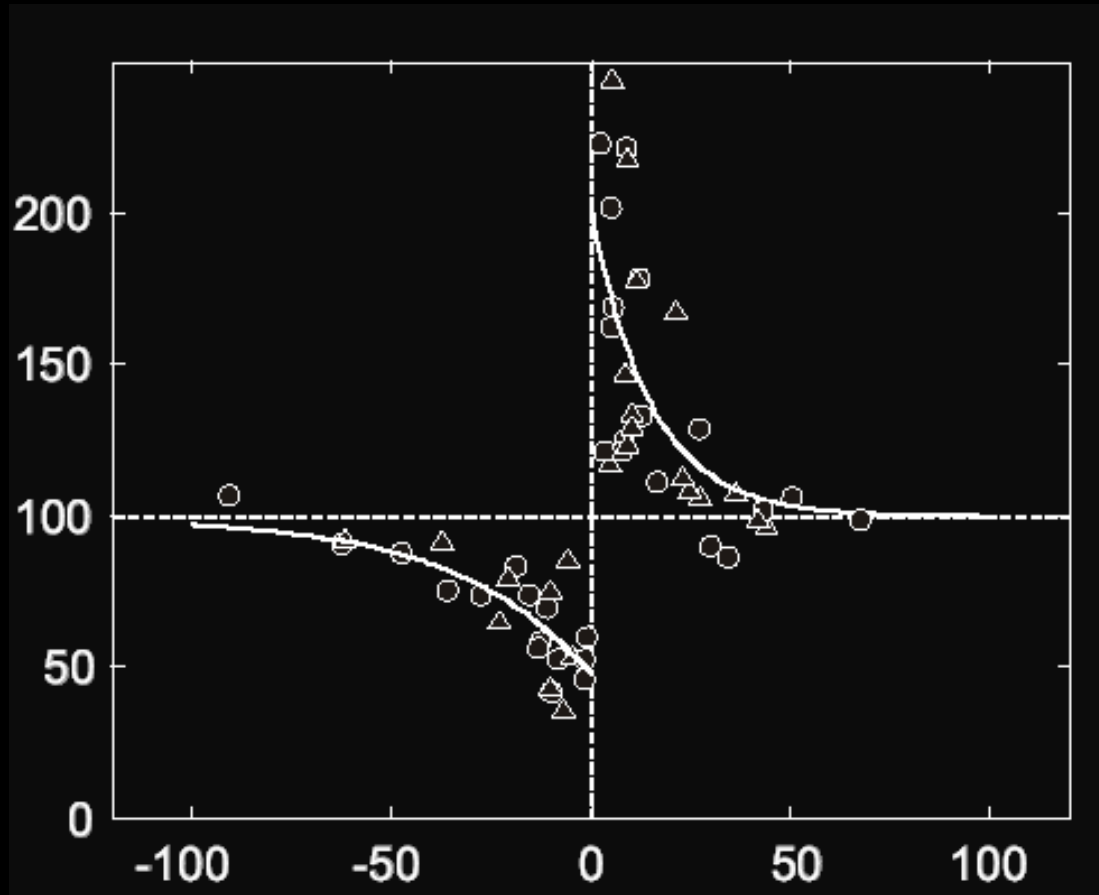




L2/3  
L4  
L5  
L6

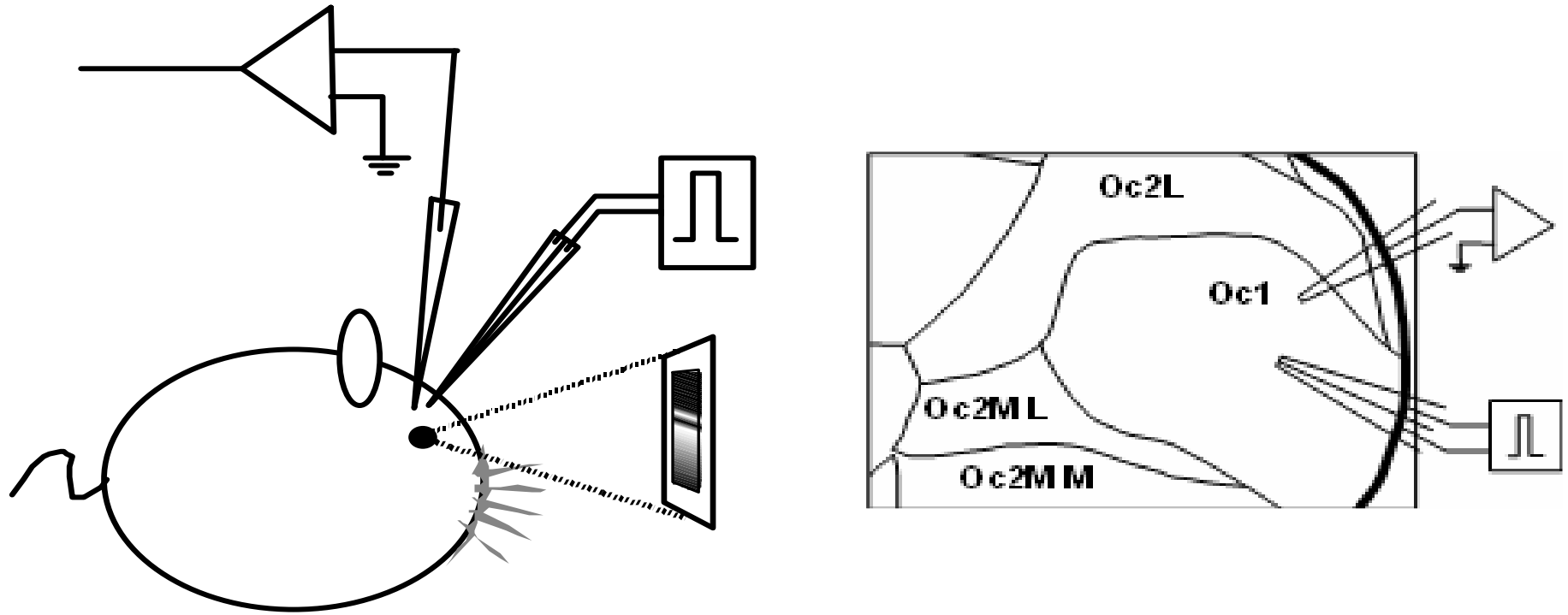


Normalized EPSP slope (%)

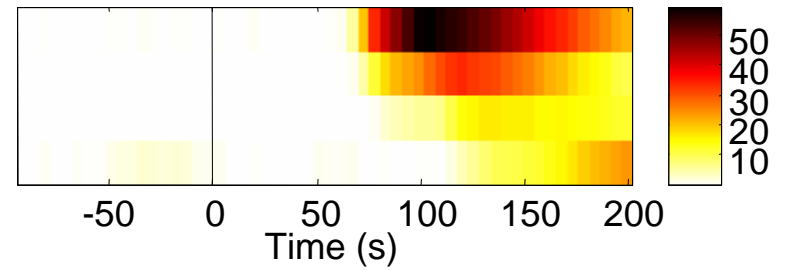
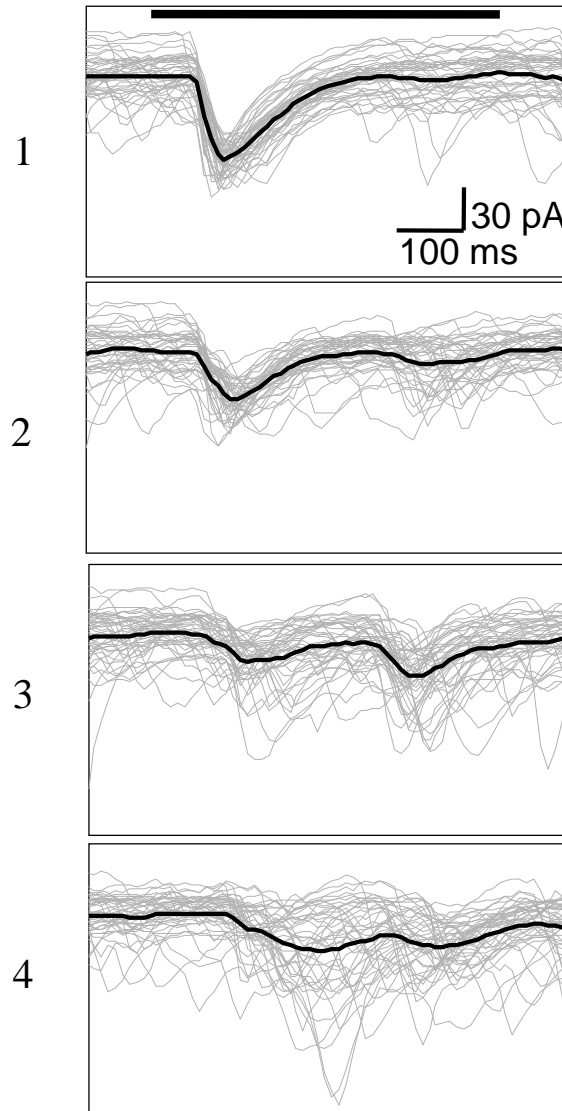
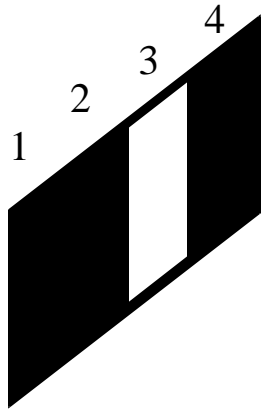


Pre/post interval (ms)

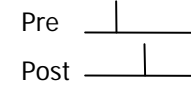
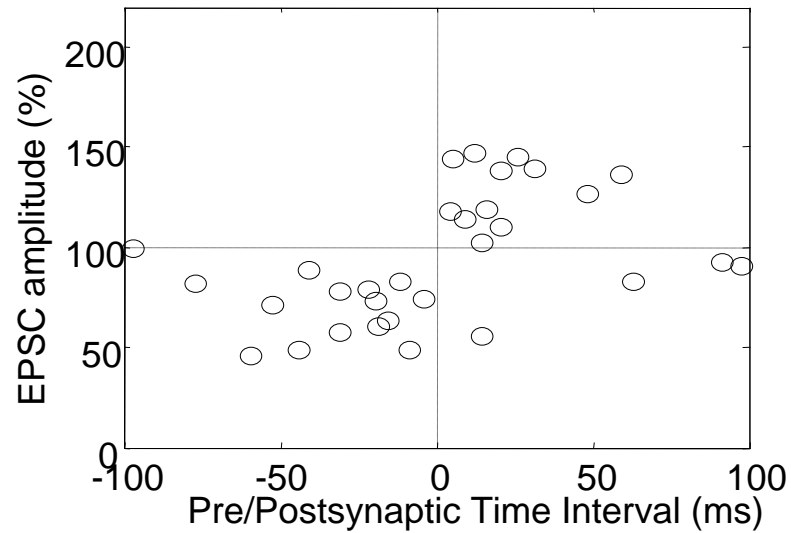
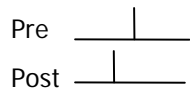
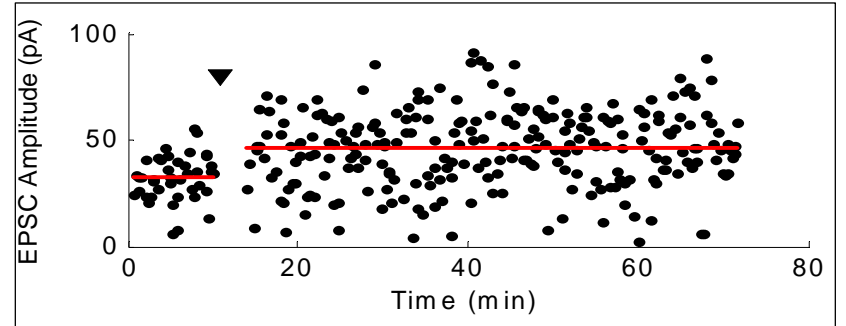
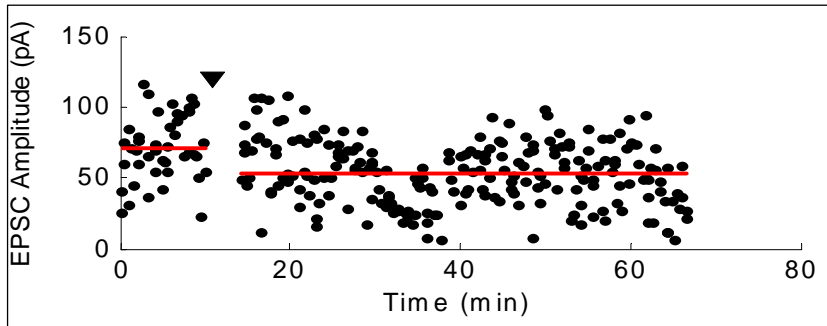
# Spike-timing Dependent Plasticity Rat Oc1



