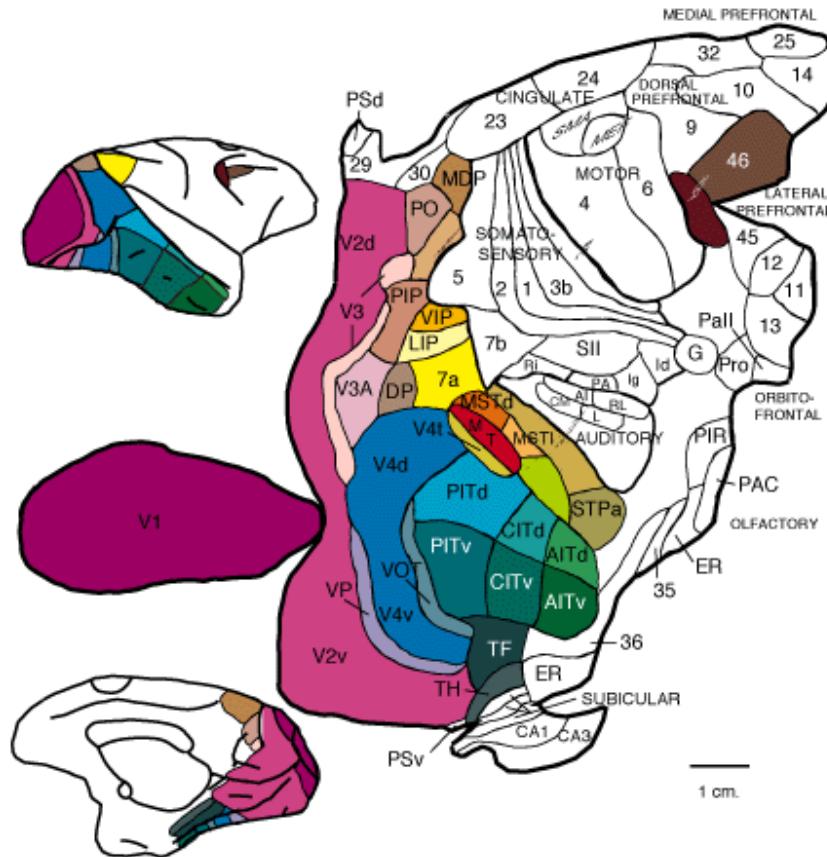
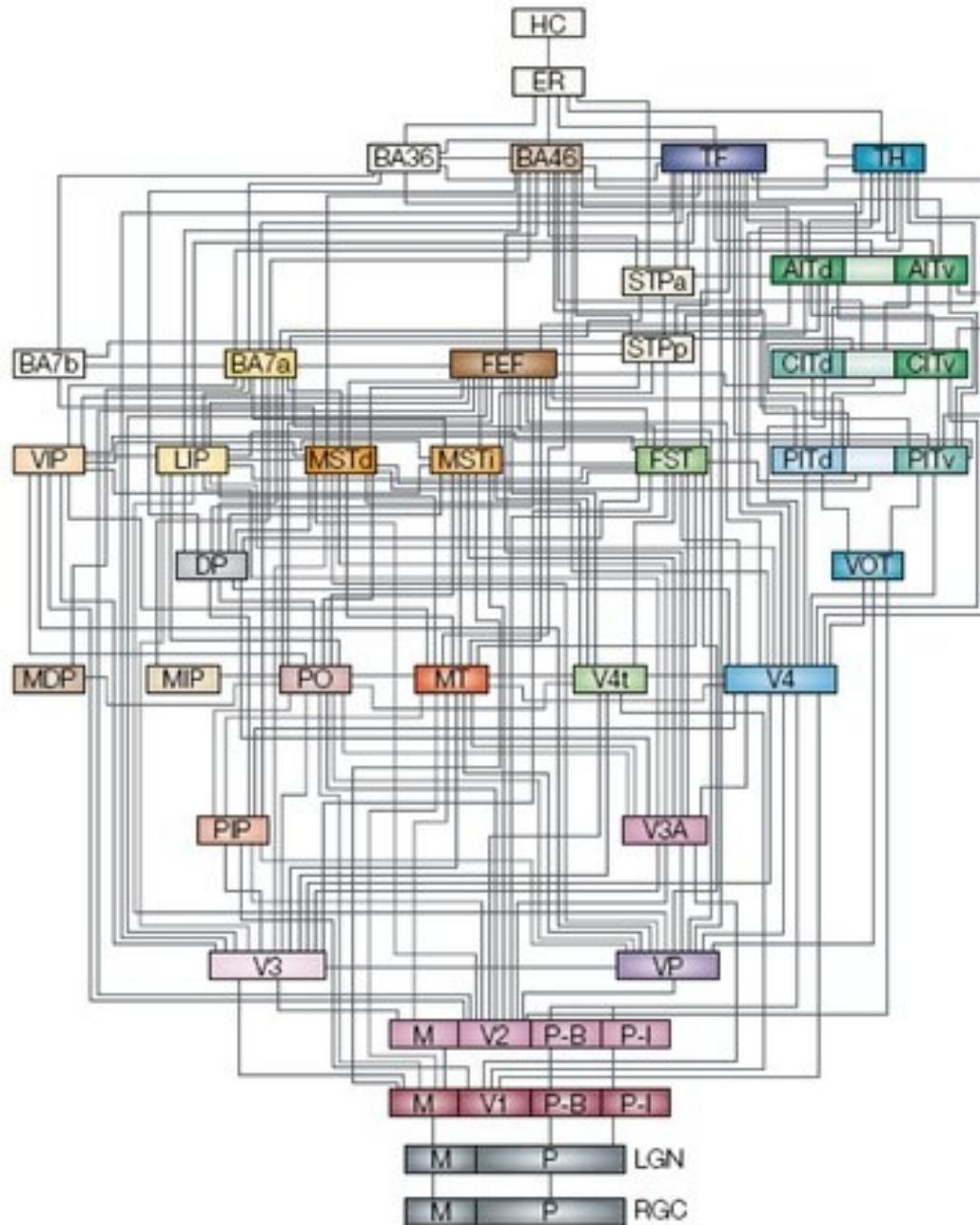
