

In search of the NCC: Visual system experiments

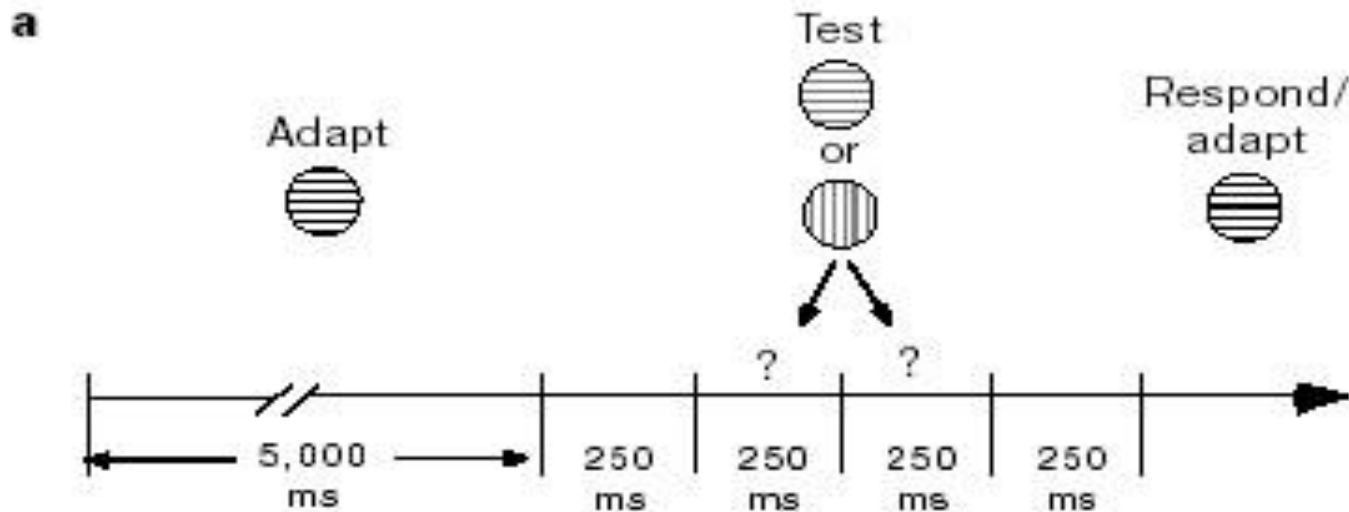
Daniel Kiper
26.9.2024

Aftereffect to invisible stimuli

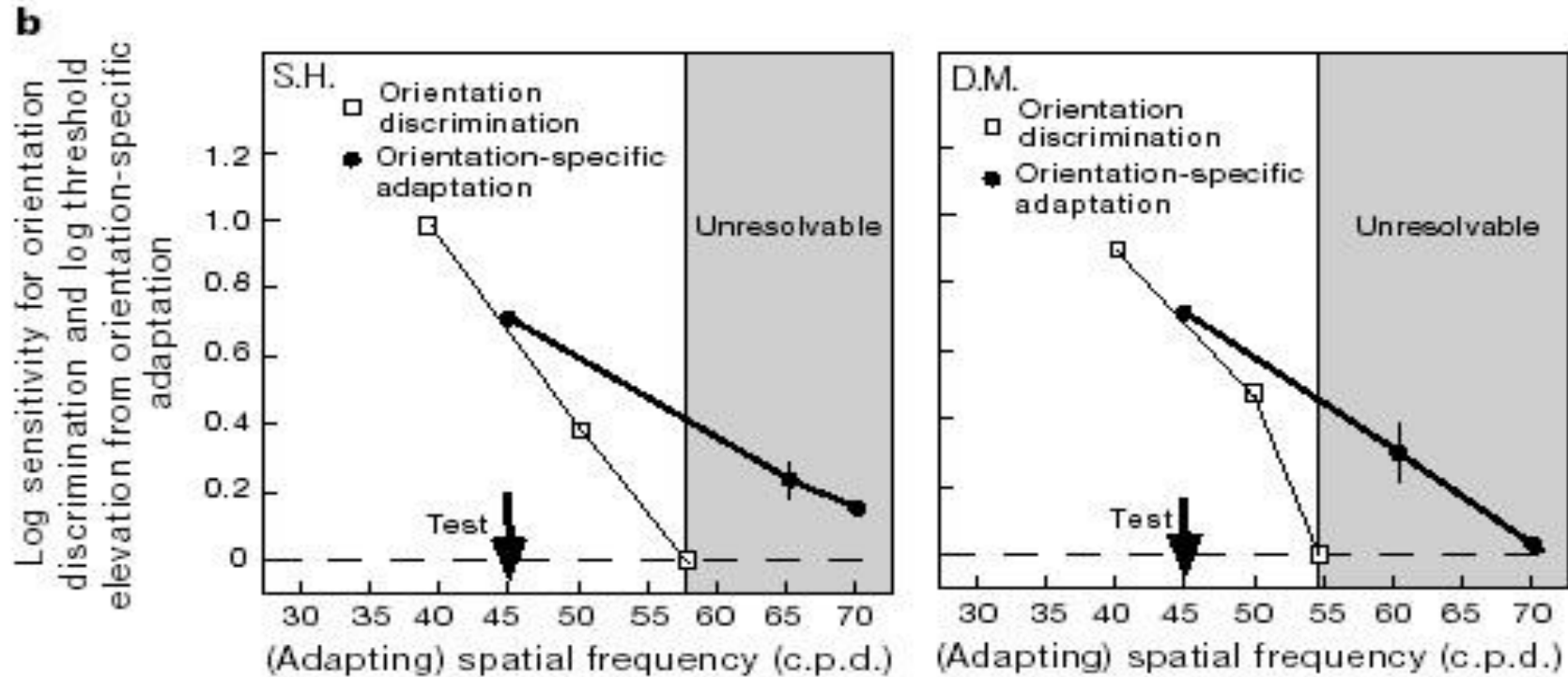
Experimental Setup:

- Laser Projection of an either horizontal or vertical adapting grating onto the retina for 5 seconds (different resolutions)
- Test grating (various contrast, to determine threshold contrast)

The after-effect in this case is a reduced threshold contrast for gratings with the same orientation as the adaptation grating



Results:



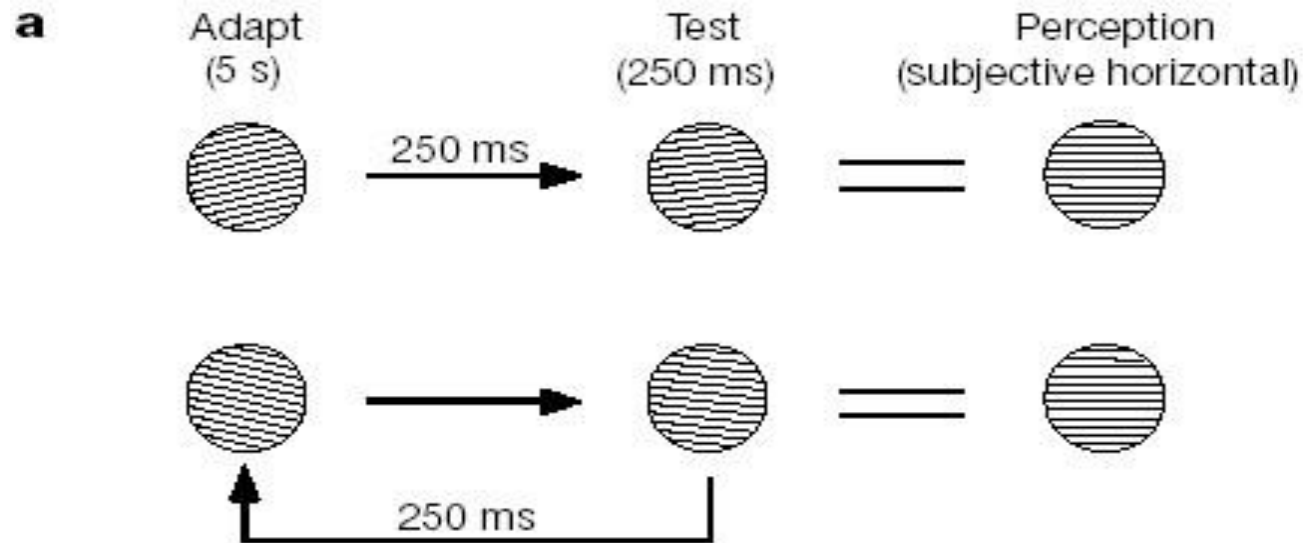
- Even invisible gratings had a measurable after-effect above 55 cpd: inability to tell the orientation in a forced choice test