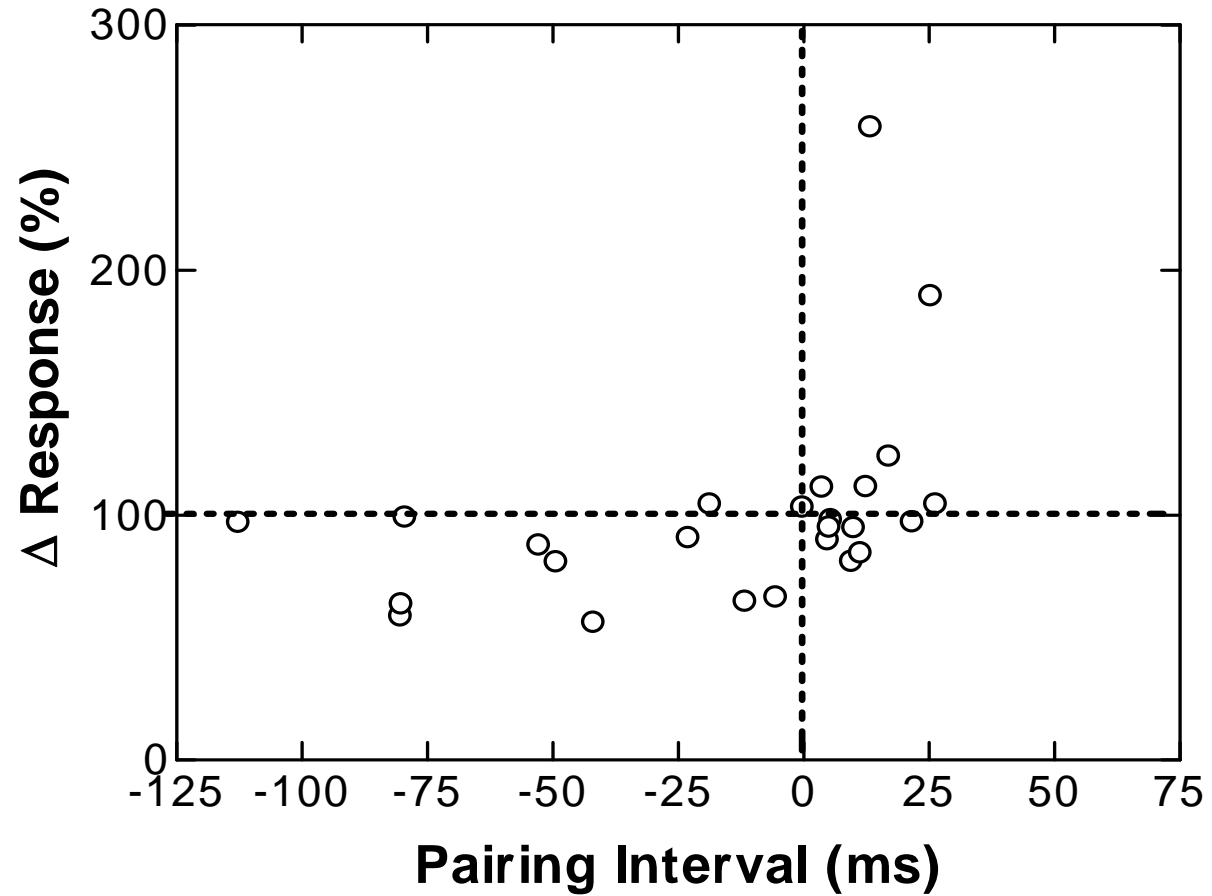
# Spatiotemporal Visual Receptive Fields

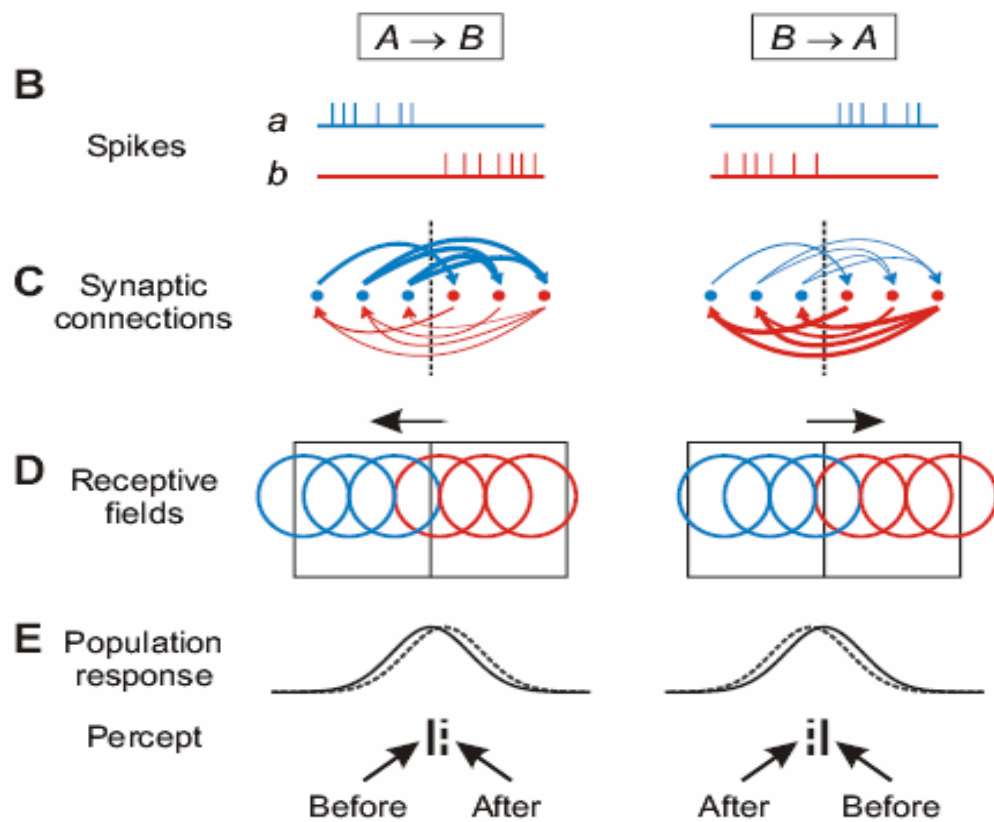
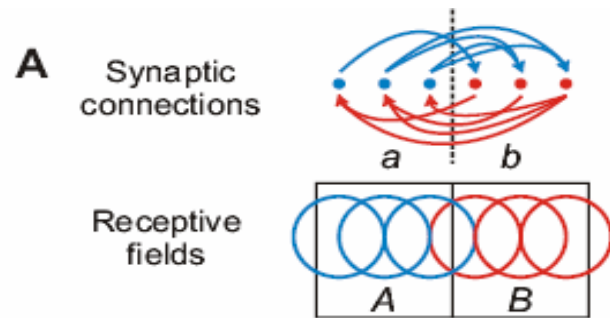


# STDP of Visual Responses in 3 wk old rats

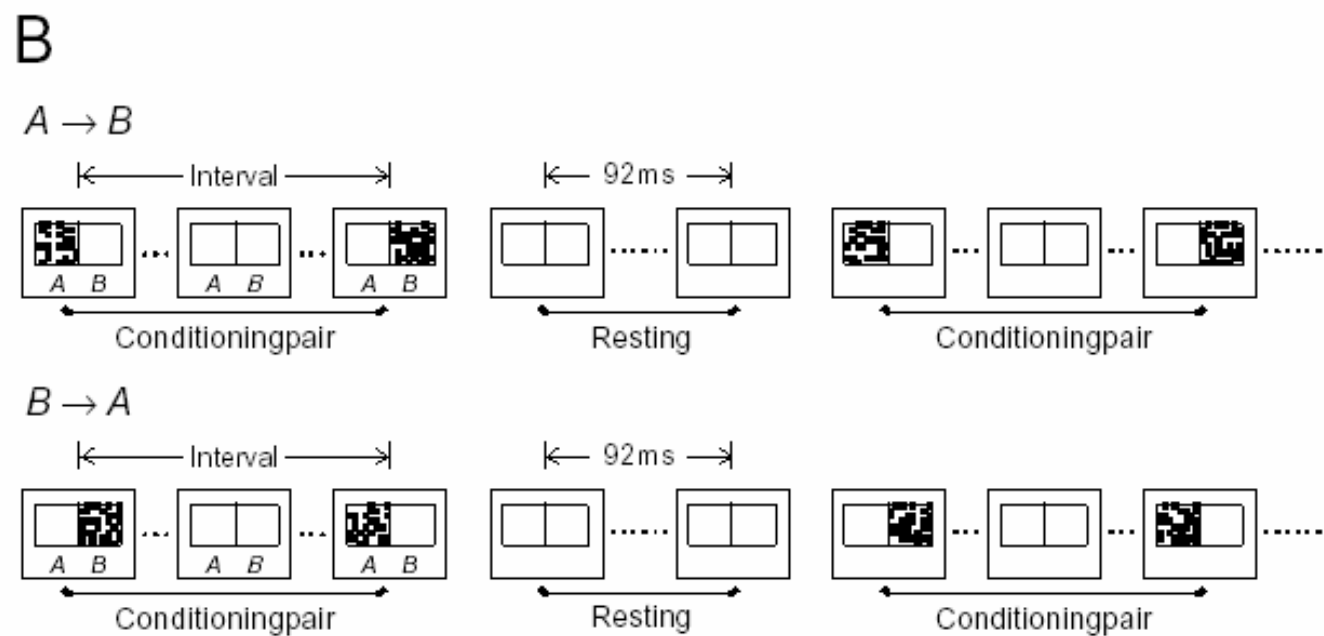
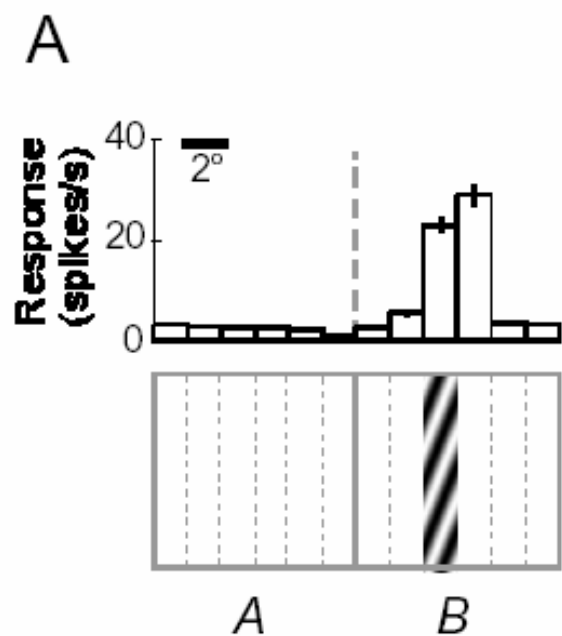


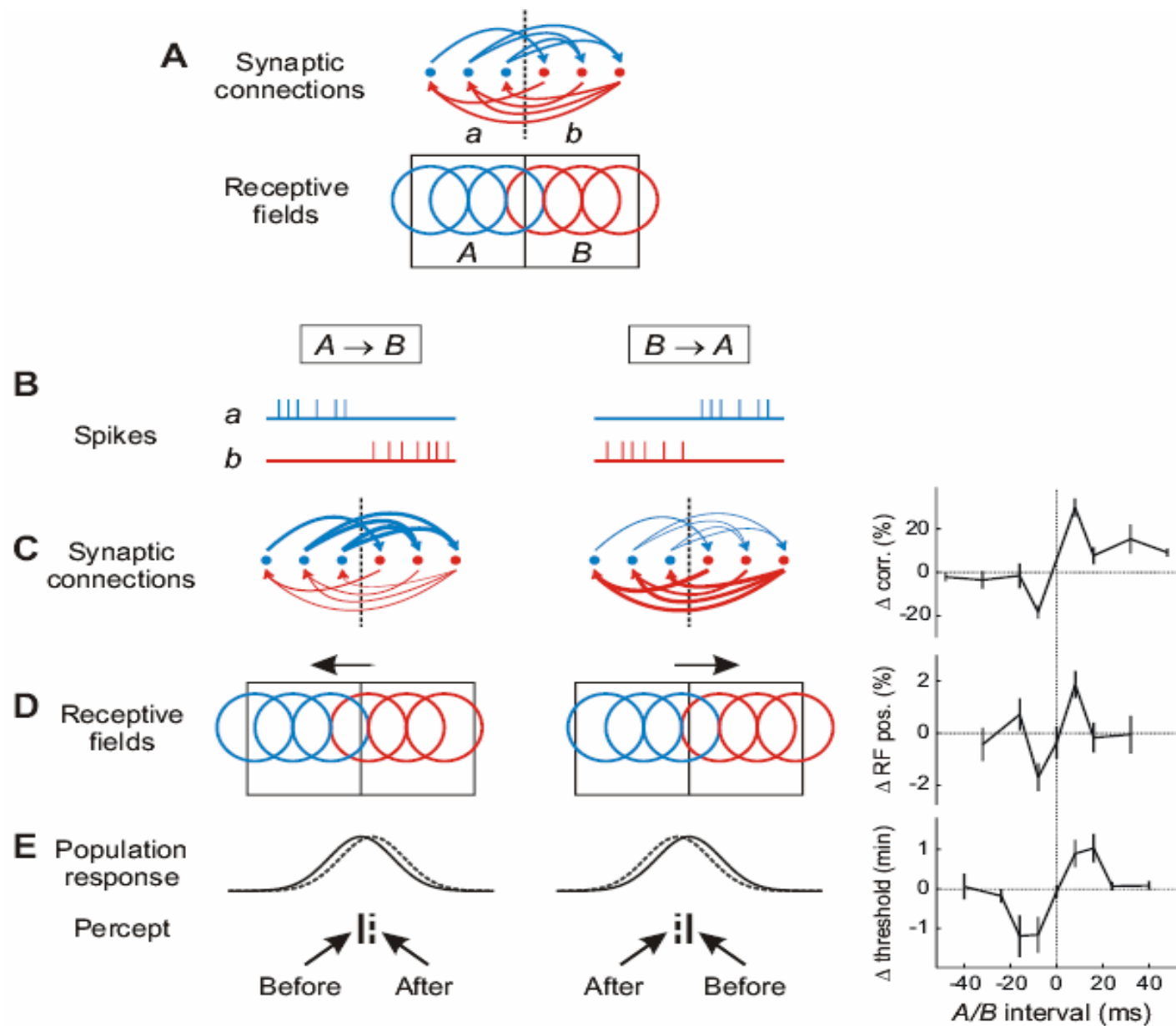
# STDP of Visual Responses in adult rats