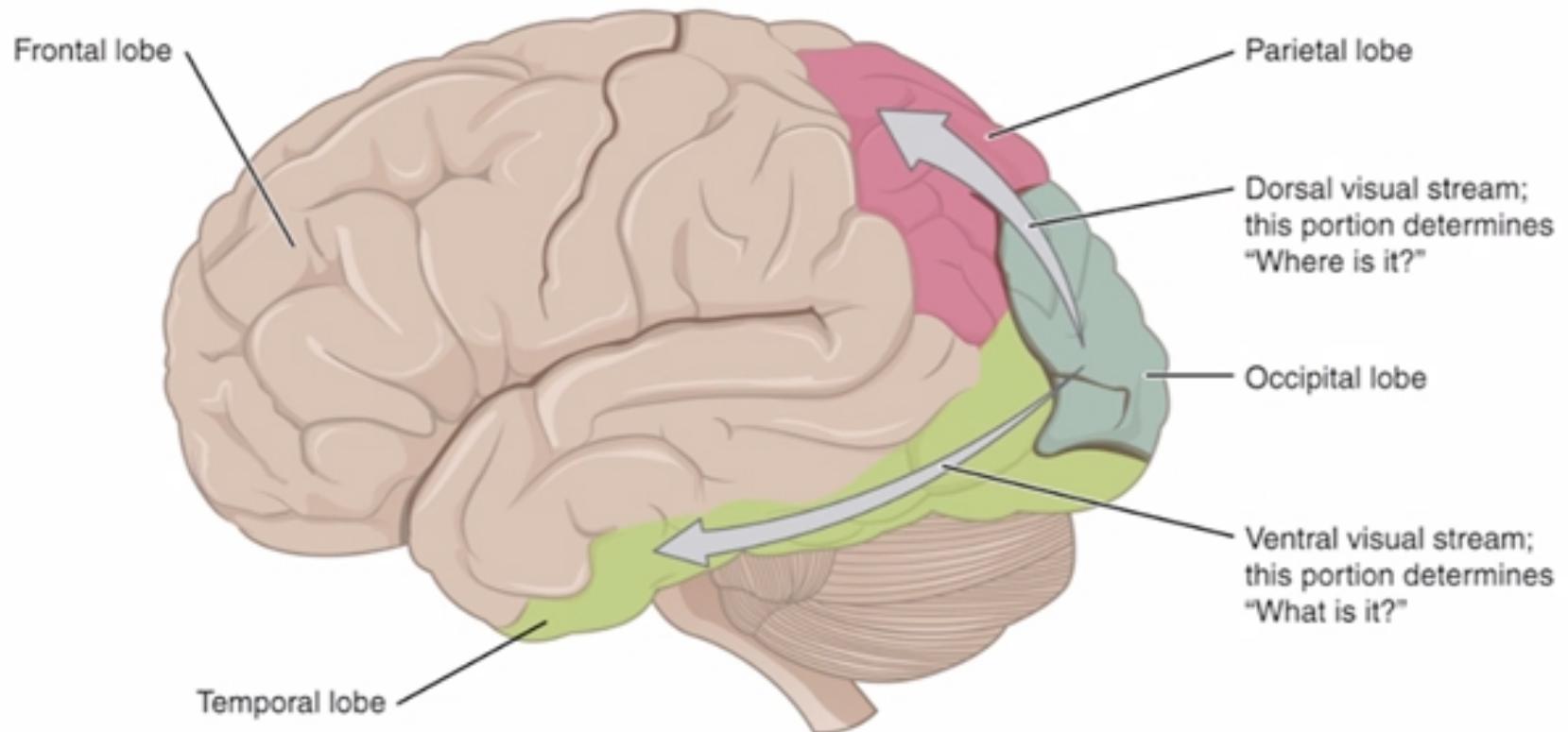