Their conclusions:

Stimuli too fine to be resolved can activate orientation selective neurons in cortex.

Second Experiment:

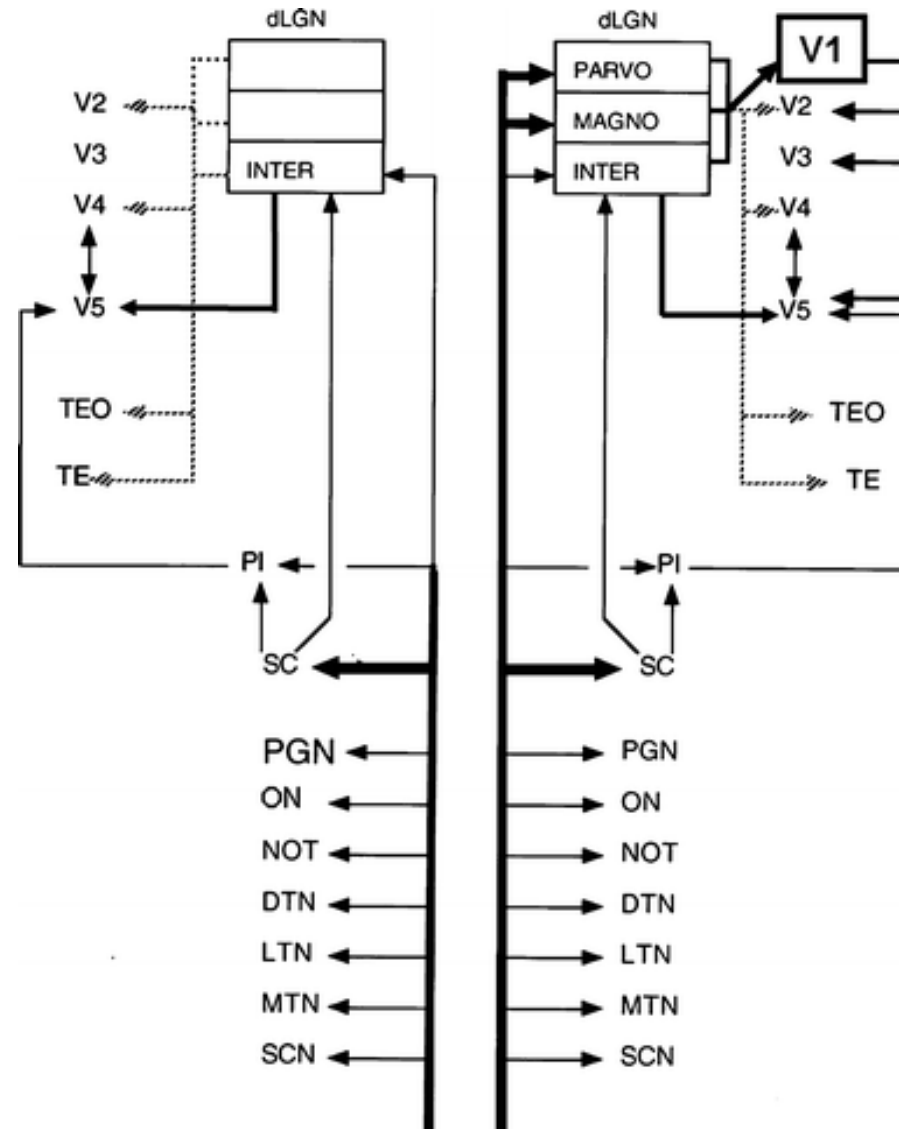
Tilt after-effect with invisible gratings:



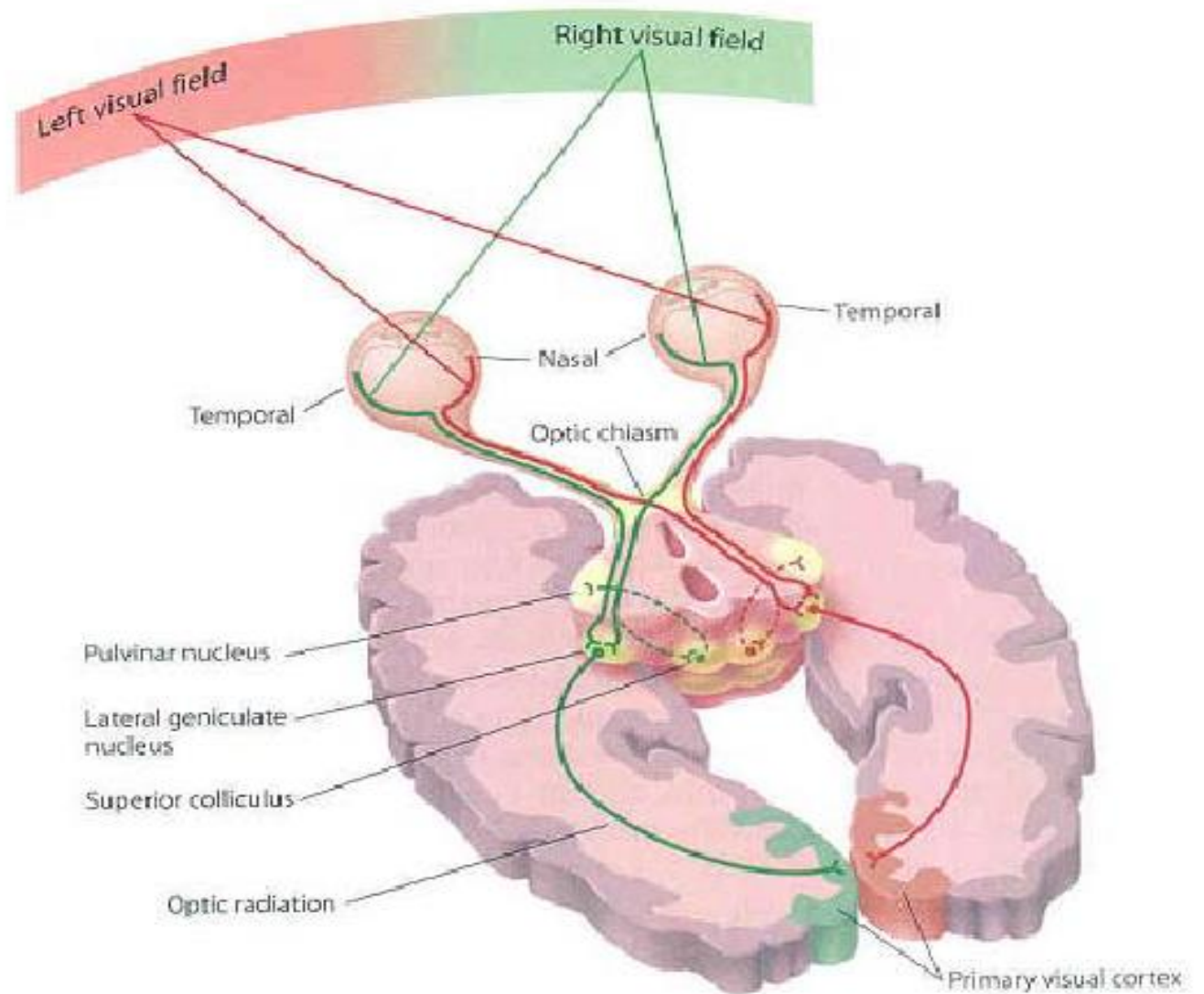
This also worked...