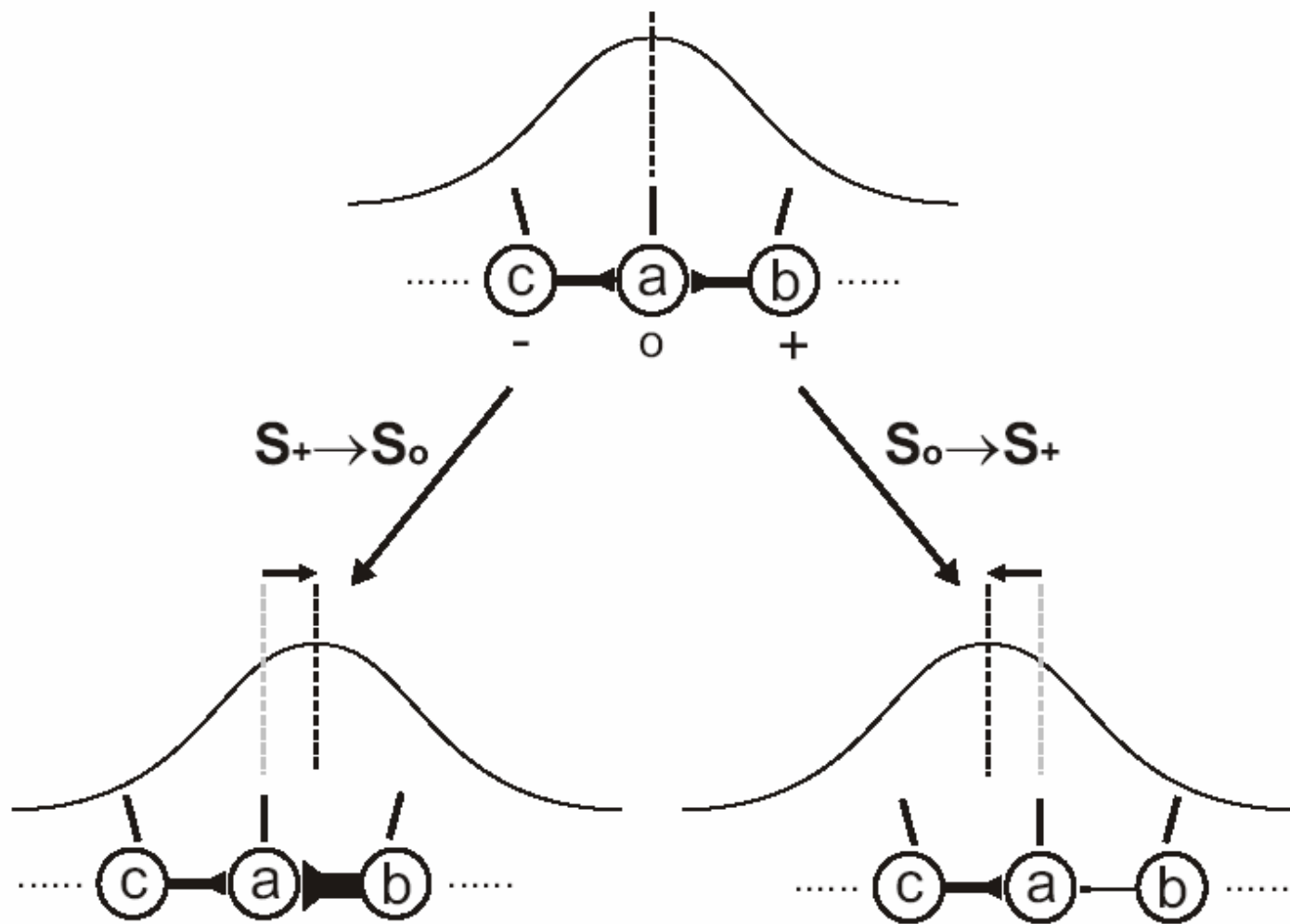




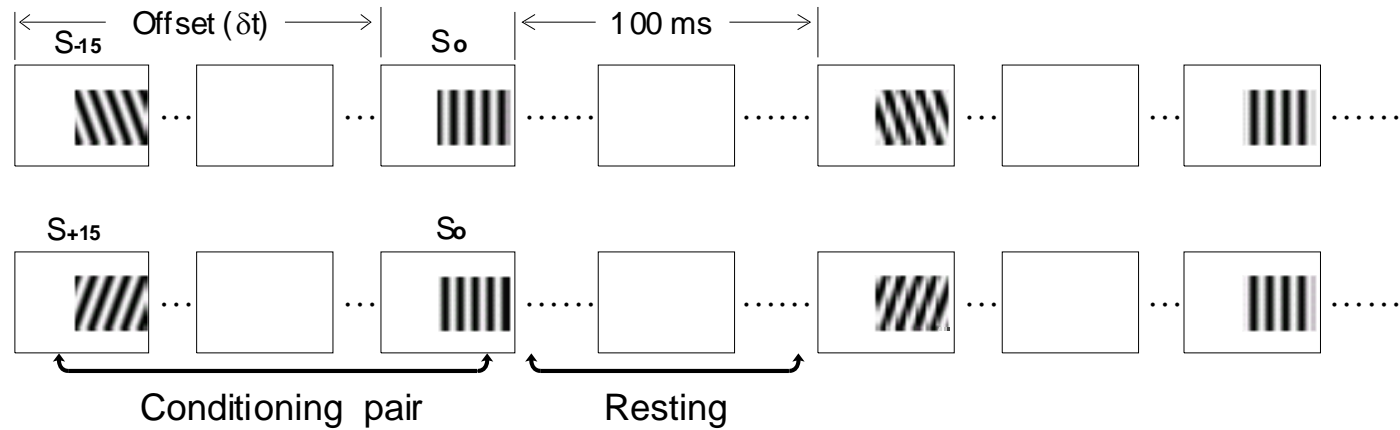




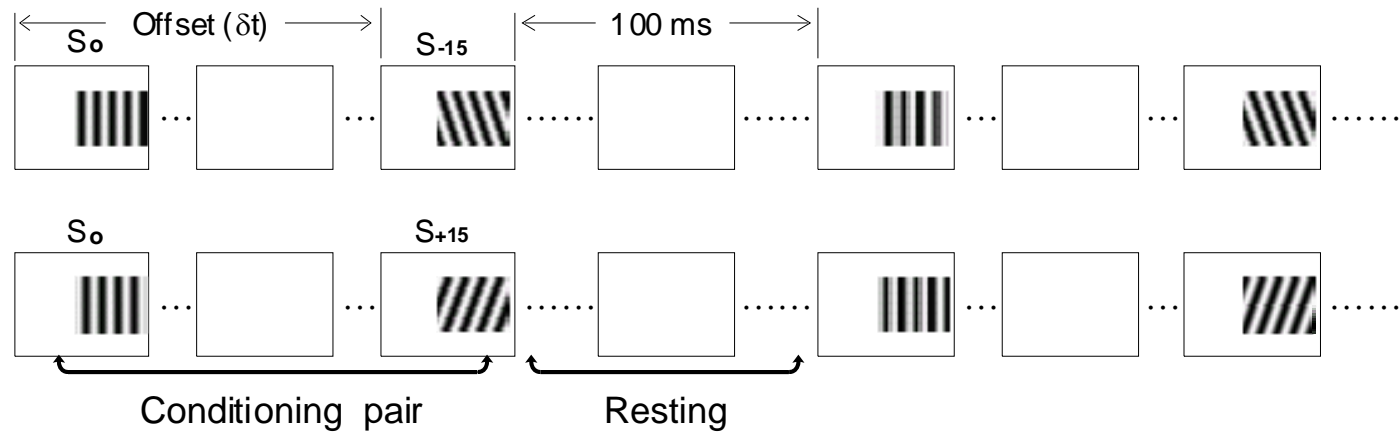




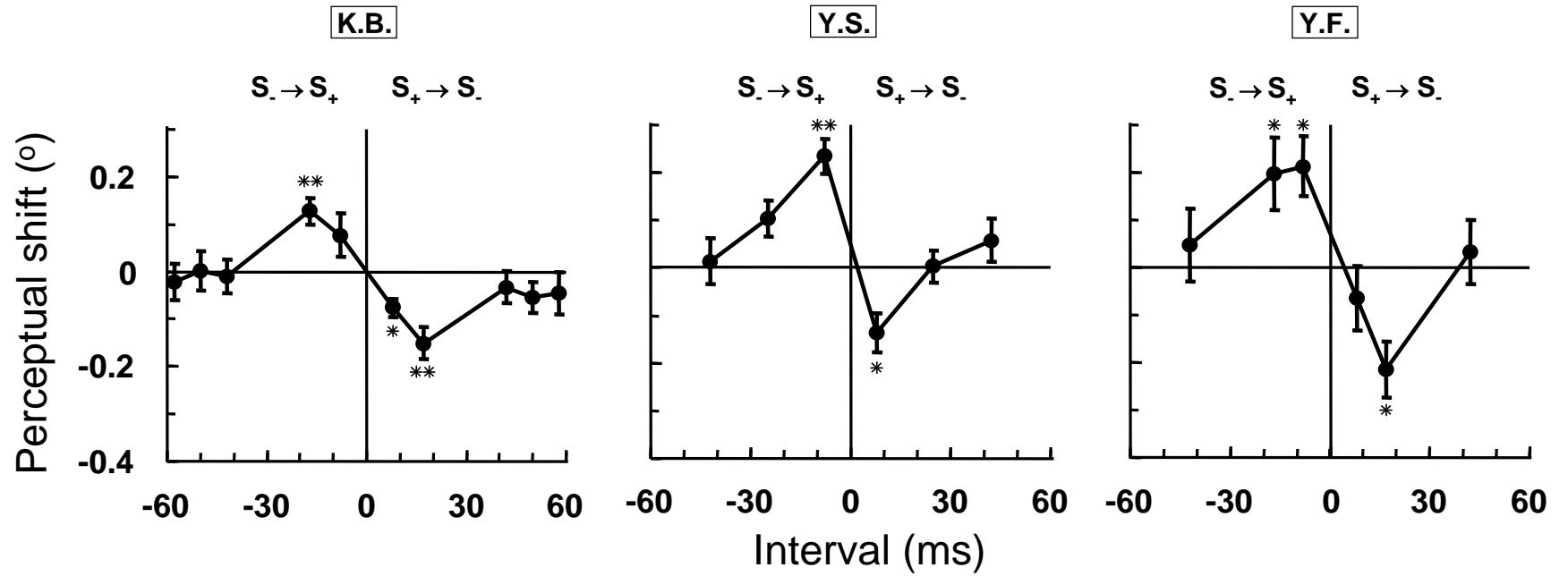
**b**  $S_{\pm 15} - S_0$



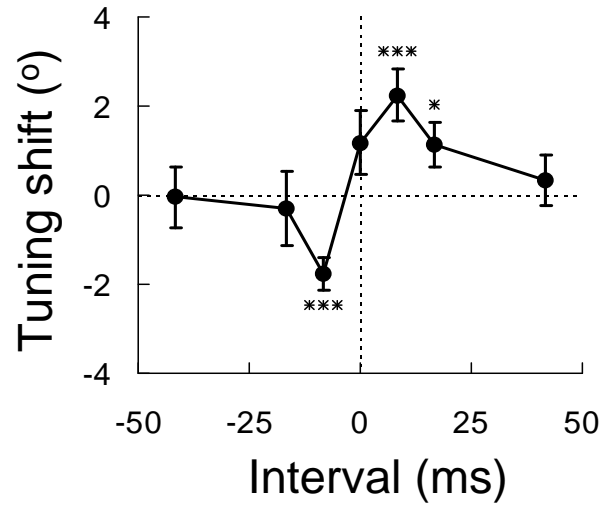
$S_0 - S_{\pm 15}$



Human psychophysics

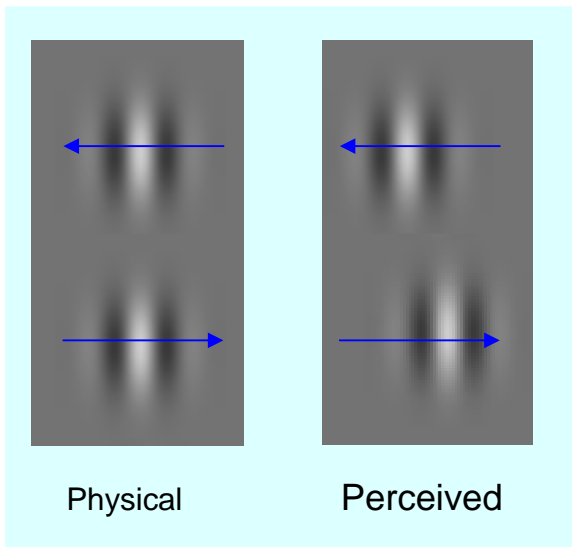


Cat V1



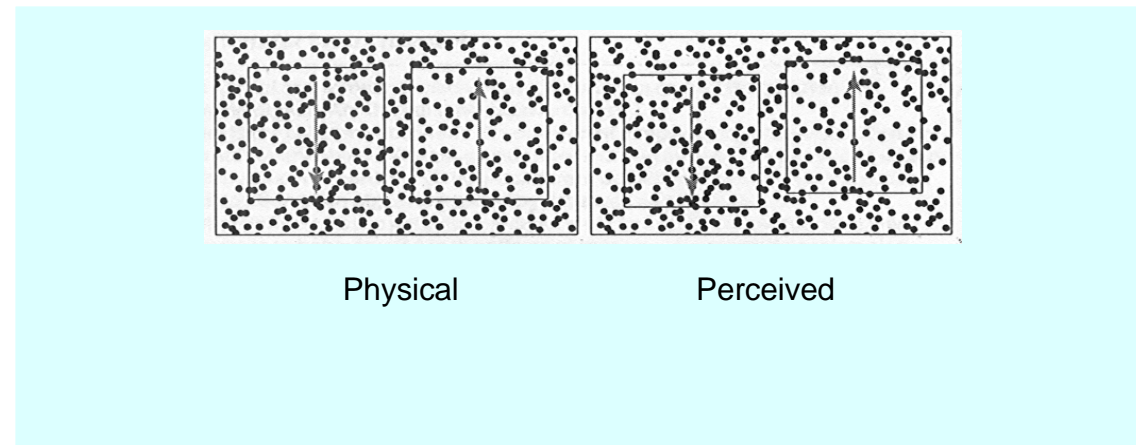
# Illusion 1: Shift in Perceived Target Position Induced by Local Motion