Anatomical segregation of visual system

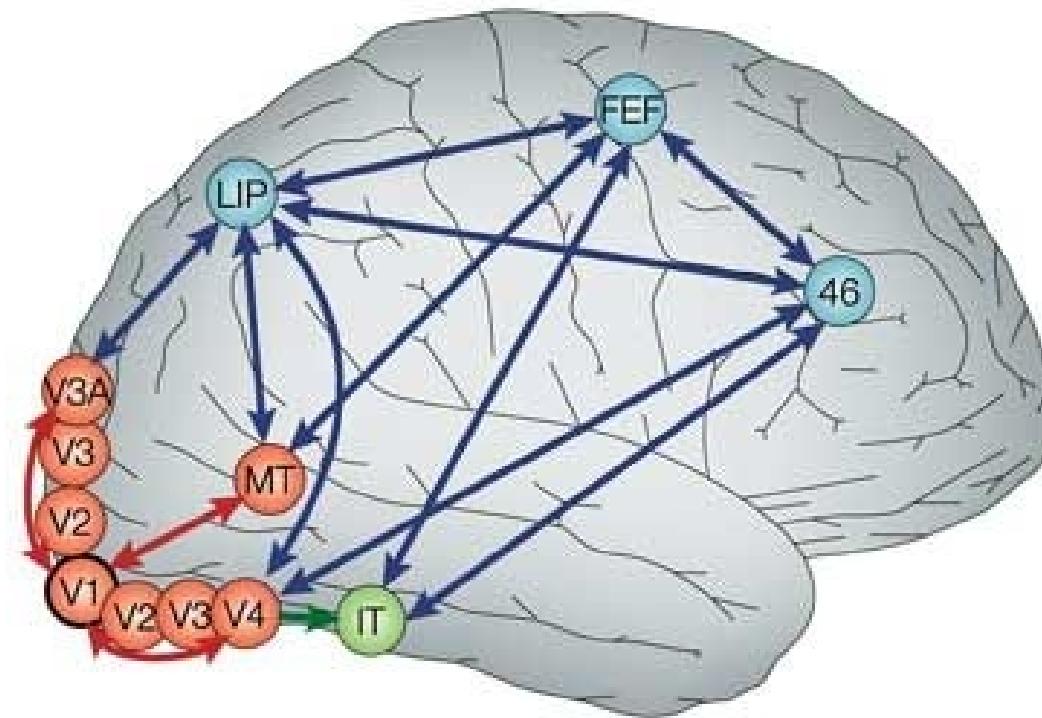




WHAT vs. WHERE

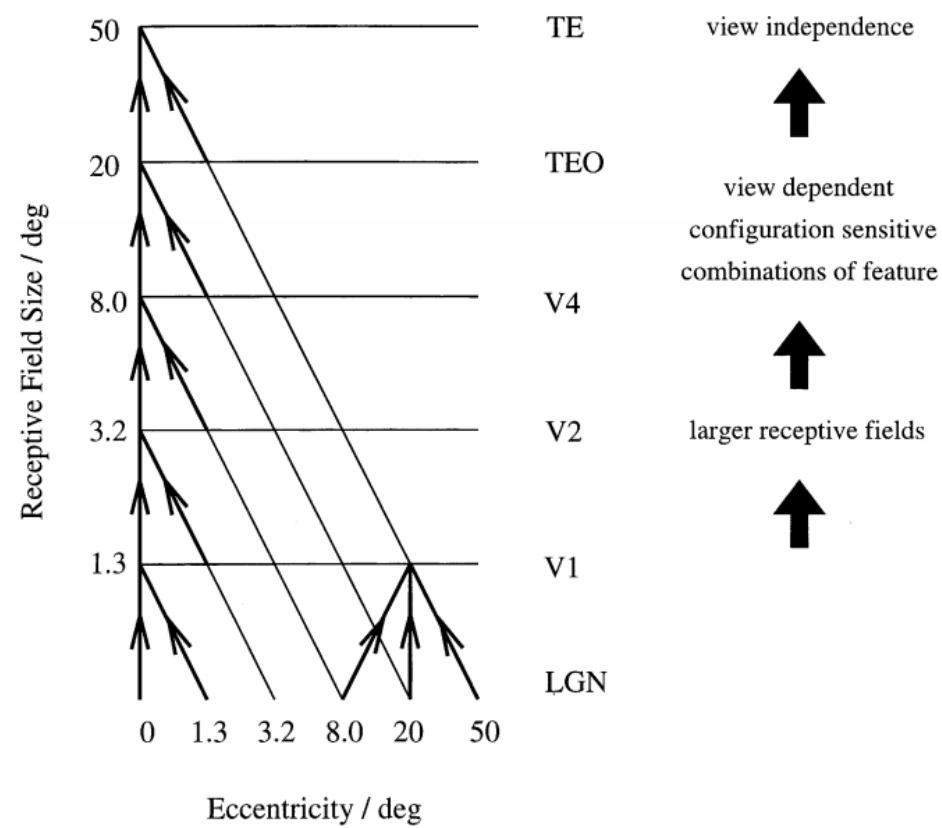
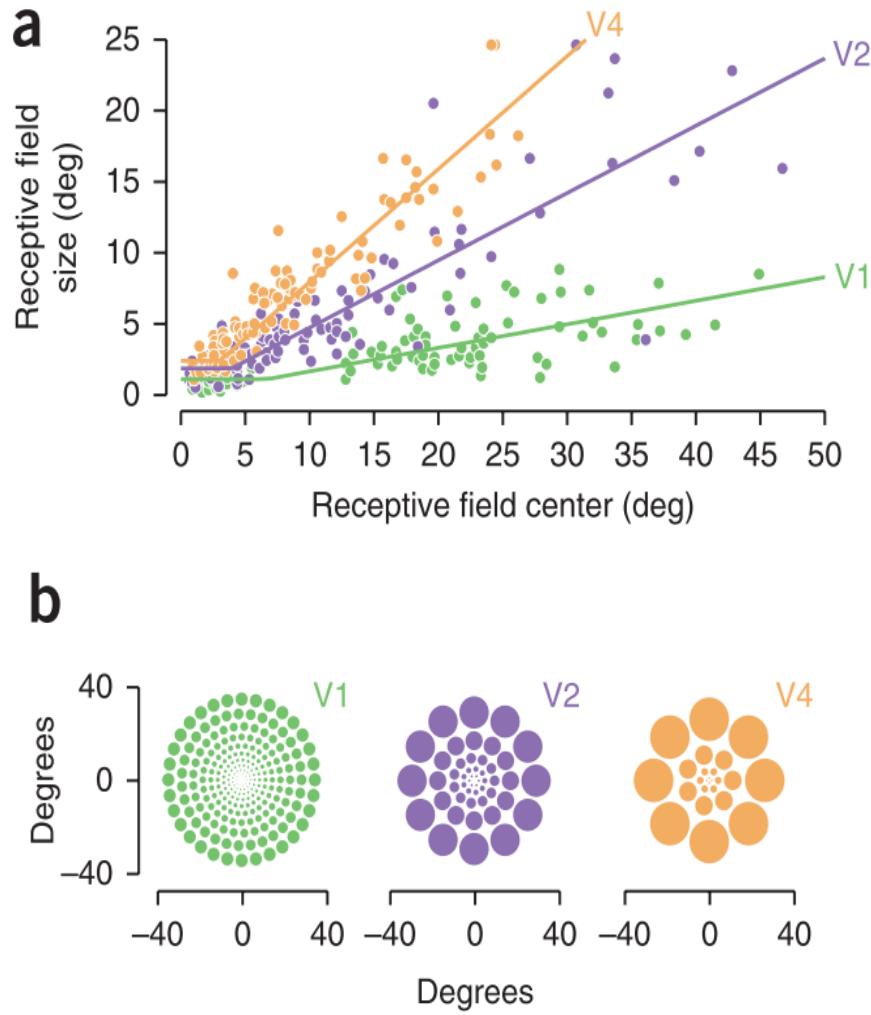