Blindsight: Weiskrantz et al. 1995

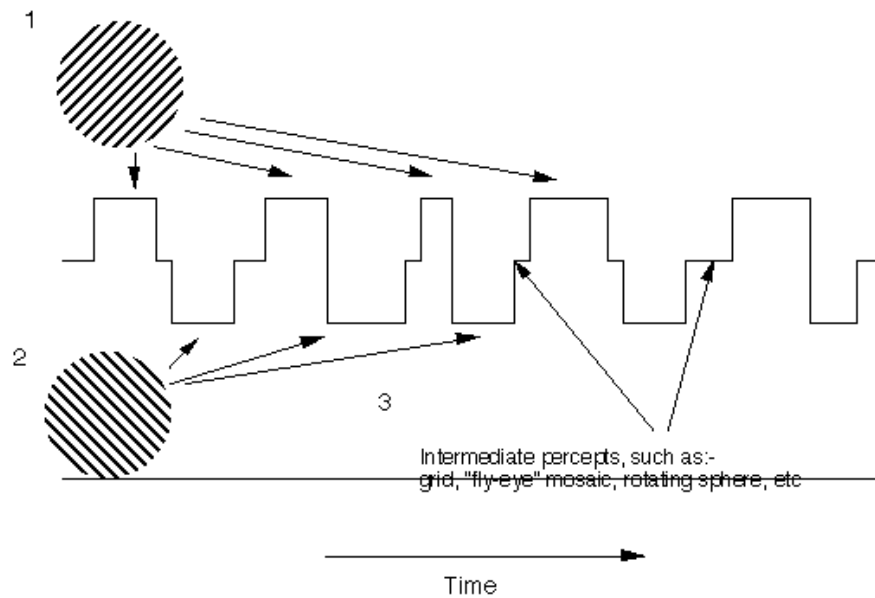
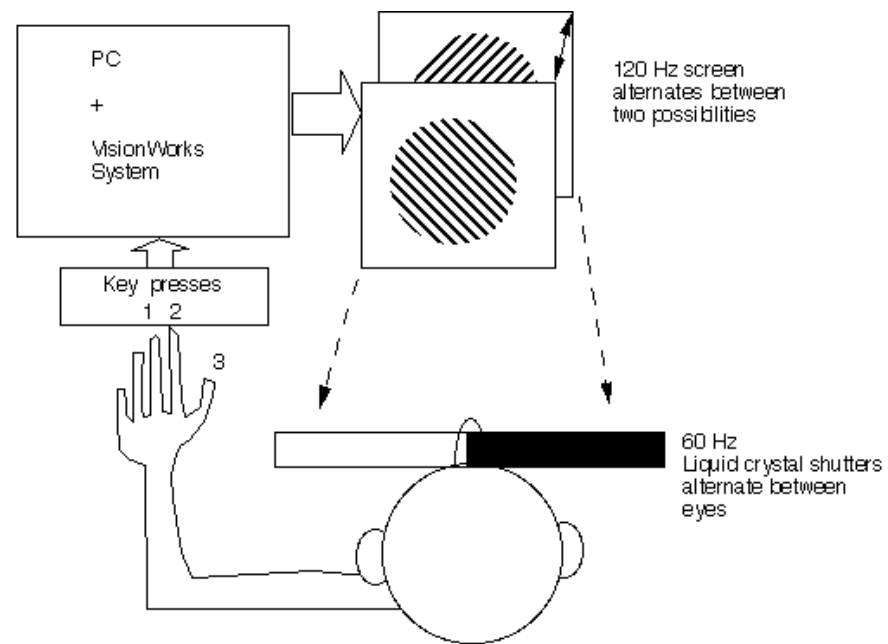
Blindsight: (Cowey 2010)