## De Valois & De Valois (1991)



Demo

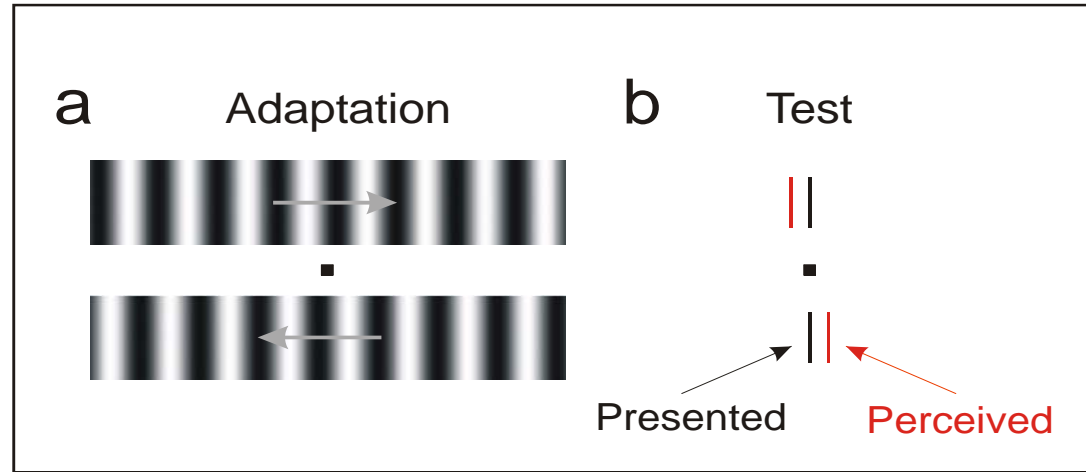
## Ramachandran & Anstis (1990)



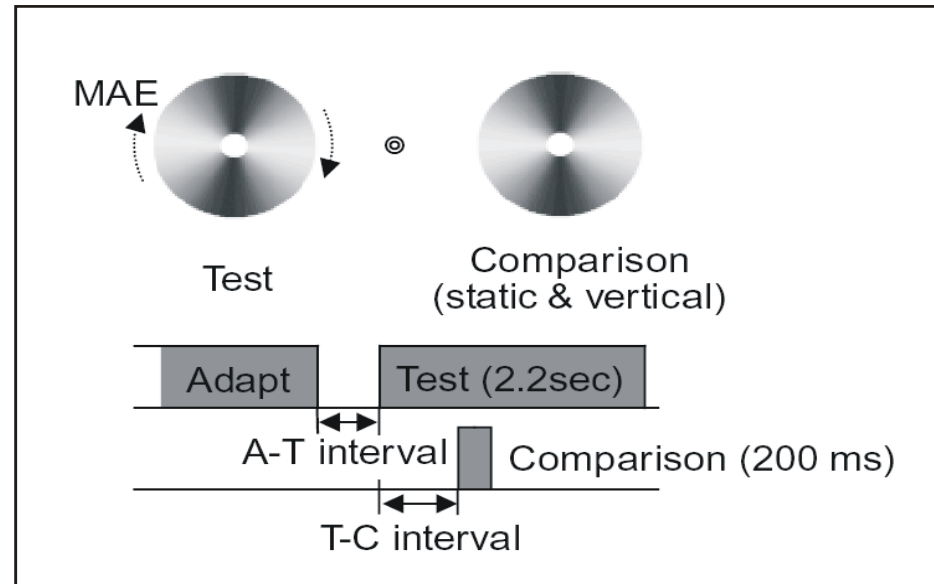
Demo

## Illusion 2: Shift in Perceived Target Position Induced by Motion Adaptation

Snowden, 1998

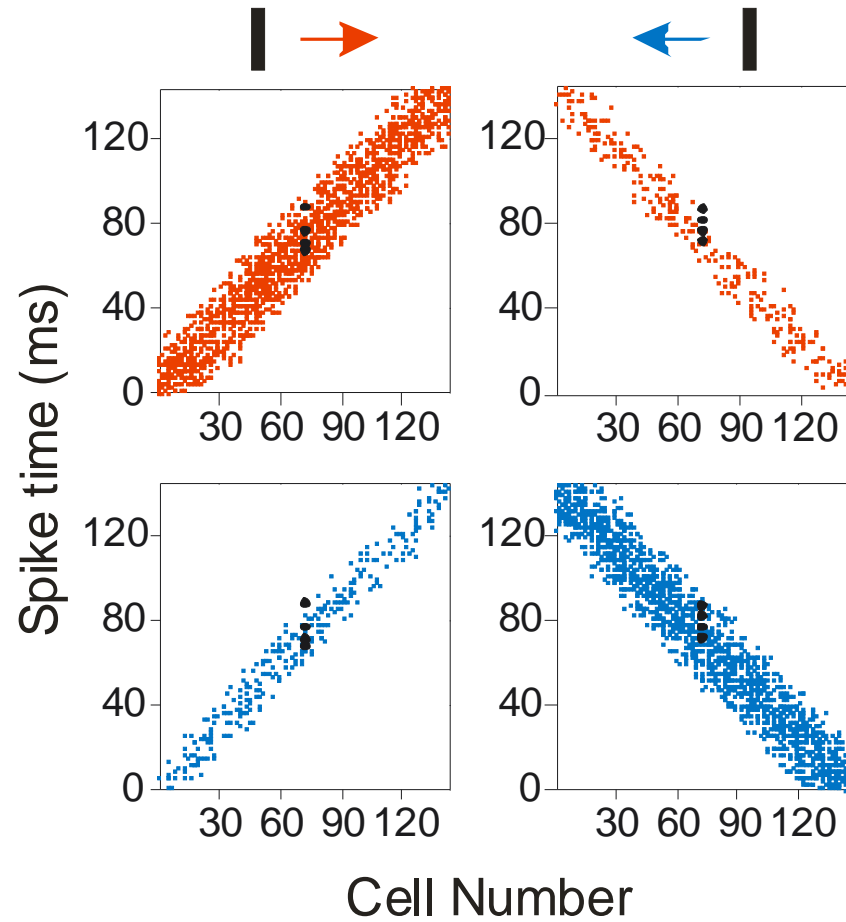
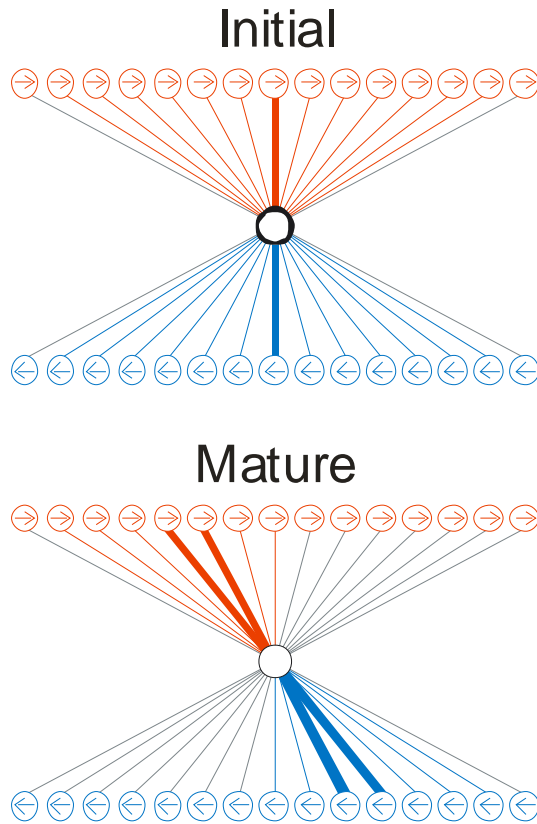


Nishida & Johnston, 1999



# STDP and motion stimuli

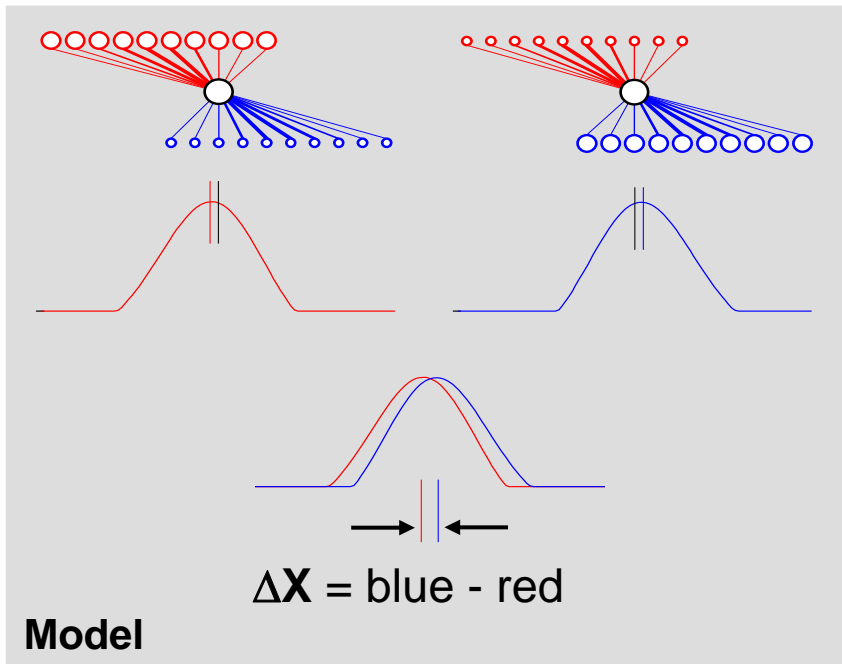
## during development of cortex circuit



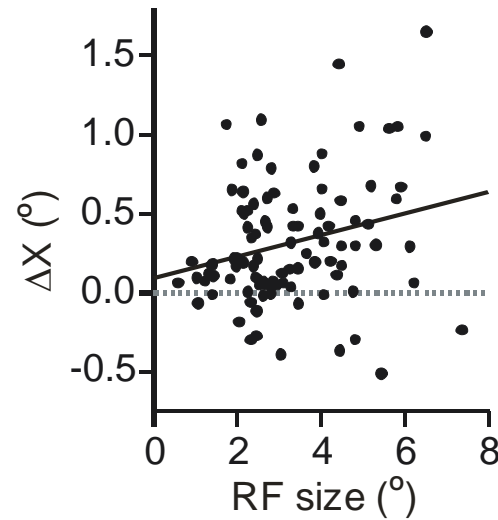
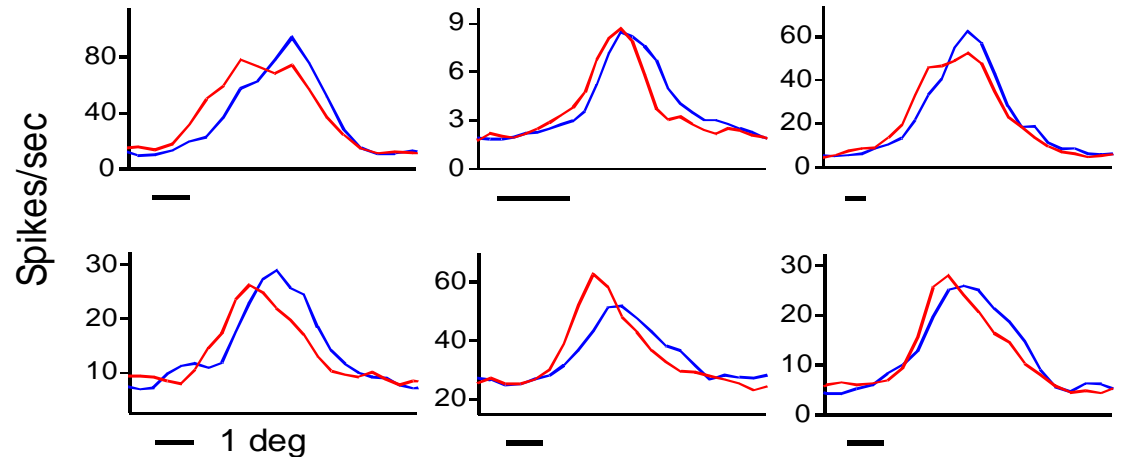