Visual Cortical Areas

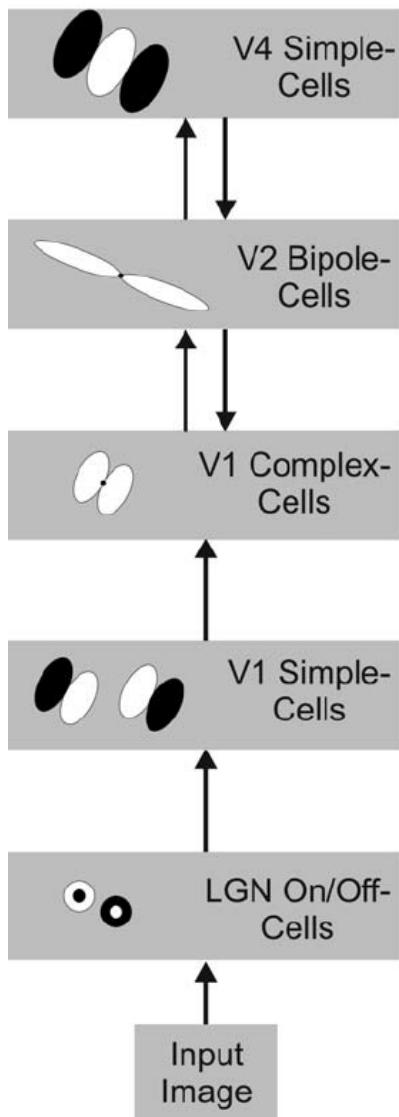


General Organizational Principles

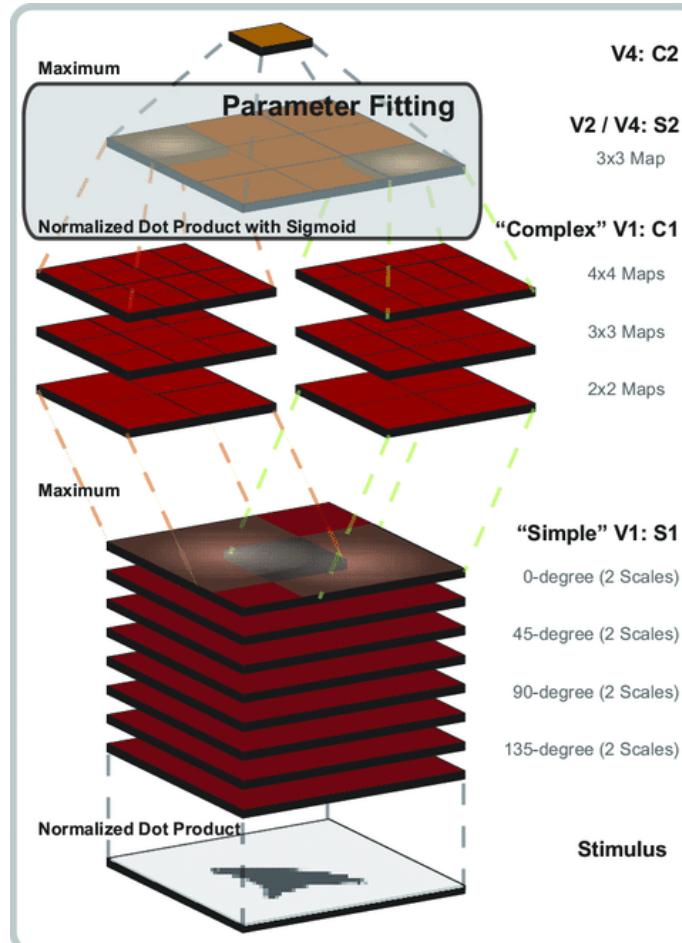
Receptive field size progression



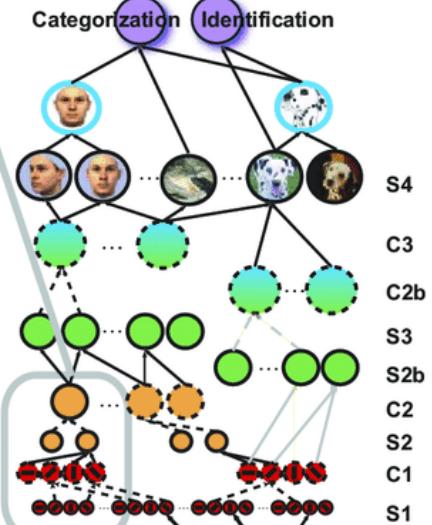
The theory of computational hierarchy



↑
Recurrent Texture Boundary Processing