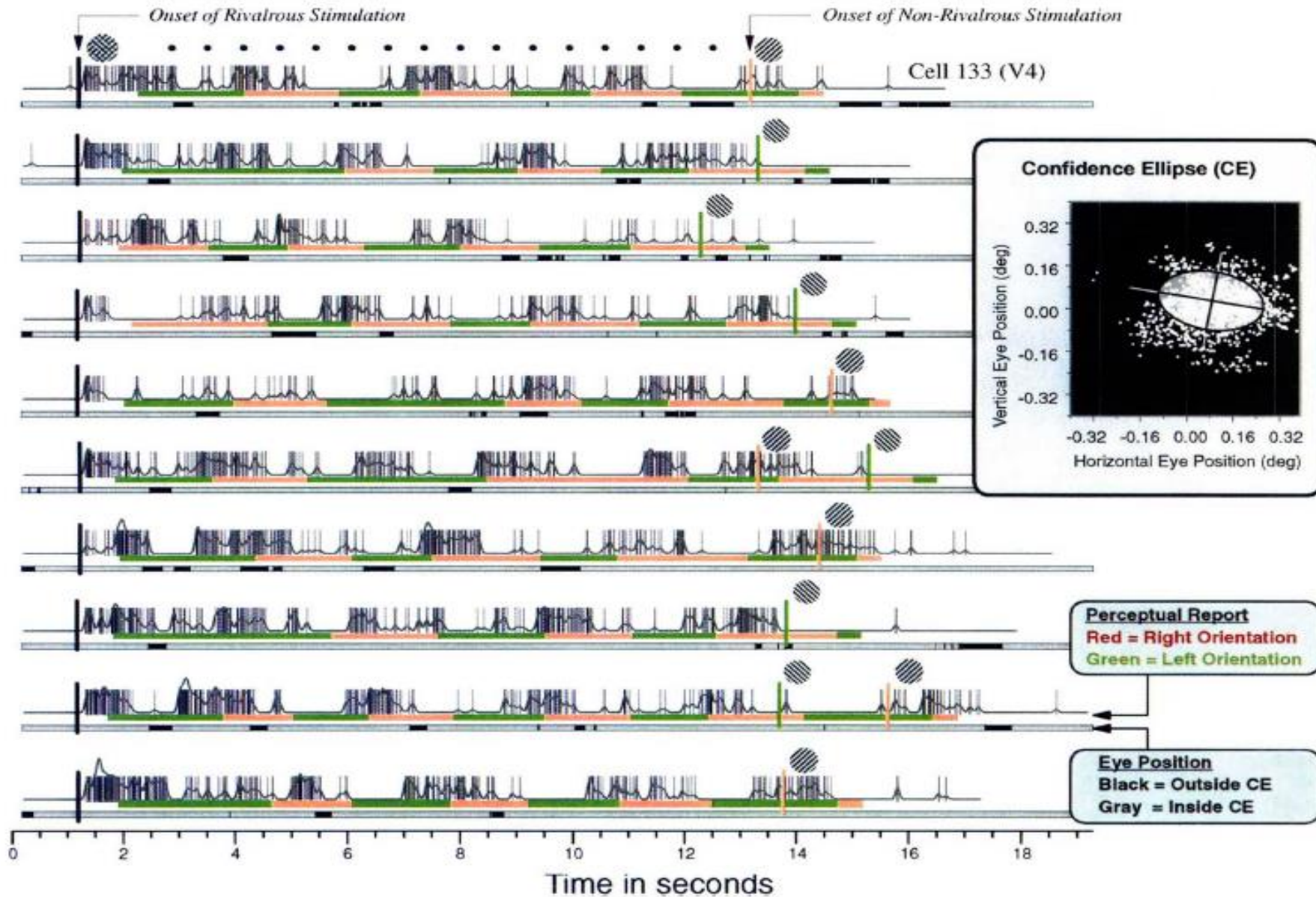
Visual Pathways



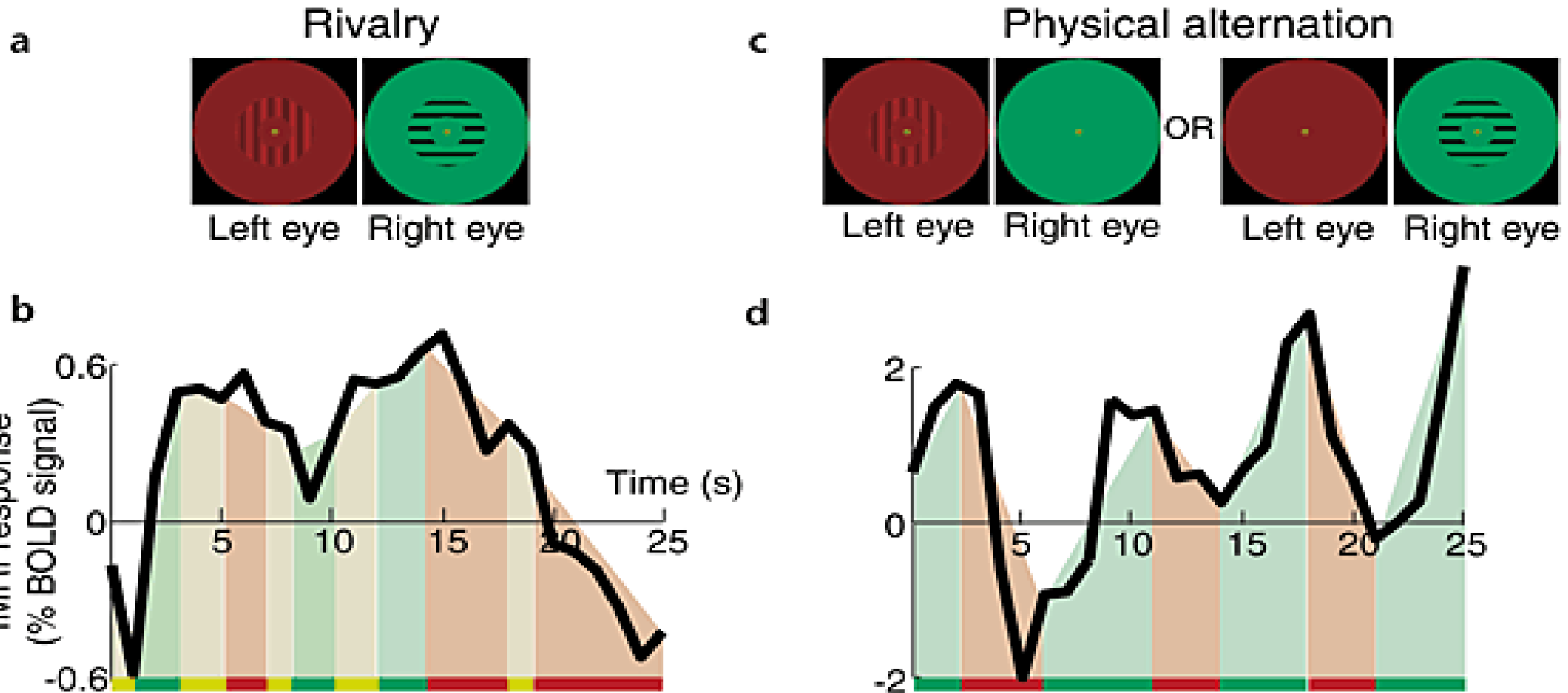
Binocular Rivalry



Leopold and Logothetis (1996)