# Prediction 1: Dependence of Cortical RF on Local Motion

## RF Mapping w/ Local Motion

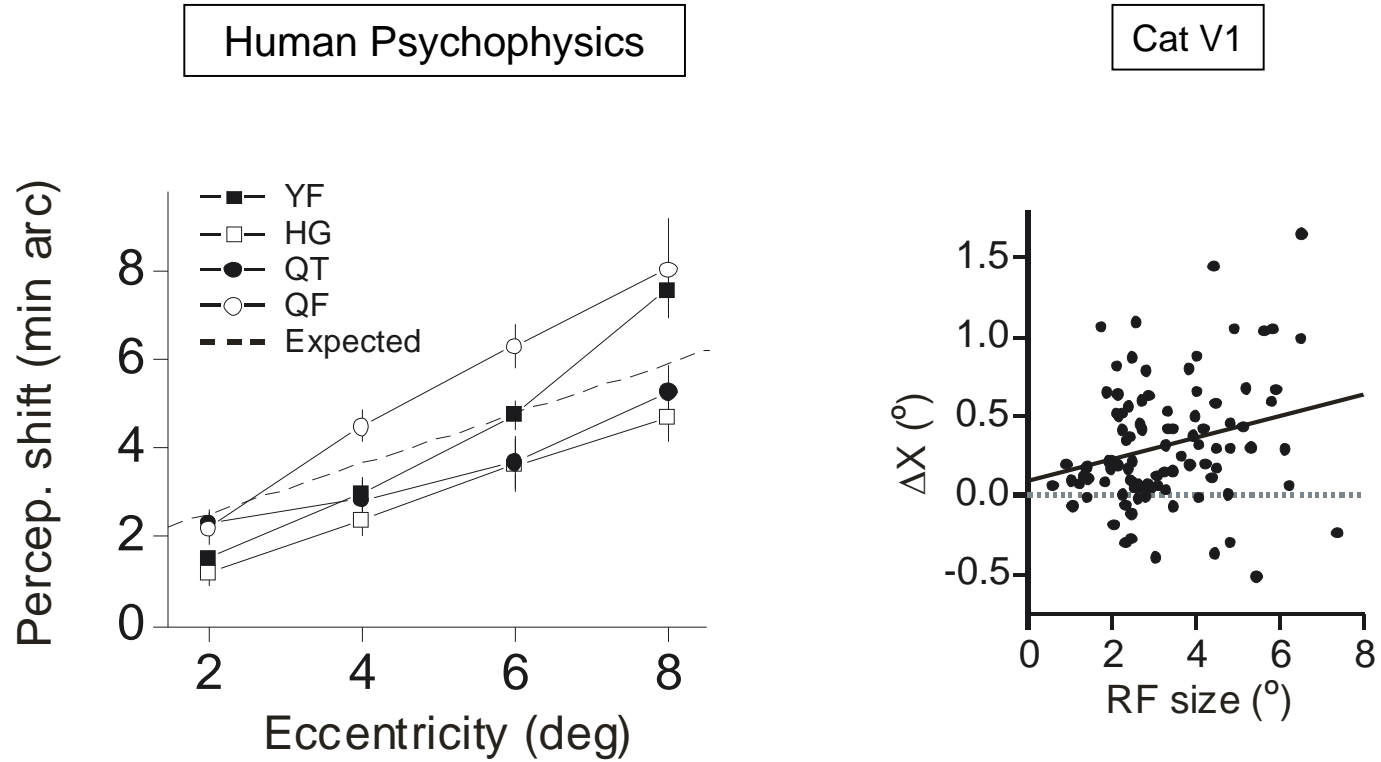


## Data

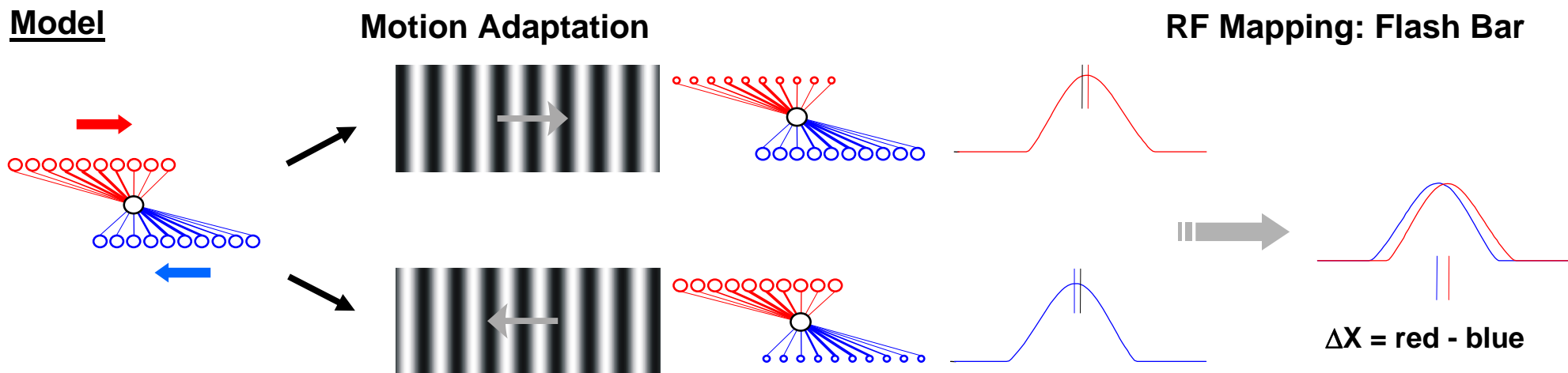


Fu et al.,  
*J. Neurosci.*, 2004

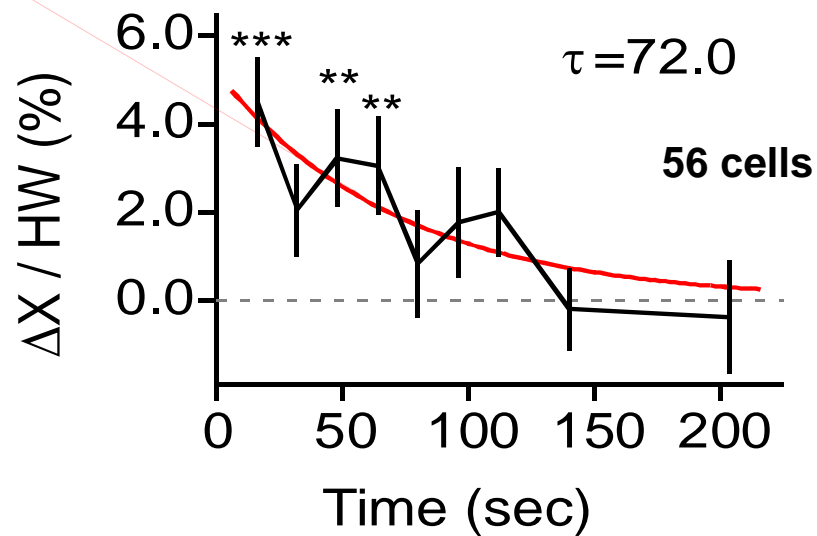
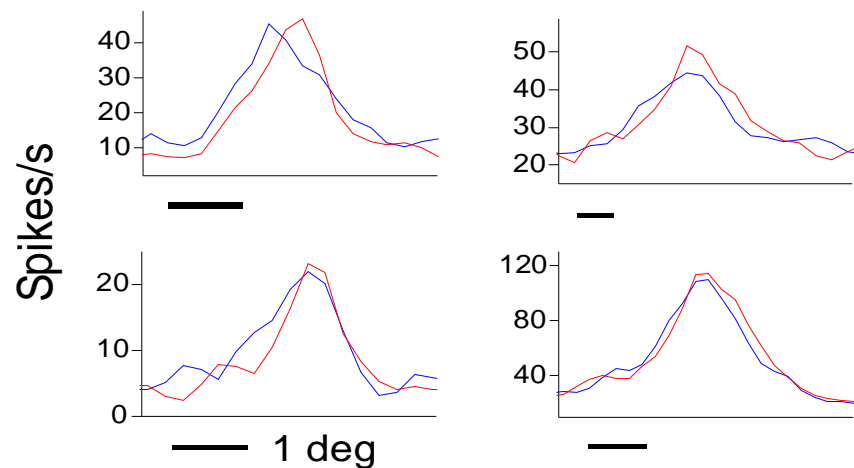
# Physiological Basis of Illusion 1



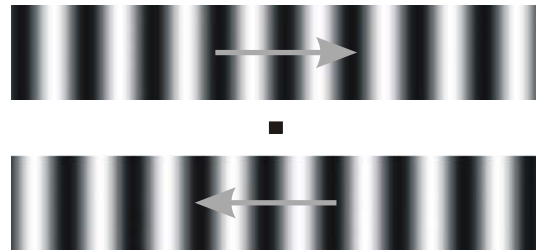
## Prediction 2: Dependence of Cortical RF on Motion Adaptation



### Data



## Physiological Basis of Illusion 2



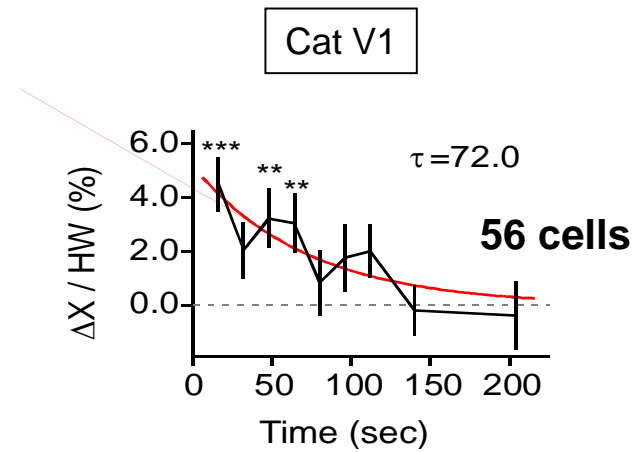
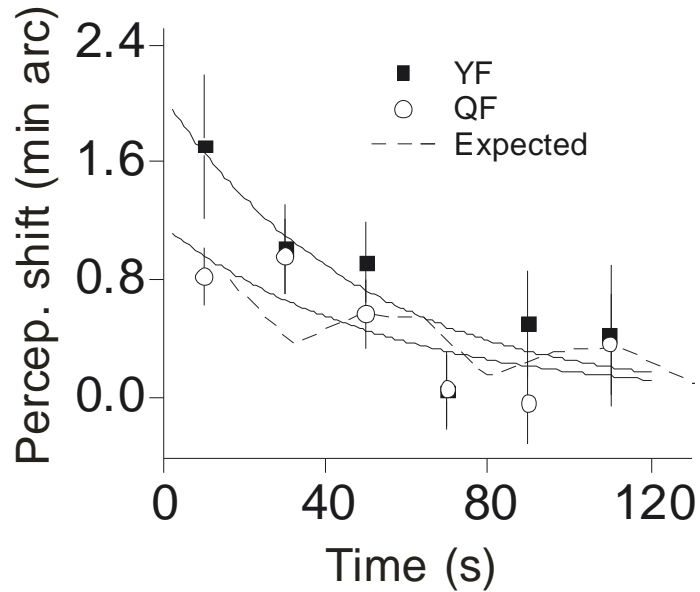
Adaptation