↓
Preprocessing

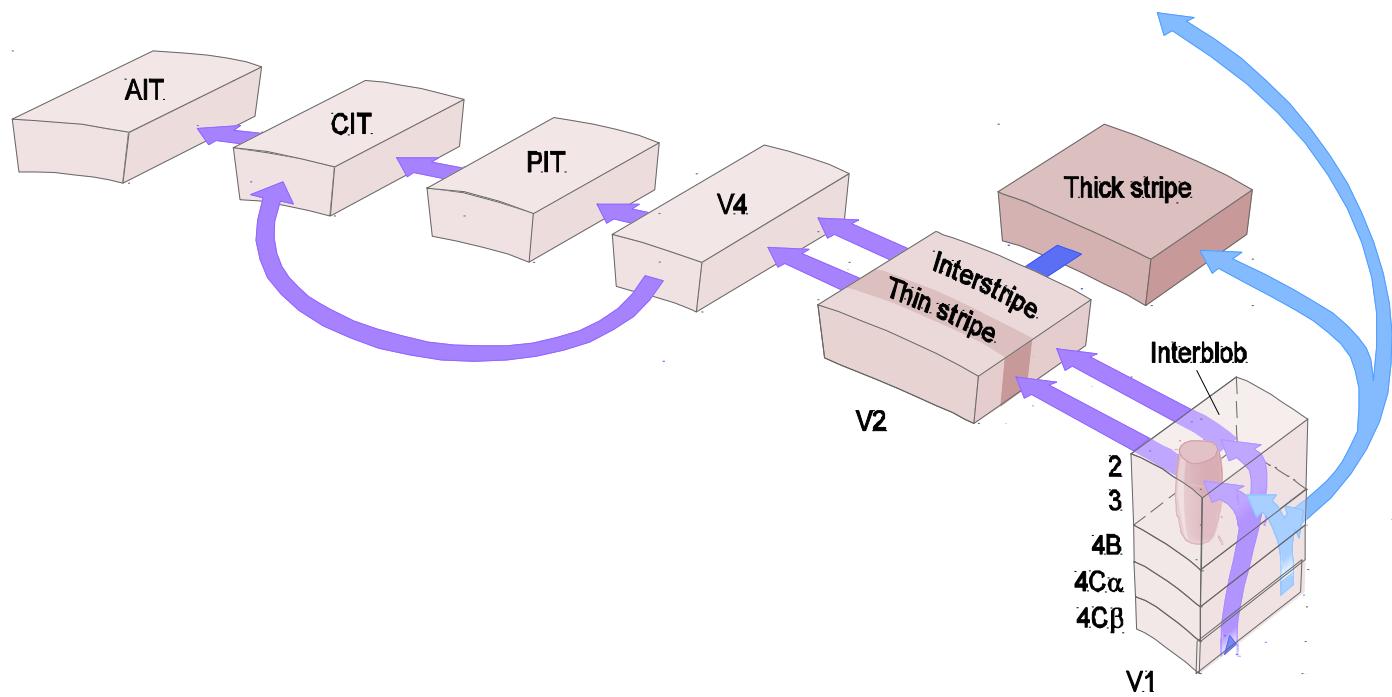


Full Model of Object Recognition



○ Simple cells
○ Complex cells
— Tuning — Main routes
-- Softmax — Bypass routes

Ventral ‘What’ Stream

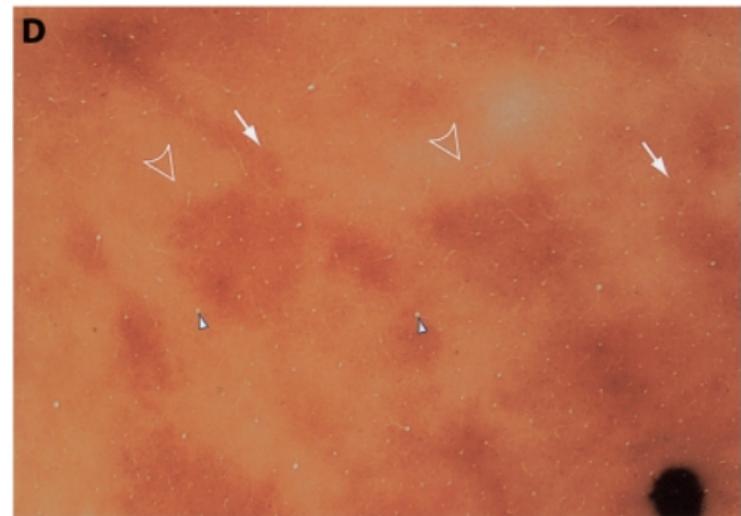
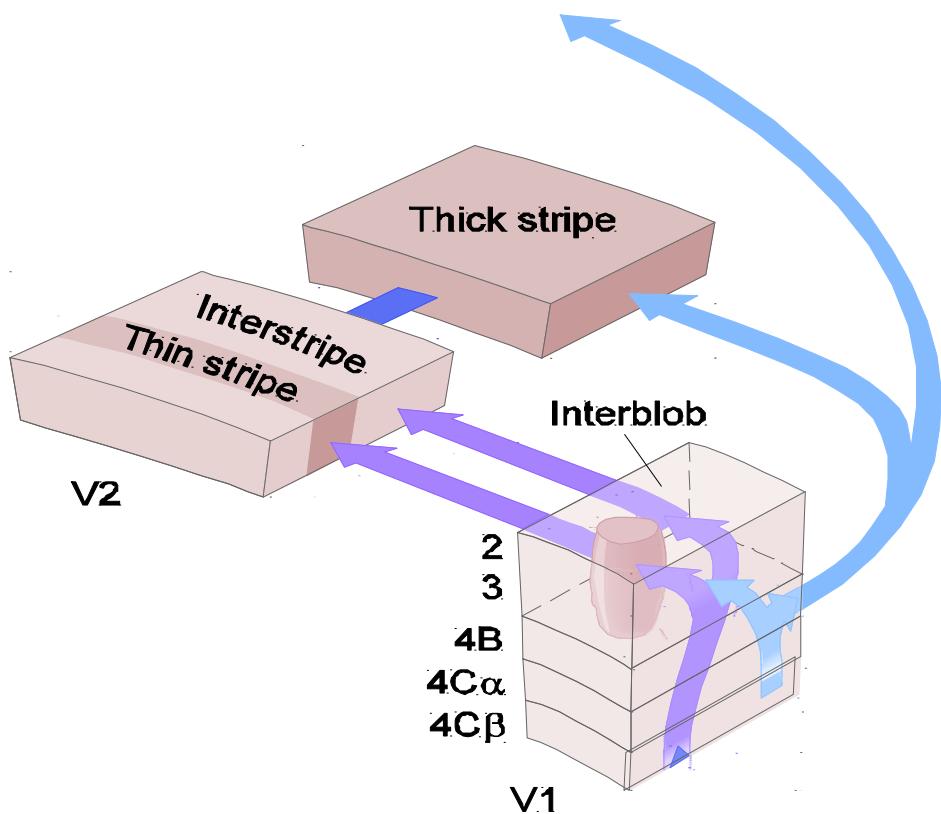