Polonsky et al. 2000. Binocular rivalry, fMRI



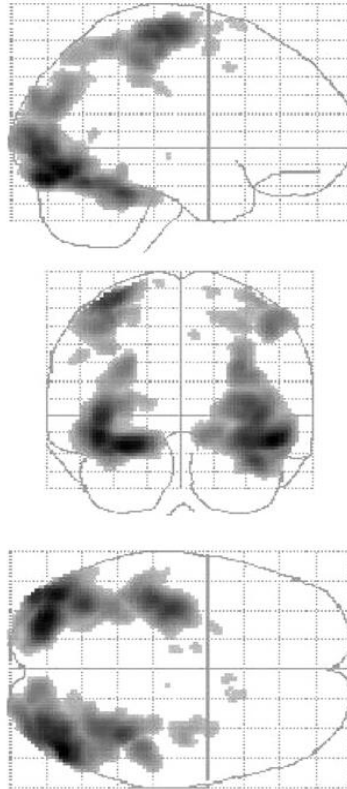
Binocular fusion

Stimulus-percept dissociation by binocular color fusion

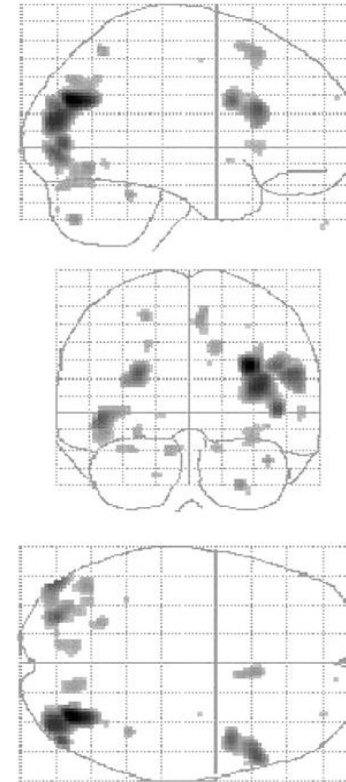


fMRI contrasts for „same“ and „opposite“ stimulation

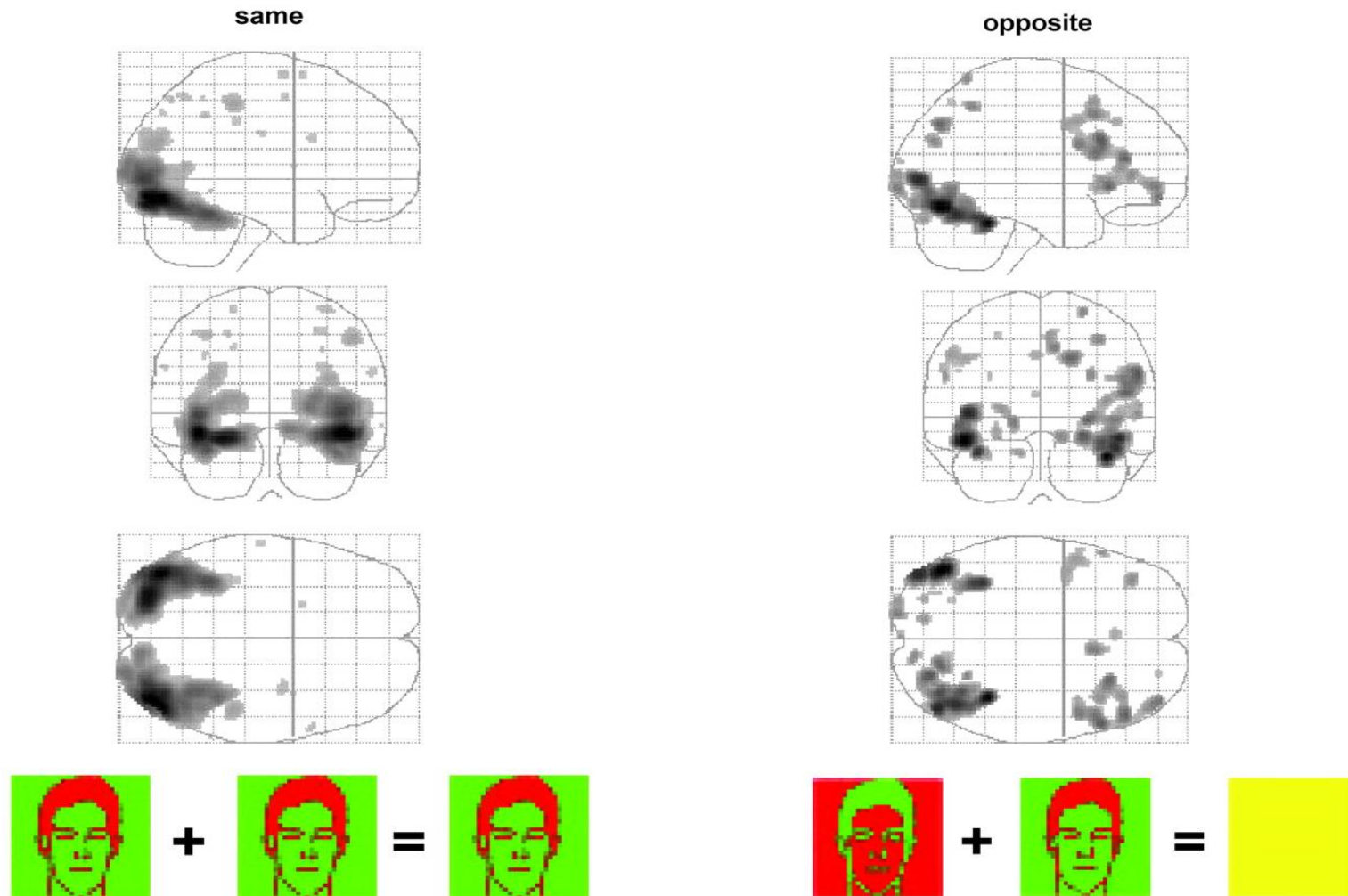
same



opposite



fMRI contrasts for „same“ and „opposite“ stimulation

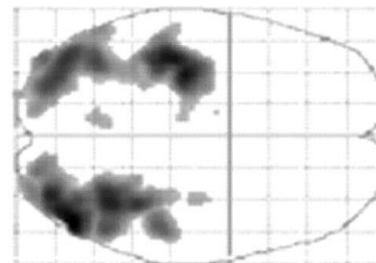
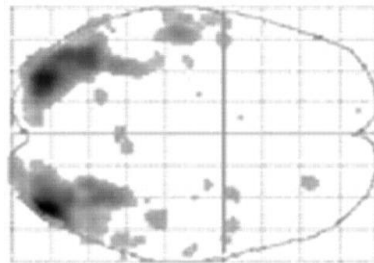
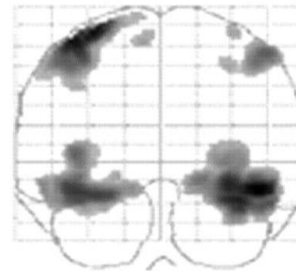
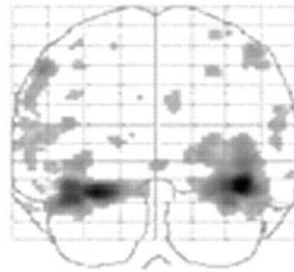
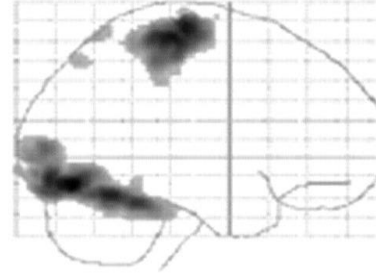
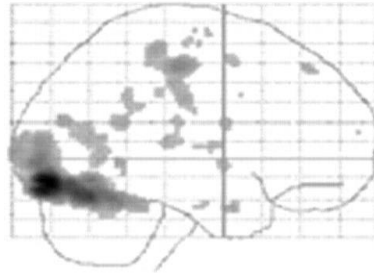


Perception covaries with increased activation

SAME versus OPPOSITE

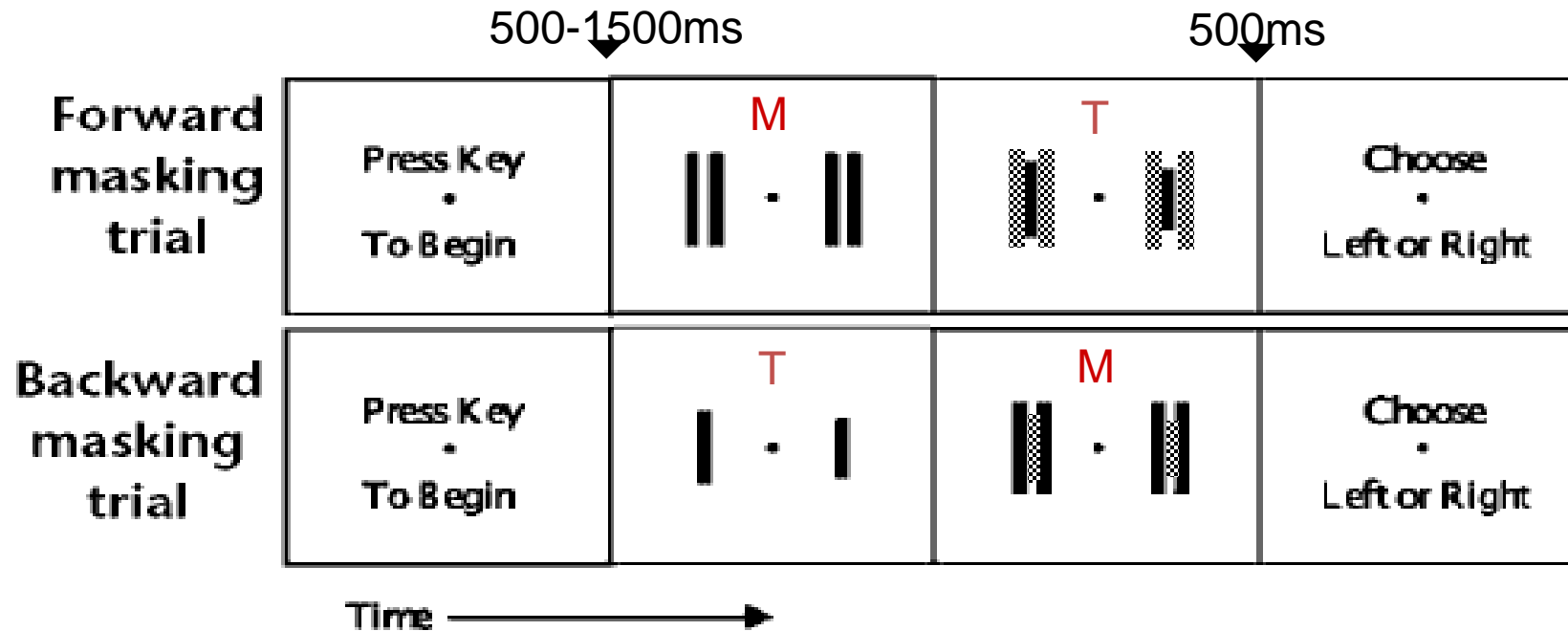
faces

houses



Temporal masking

Experimental design:

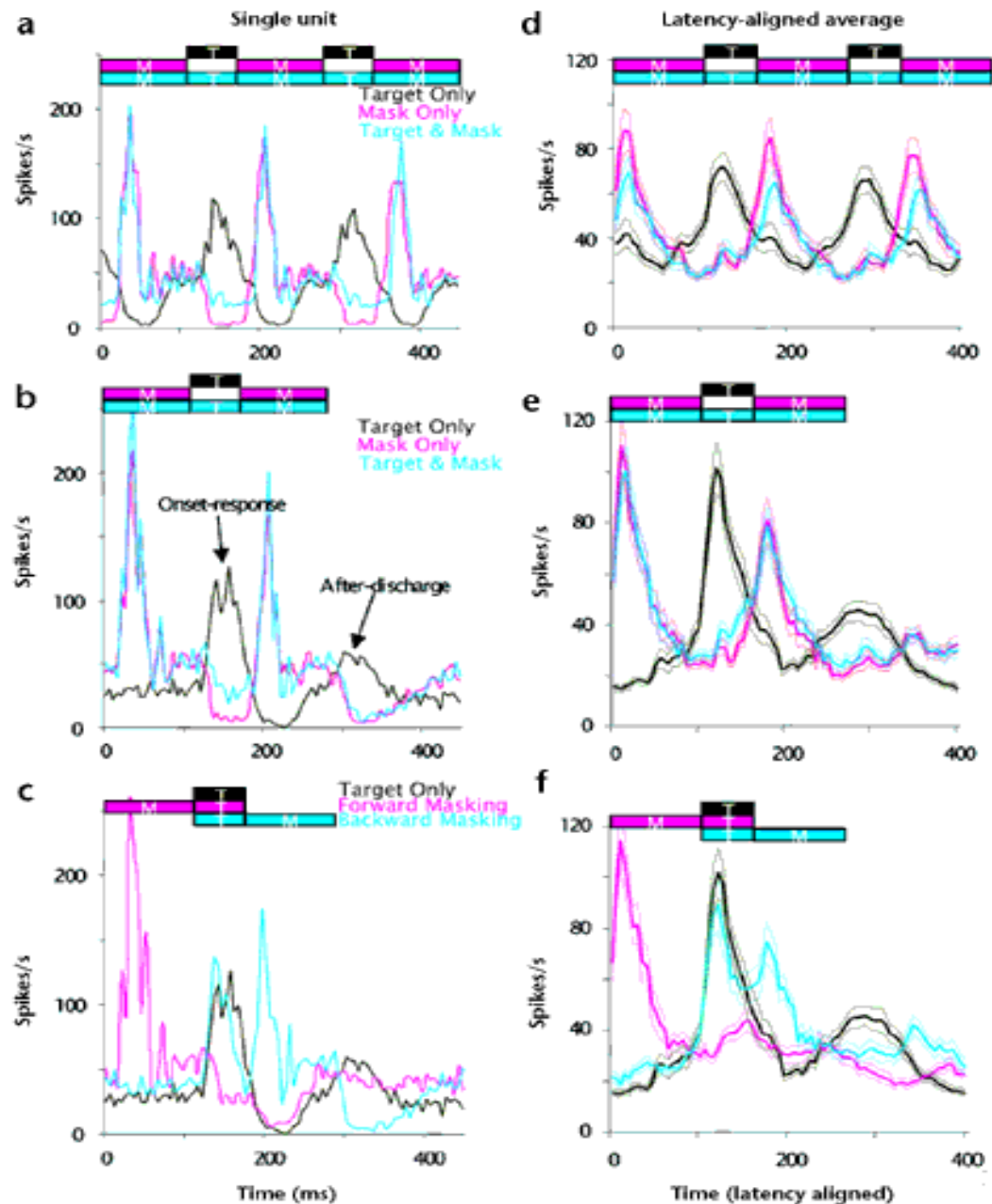


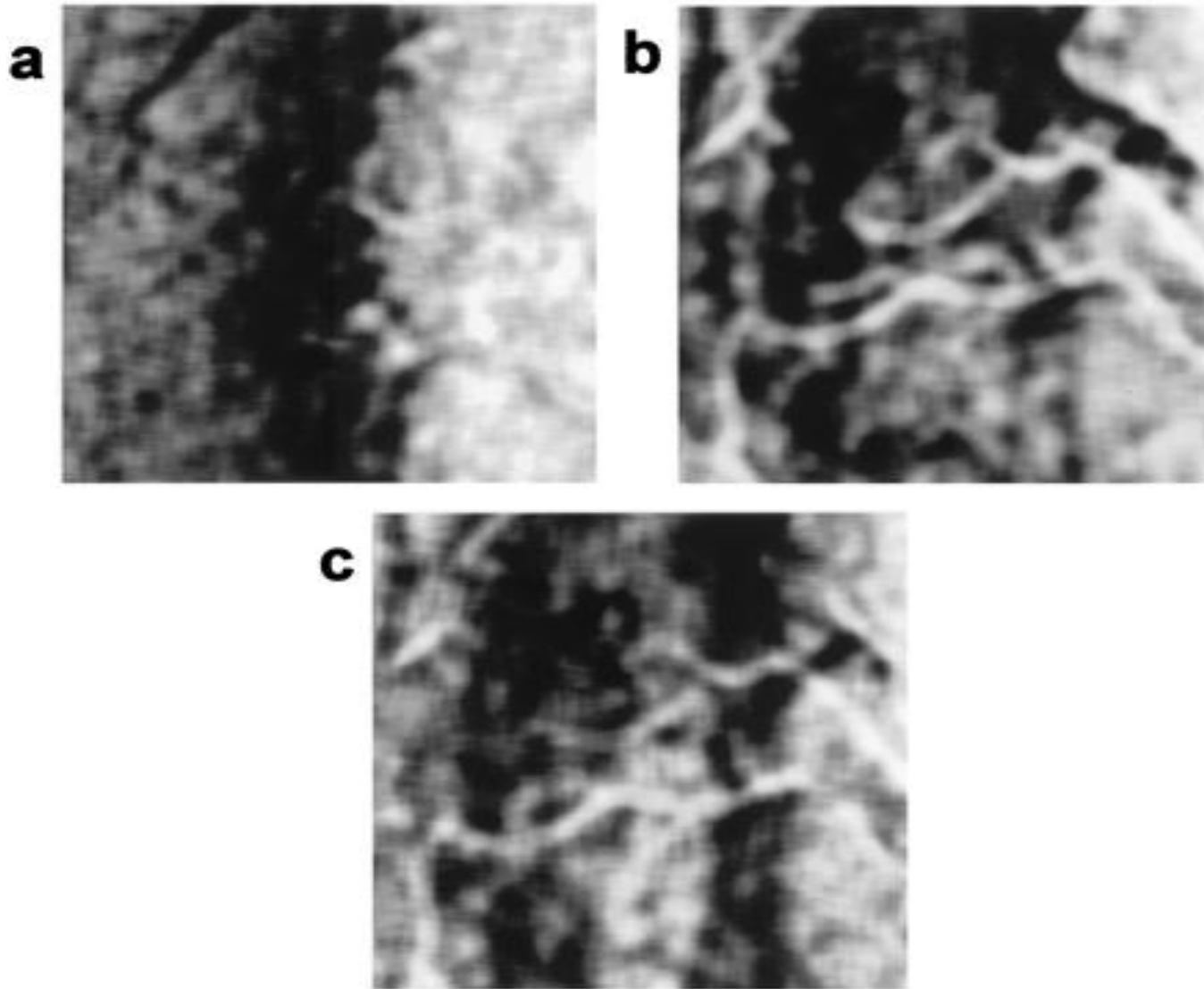
2AFC Task: Which side had longer line?