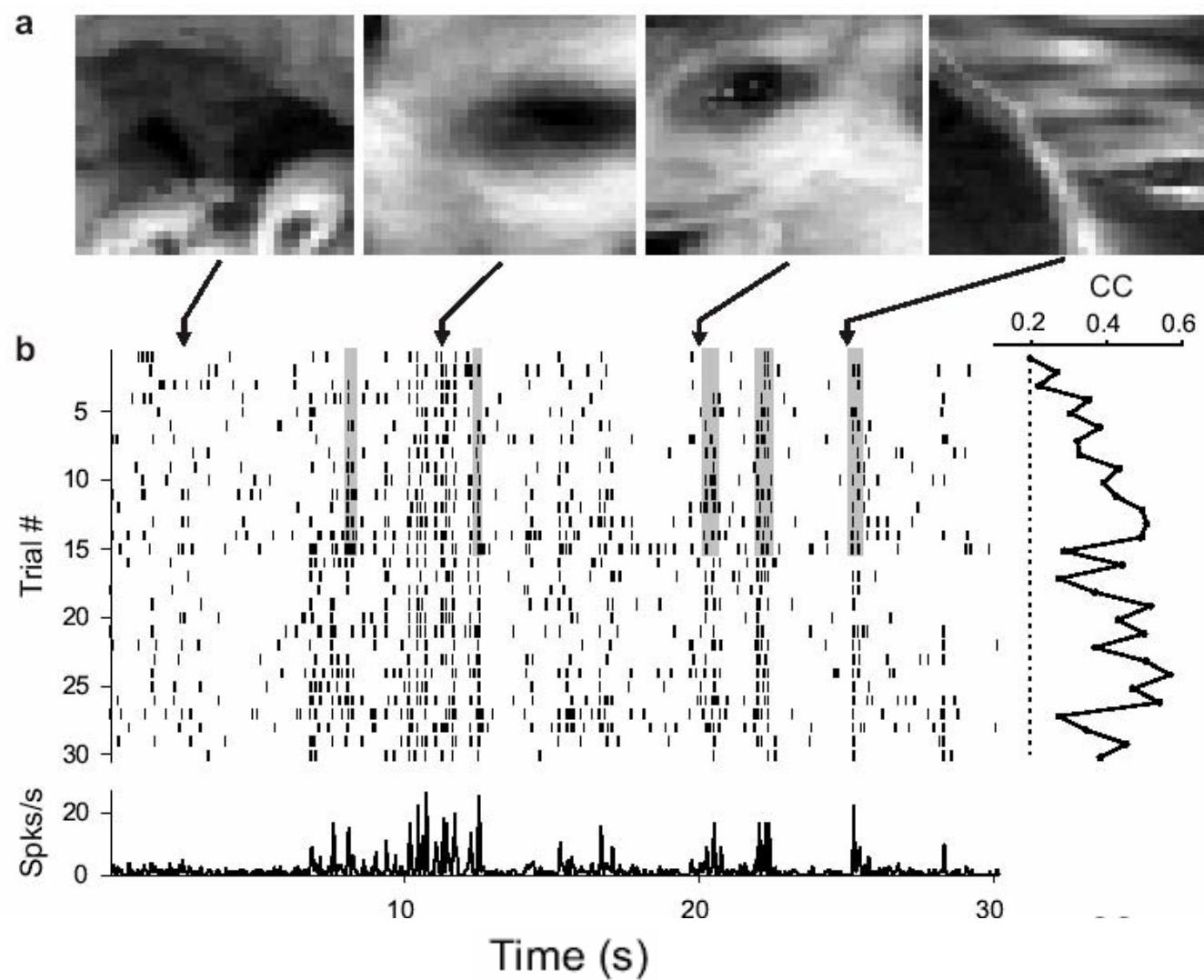
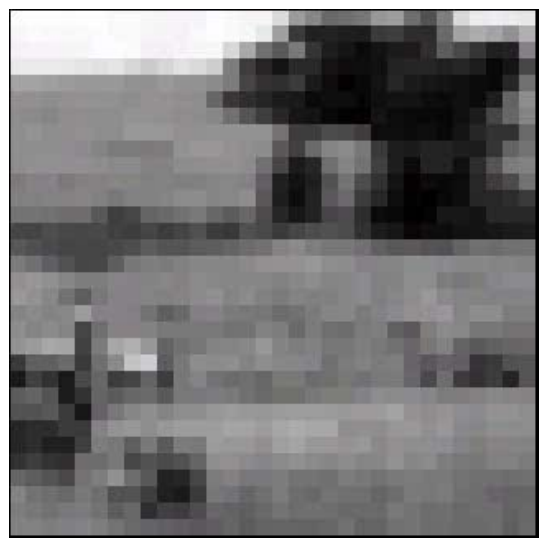


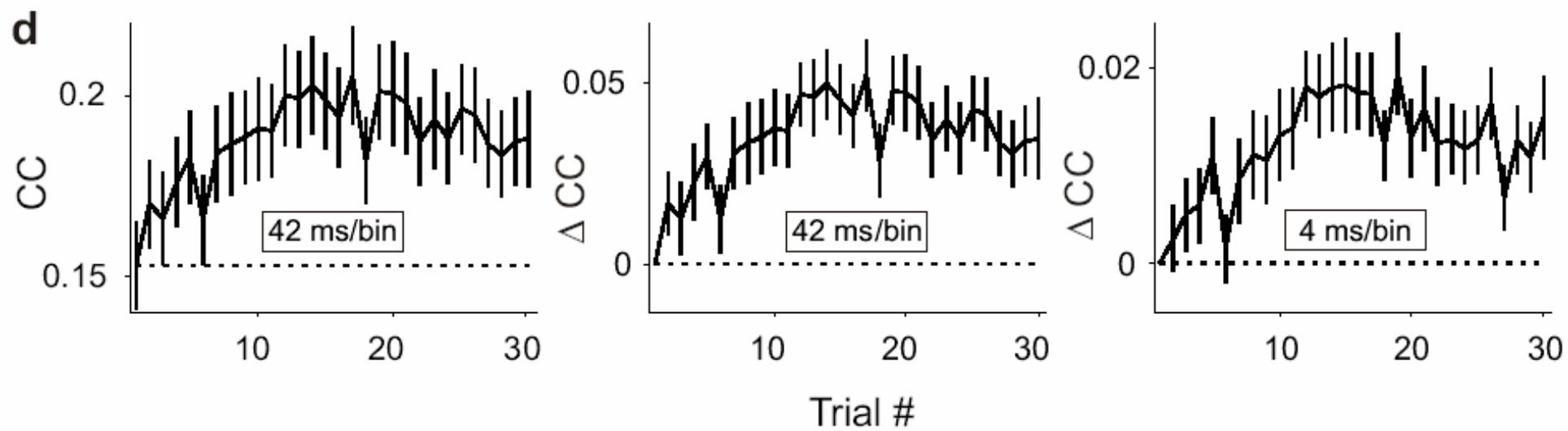
Physical/ Perceived

Psychophysics (Snowden, 1998)

Human  
Psychophysics





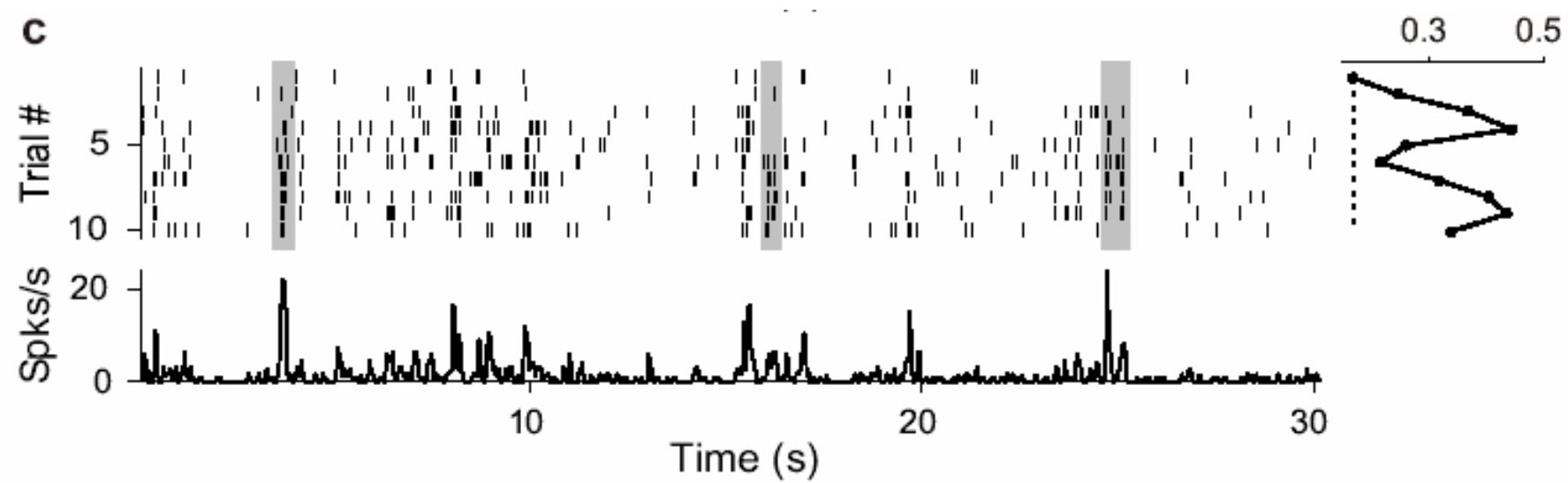


# What we found so far

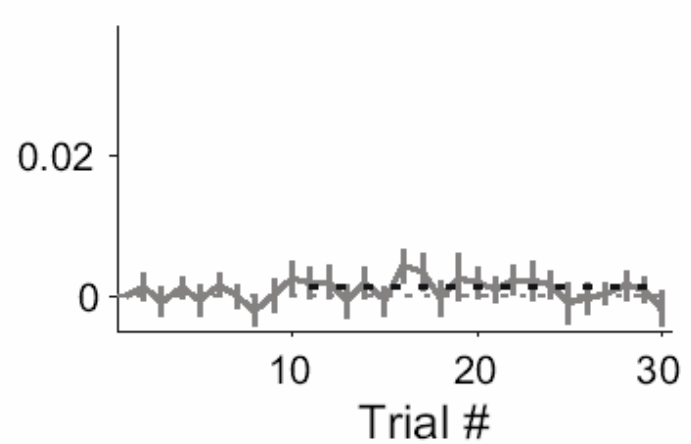
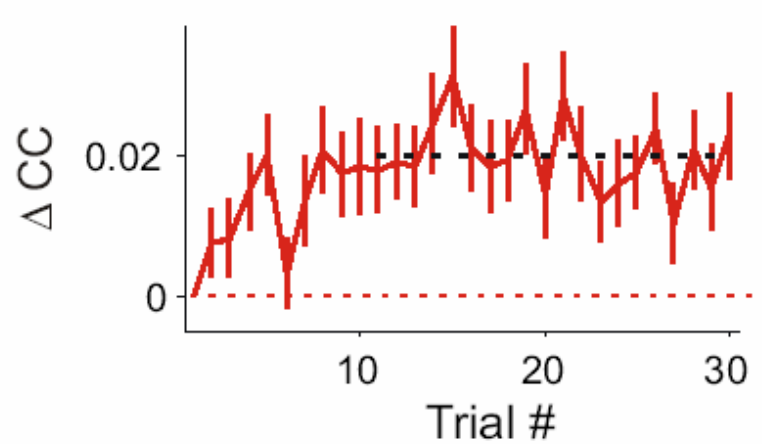
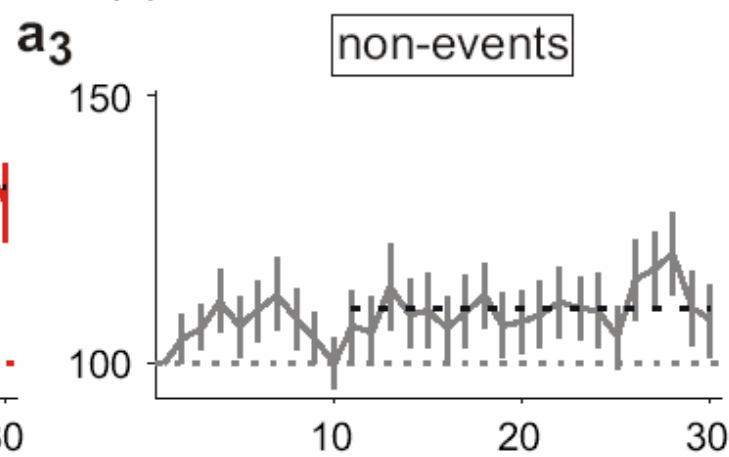
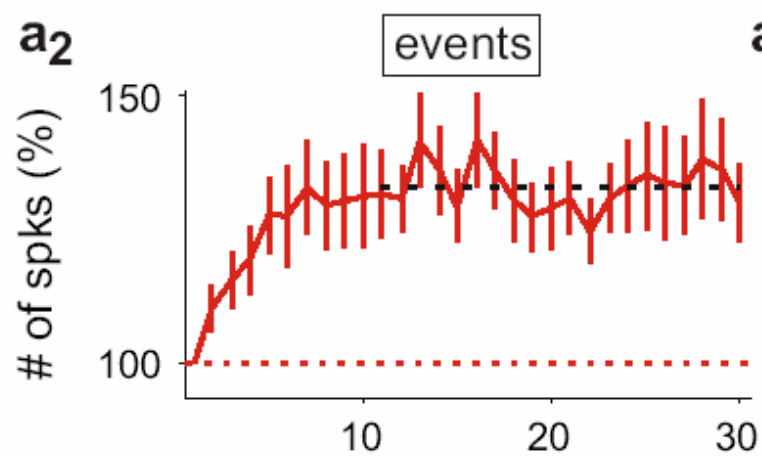
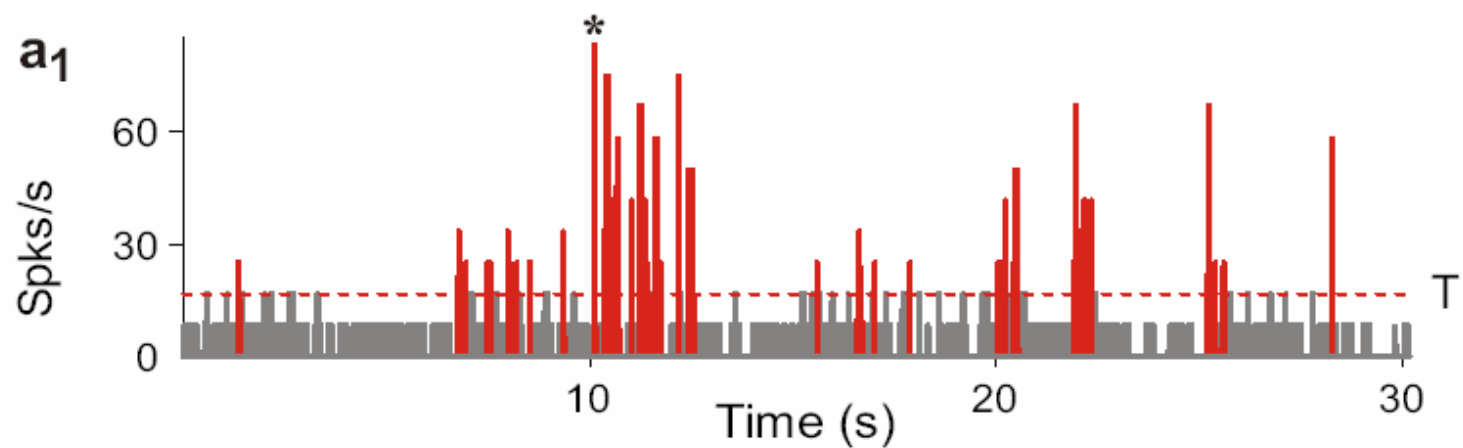
1. Repeated exposure to natural stimuli (and possibly other types of stimuli) enhances response reliability