Secondary Visual Area

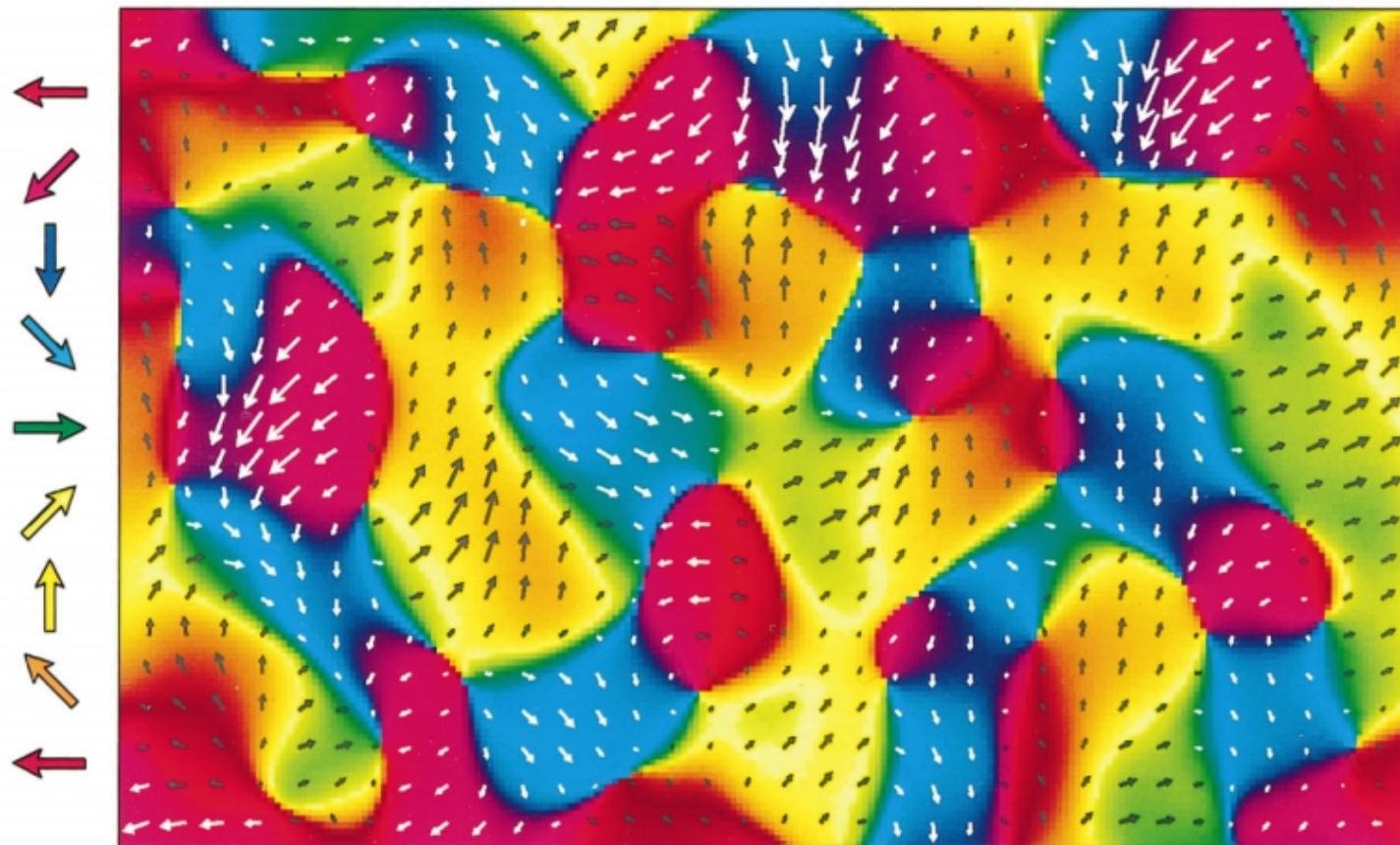
aka

V2

$V1 \rightarrow V2$

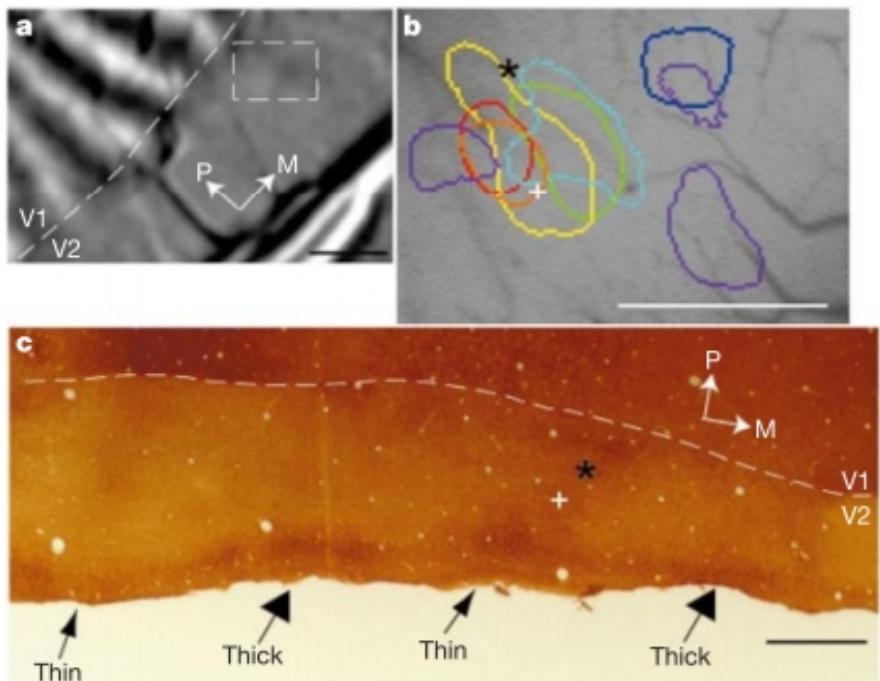
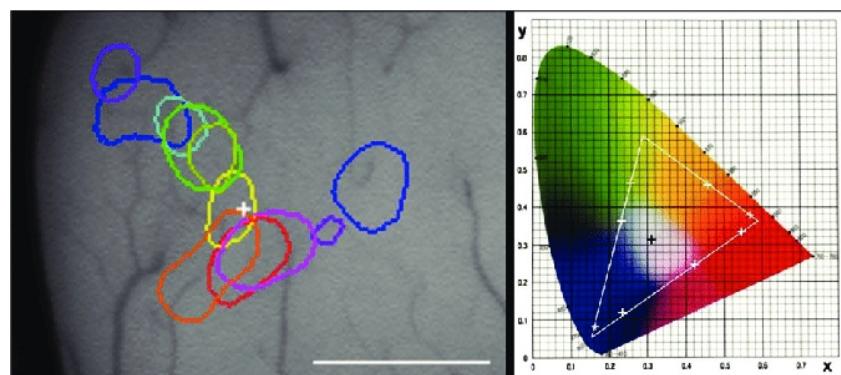