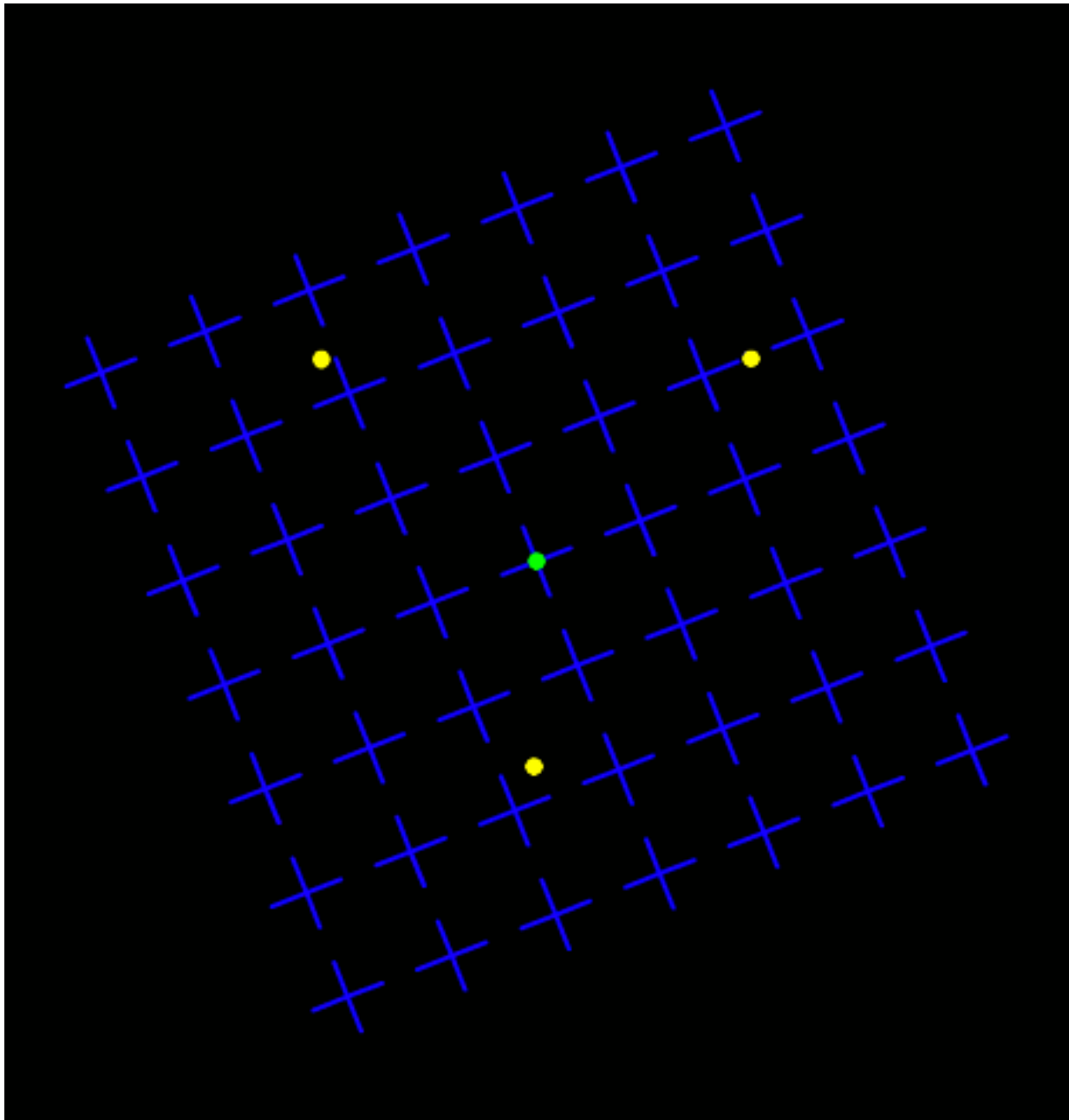
Neural correlates of visual masking:
 “Standing Wave of Invisibility” illusion=
 cyclic alternation of
 target bar (60ms) with
 flanking mask bars
 (110ms).

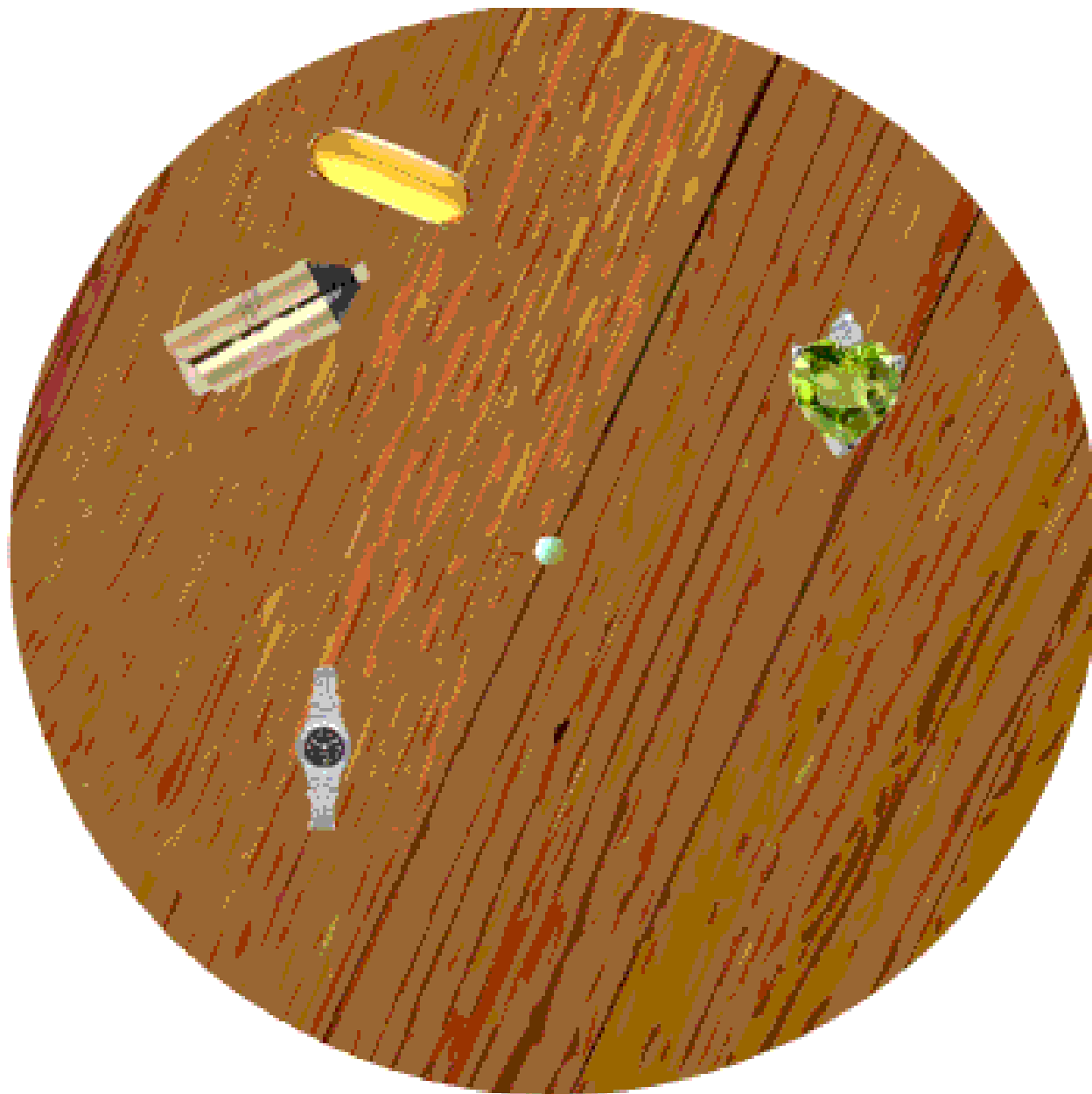
==

Measured responses in
 awake monkey V1.