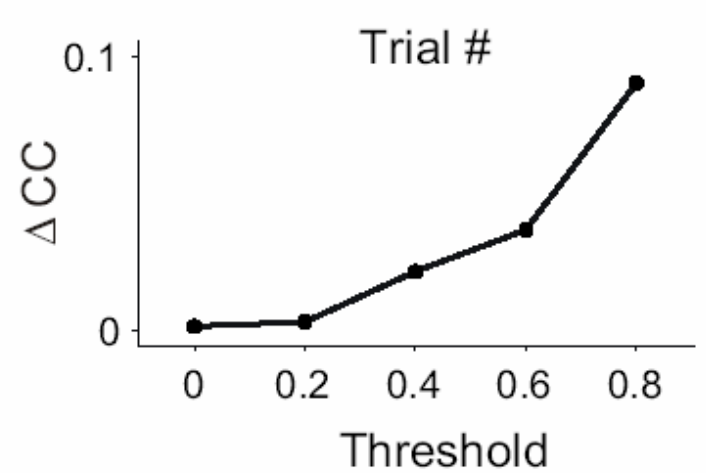
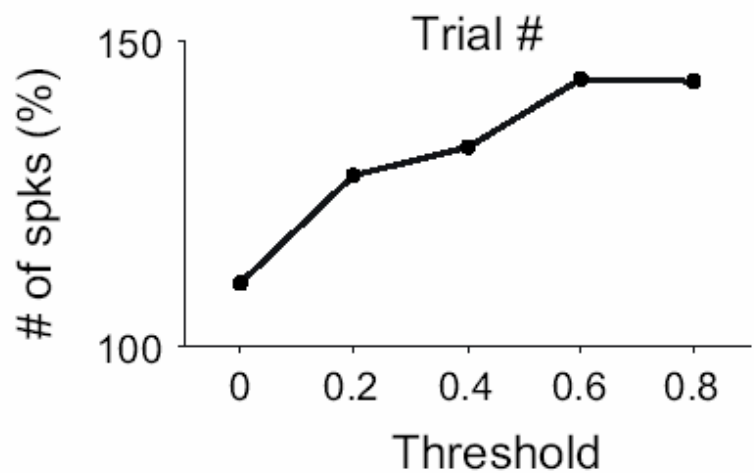
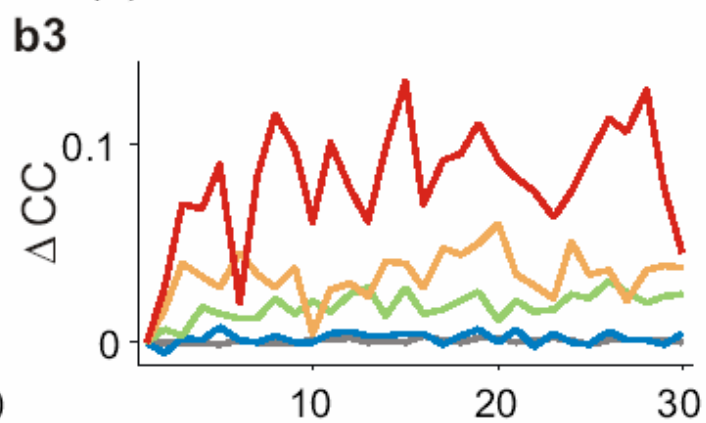
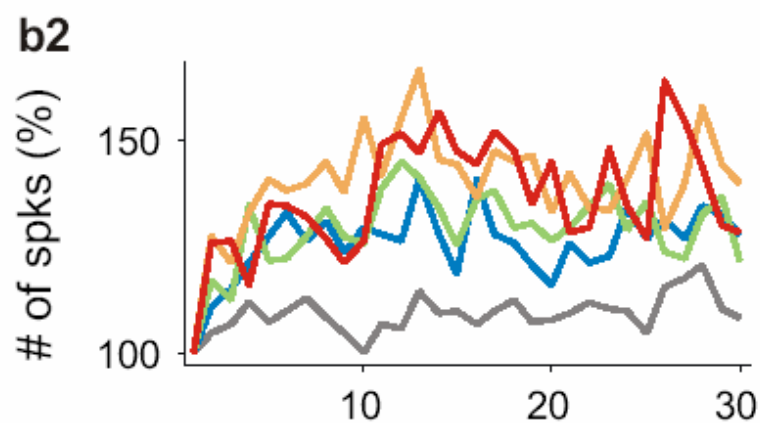
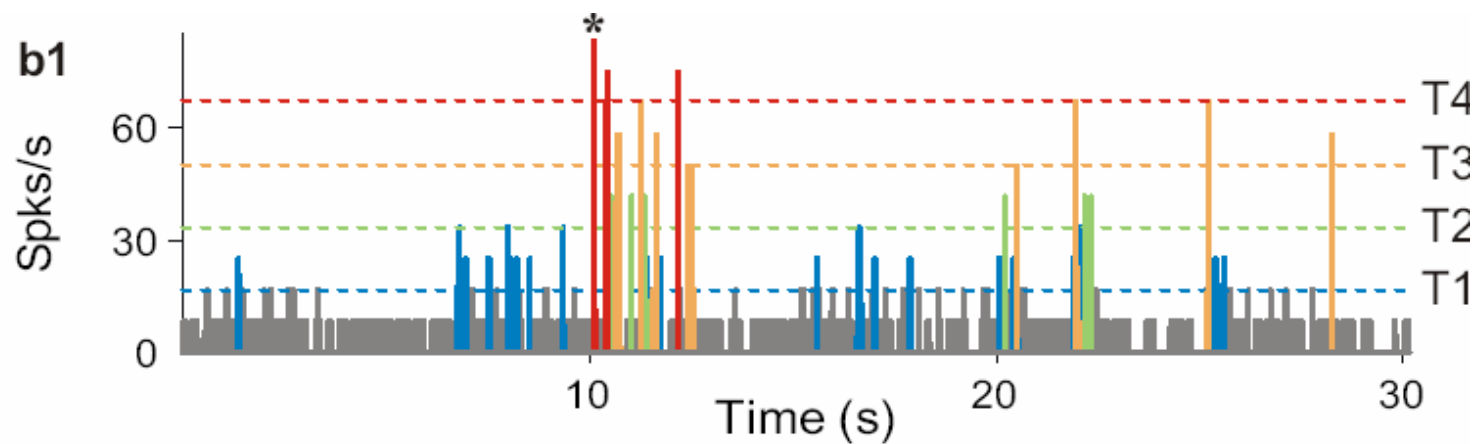
## Questions

- Which part of the natural stimuli induce the changes in cortical neurons?
- What changes in response properties underlie the improvement in reliability?

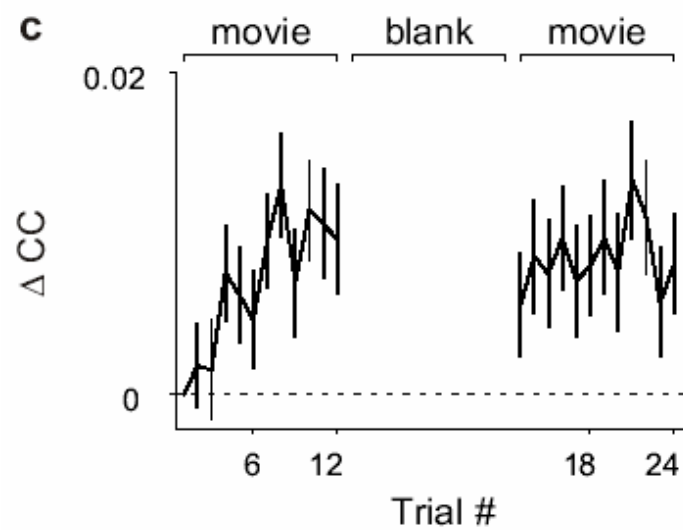
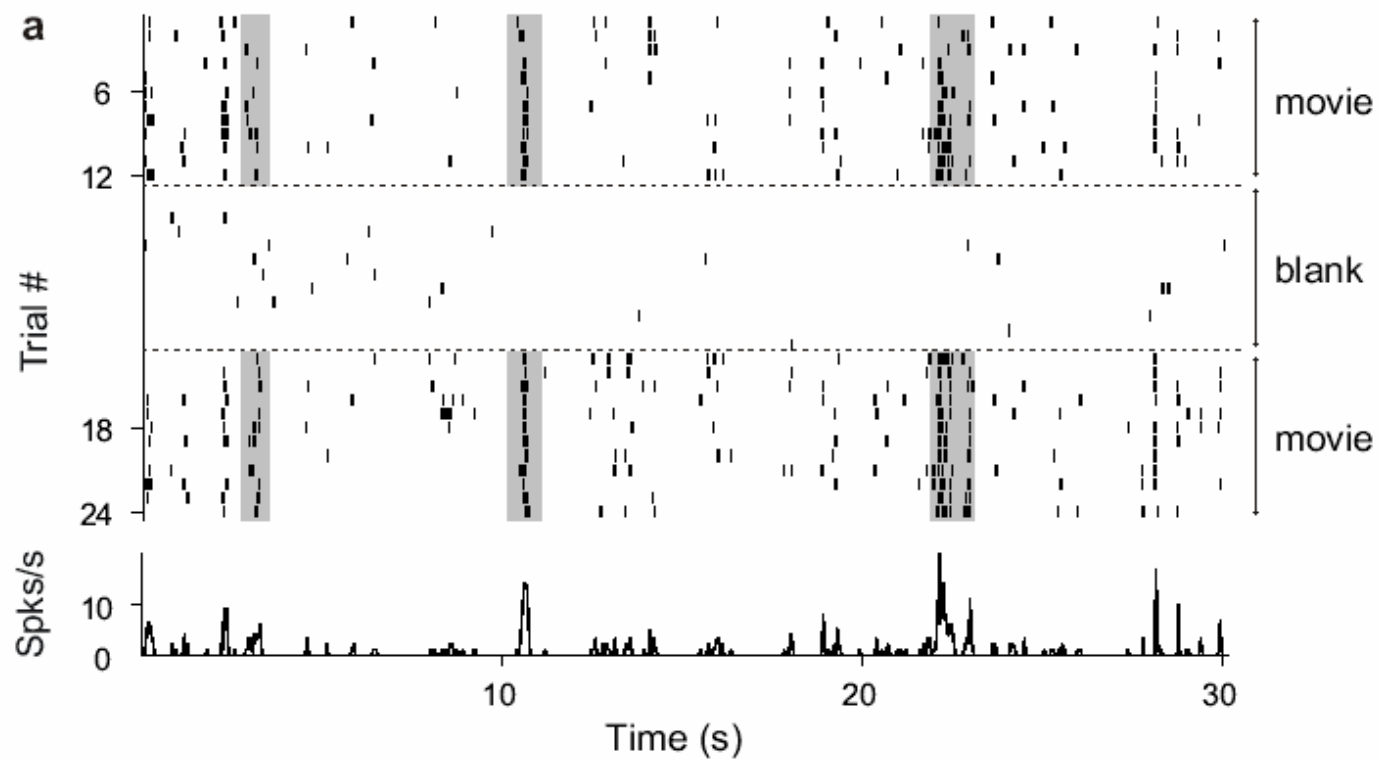