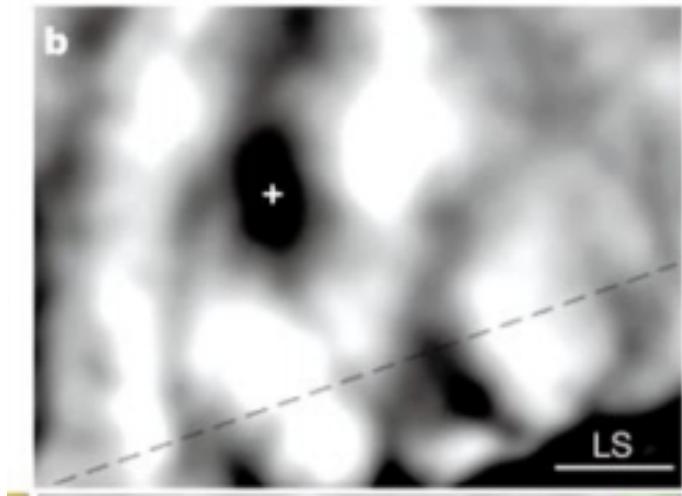


V2 functional organization

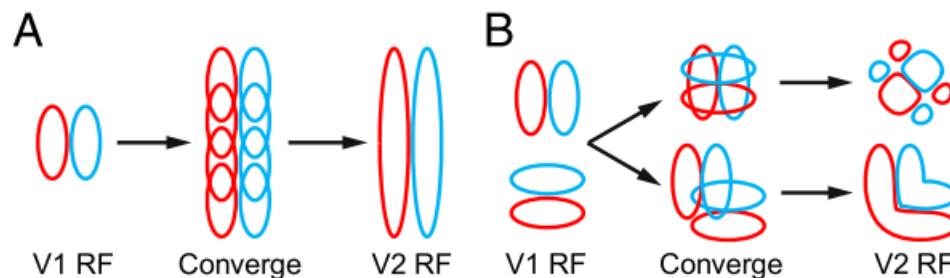
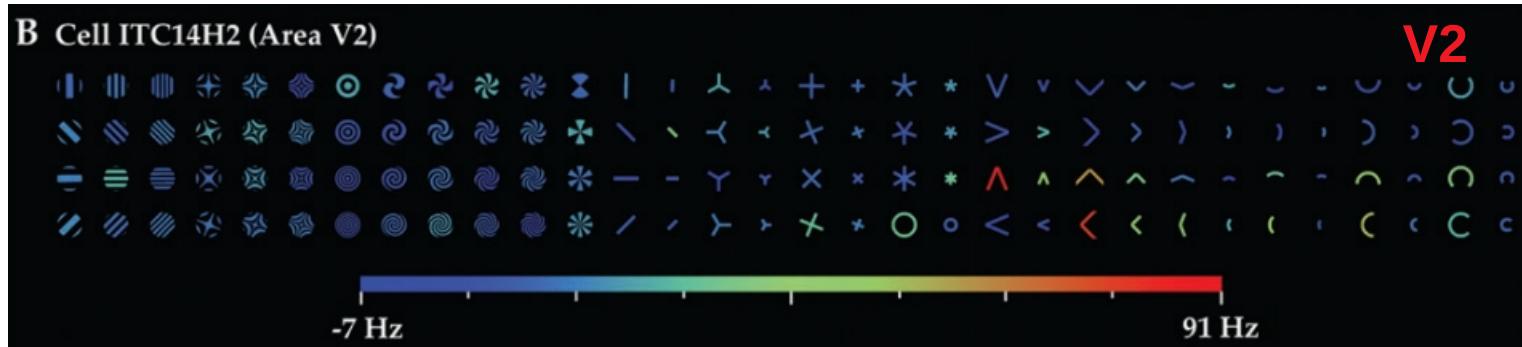
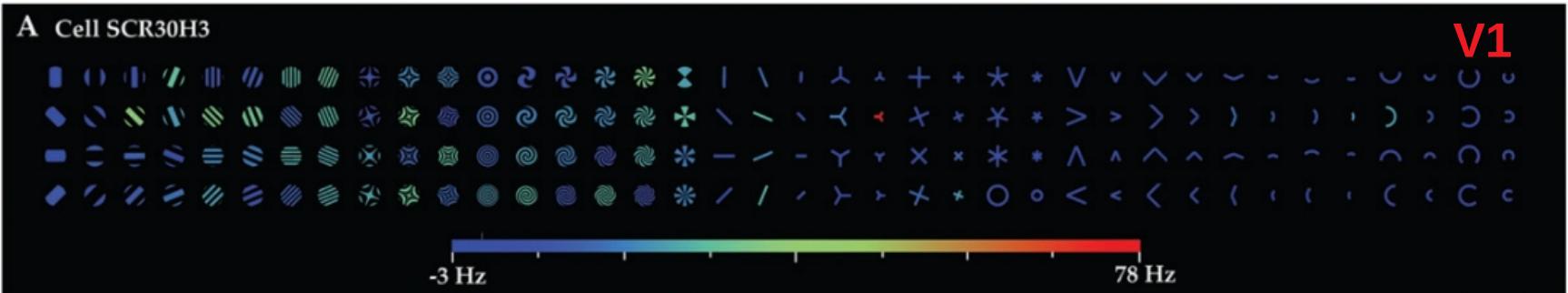