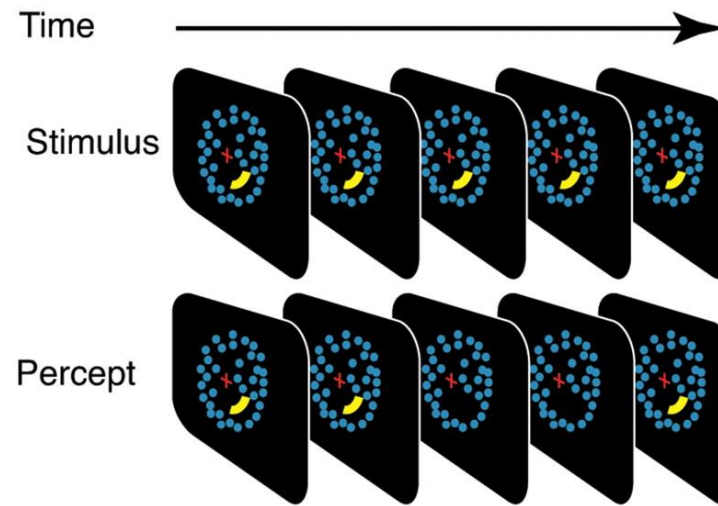




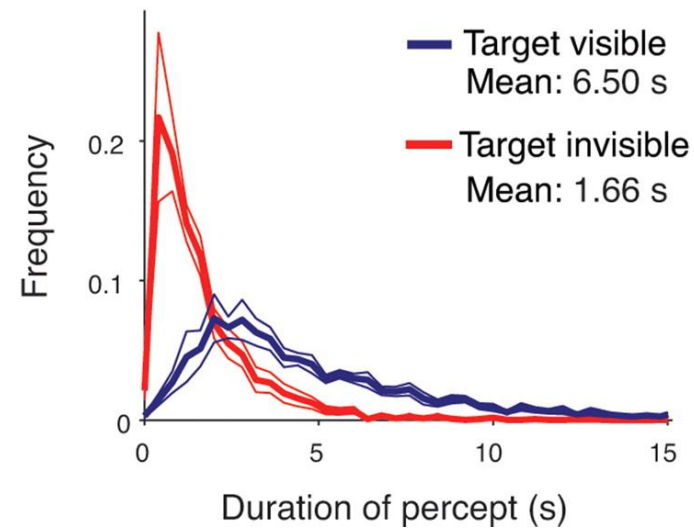


Motion Induced Blindness: Donner, Sagi, Bonnef and Heeger, 2008

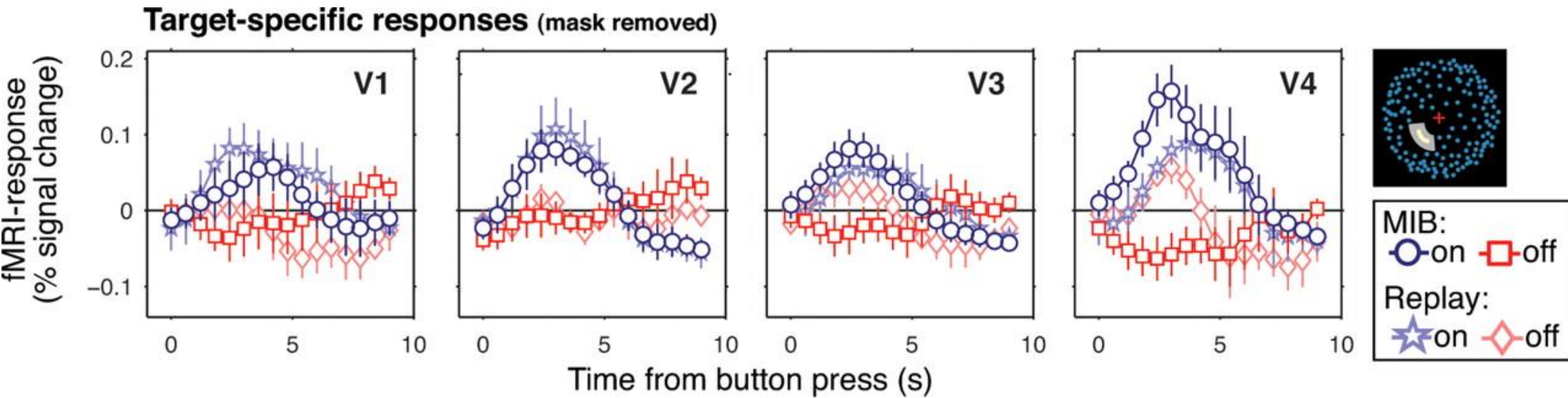
A



B



Motion Induced Blindness: Donner, Sagi, Bonnef and Heeger, 2008



Study topic	Study	Main findings	Possible NCC
Binocular rivalry in monkeys	Leopold and Logothetis "Activity changes in early visual cortex reflect monkeys' percepts during binocular rivalry"	More V4 than V1/V2 neurons correlate with visual consciousness in monkeys	V4
Binocular rivalry in humans	Polonsky et al. "Neuronal activity in human primary visual cortex correlates with perception during binocular rivalry."	V1 responds equally strongly to visual consciousness of rivalrous stimuli as V2-V4 in humans	V1-V4
Binocular fusion	Moutoussis and Zeki "The relationship between cortical activation and perception investigated with invisible stimuli."	Level of activity in primary and higher visual areas correlates with visual consciousness in humans	V1 and higher (fusiform, Para-HPC)
Afterimages to filled-in surface	Shimojo et al. "Afterimage of perceptually filled-in surface."	Cortical neural adaptation responsible for visual consciousness of global afterimage of filled-in surface in humans	Cortex
Afterimages to invisible stimuli	He and MacLeod "Orientation-selective adaptation and tilt after-effect from invisible patterns."	Not consciously perceived visual information is represented in the cortex and exerts after-effects on subsequent visual performance in humans	Cortex?
Split-Brain	Corballis and Corballis "Interhemispheric visual matching in the split brain"	?	?
Blindsight	Weiskrantz et al. "Prime-sight in a blindsight patient"	Conscious visual perception of after-images to not consciously perceived visual stimuli in a blindsight patient	Cortex?
Visual masking	Macnisk and Livingstone "Neuronal correlates of visibility and invisibility in the primate visual system."	Onset- and offset-transient responses to visual stimuli in V1 correlate with visual consciousness	V1 (higher areas not studied)

What/where, or conscious/unconscious pathways ?