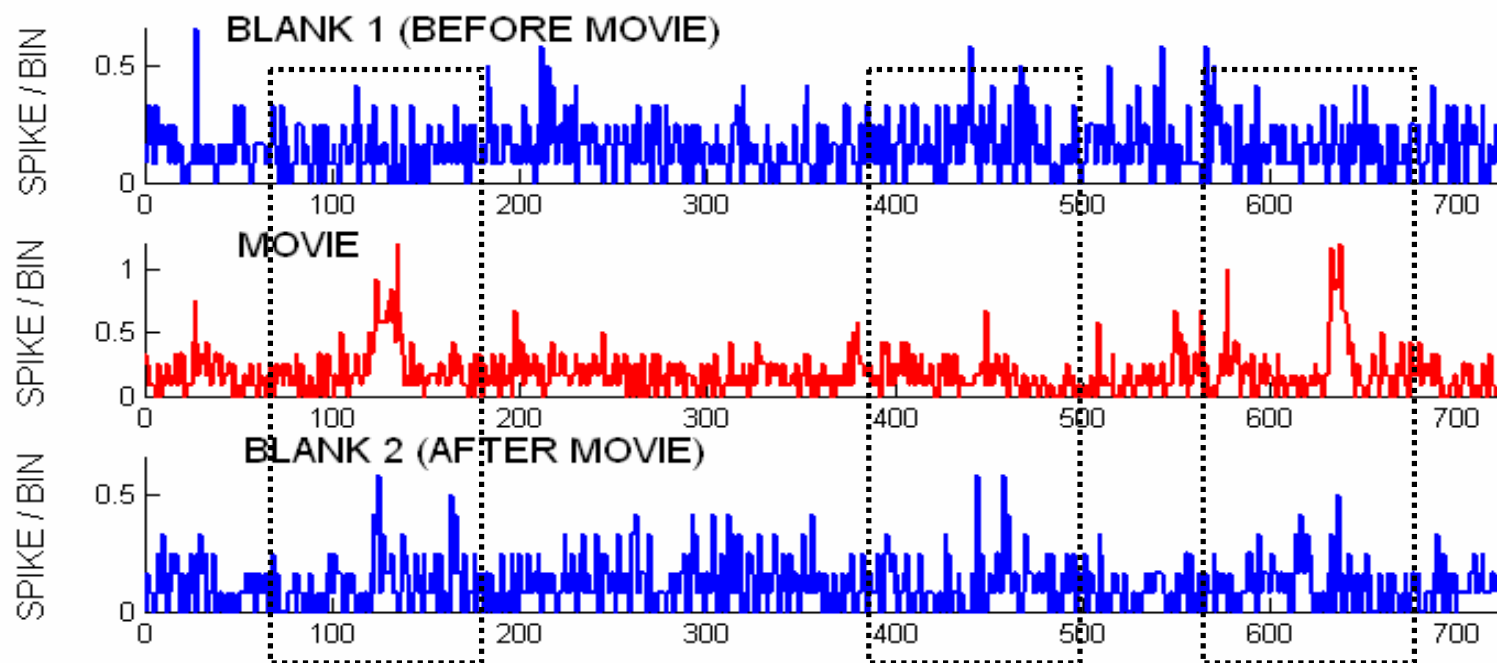


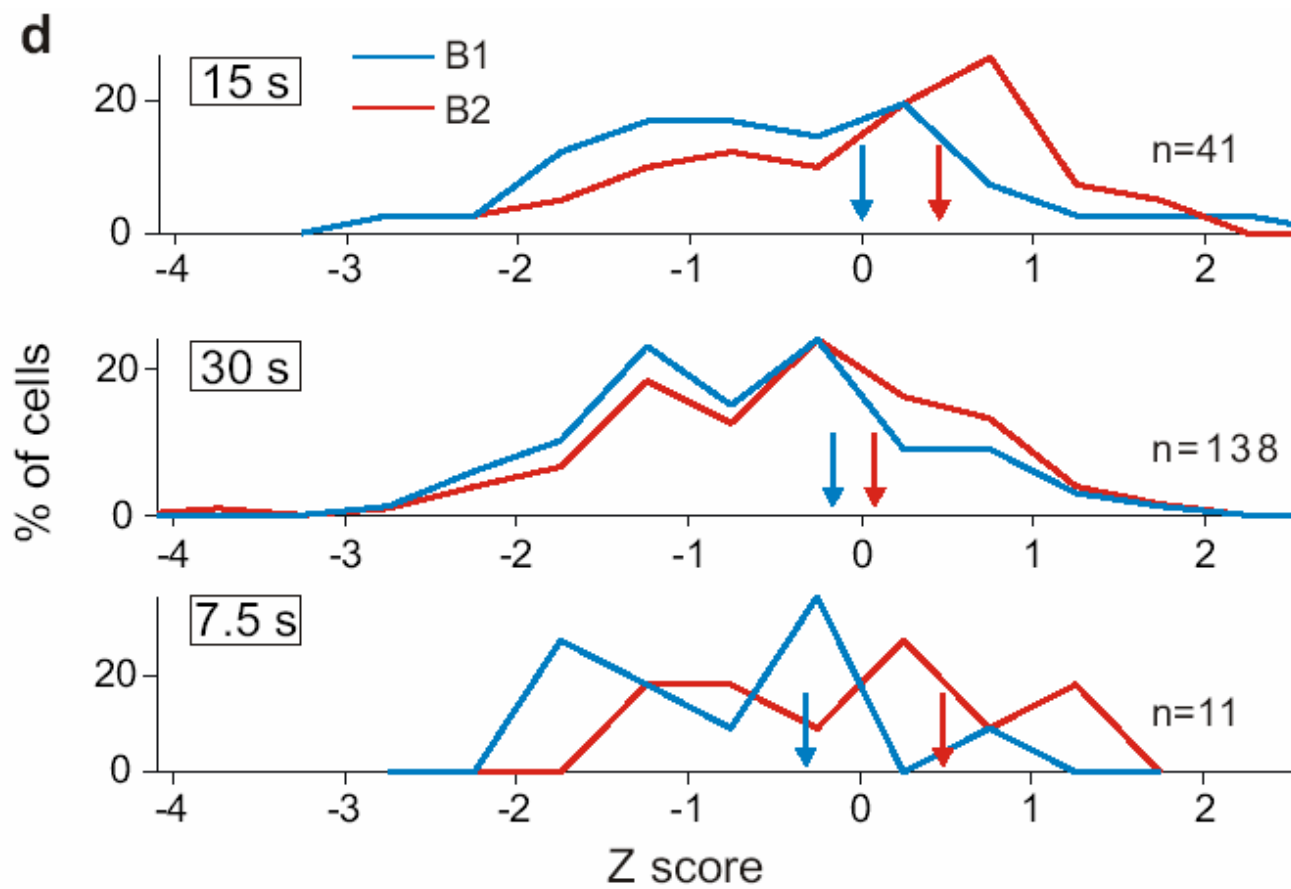


1. Which part of the natural stimuli induce the changes in cortical neurons?
  1. Preferred stimuli (?)
  
2. What changes in response properties underlie the improvement in reliability?
  1. Point process adaptive filtering, but we haven't found anything consistent...



050609\_LS\_08&9\_reclustered.N034\_113\_B5.sb0.mat (B2-N2-B3)(1 frame / bin)

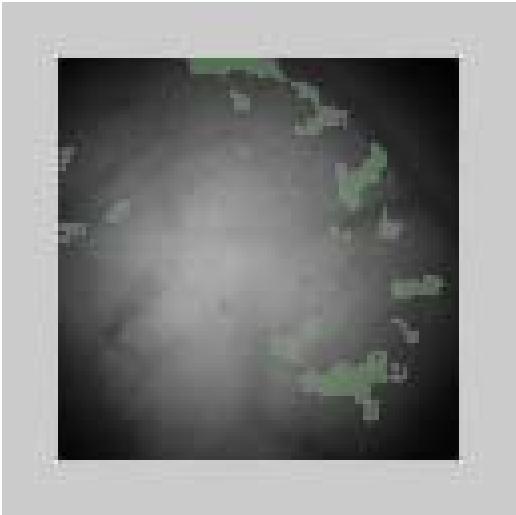




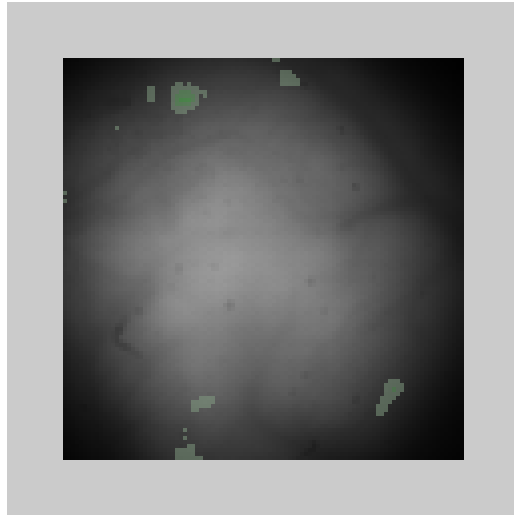
# VSD imaging

Spontaneous waves

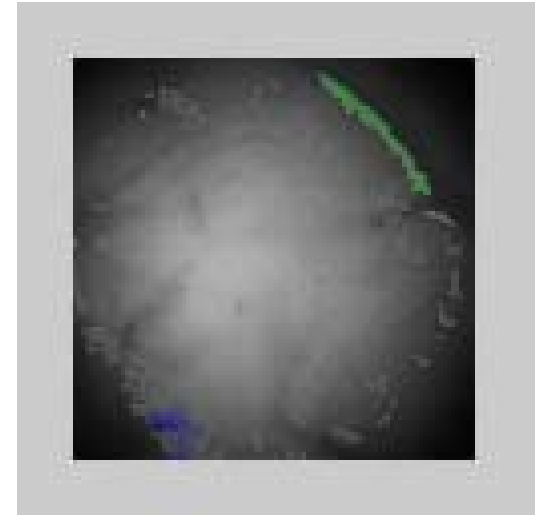
Before



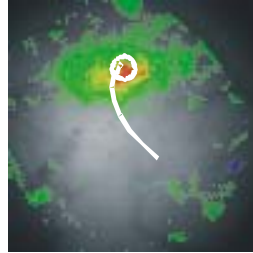
After



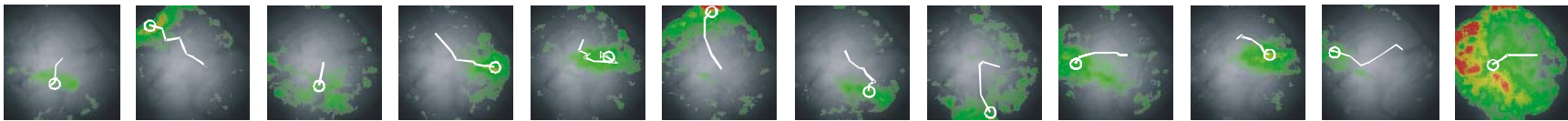
Response to  
a flashed spot



Evoked wave  
(template)



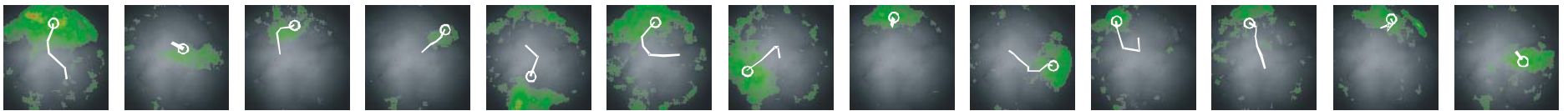
Before



\*

\*

After



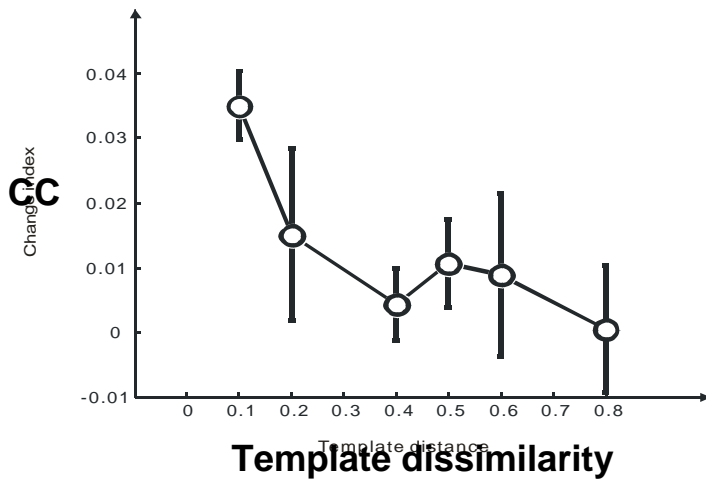
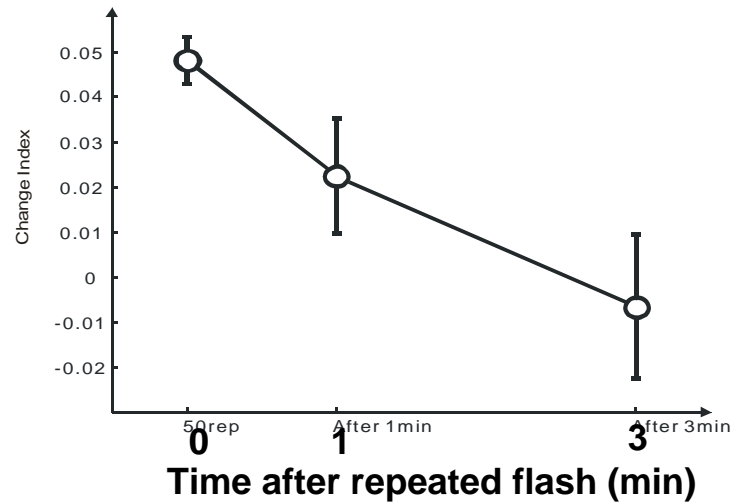
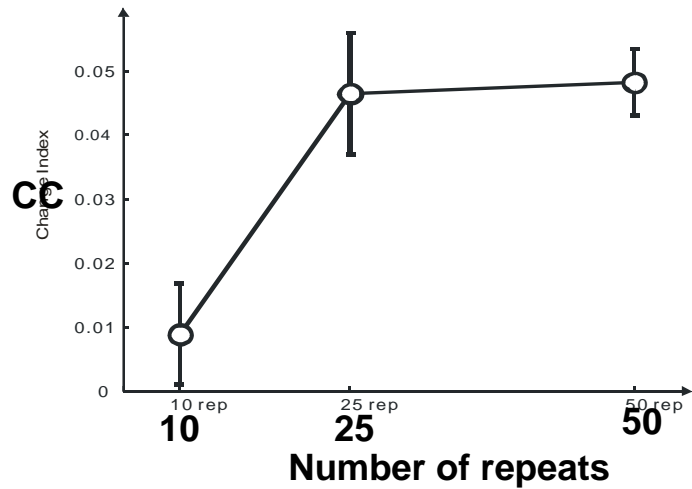
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Yu-Xi Fu



Dan Meliza



Natalia Caporale



Haishan Yao



Rob Froemke



Feng Han