(Shumel & Grinvald 1996)

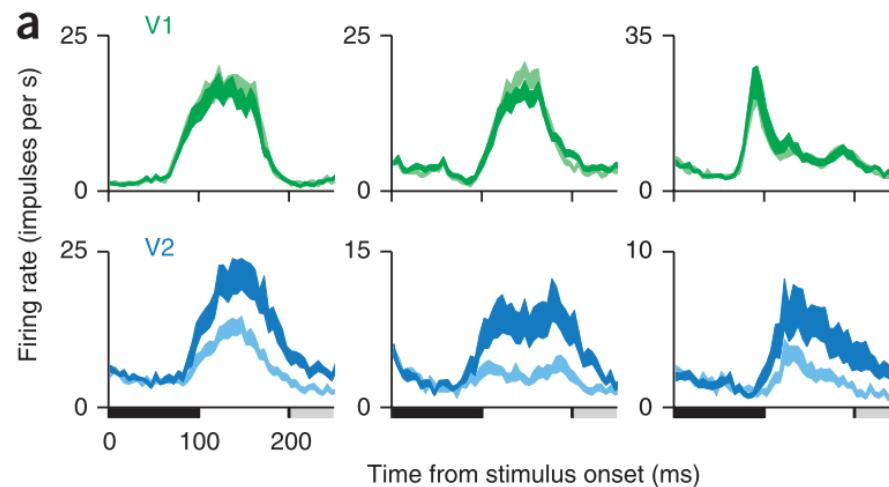
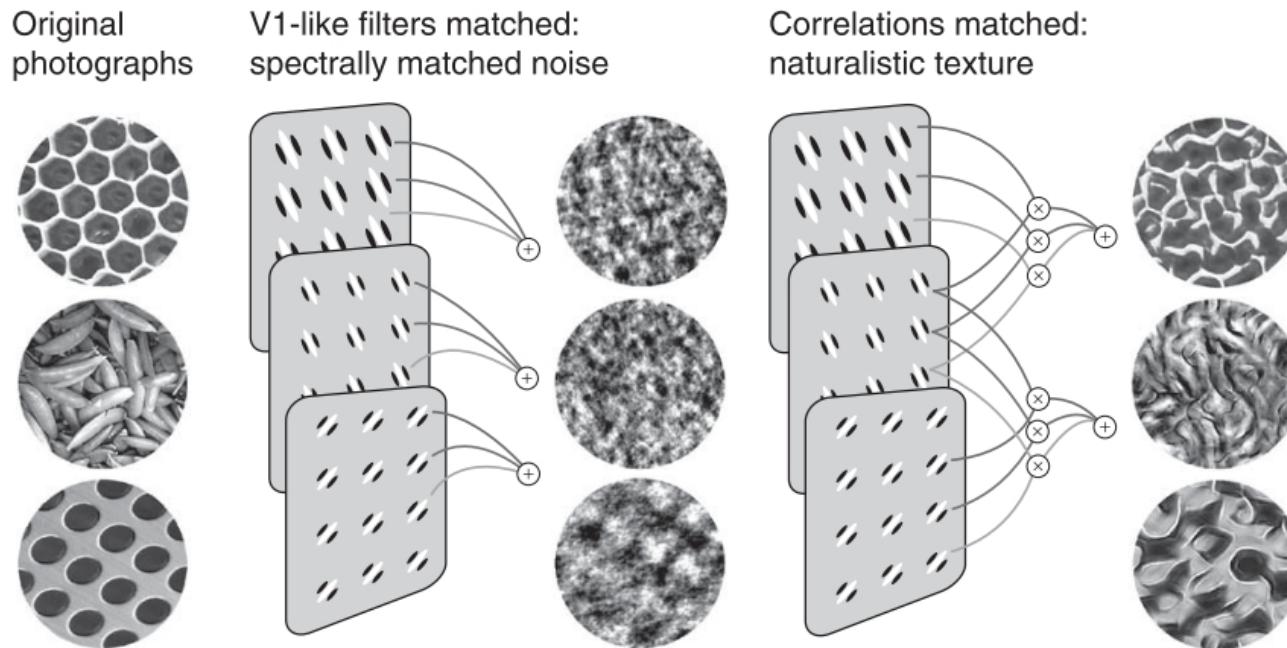
Color representation in V2



Receptive fields in V2



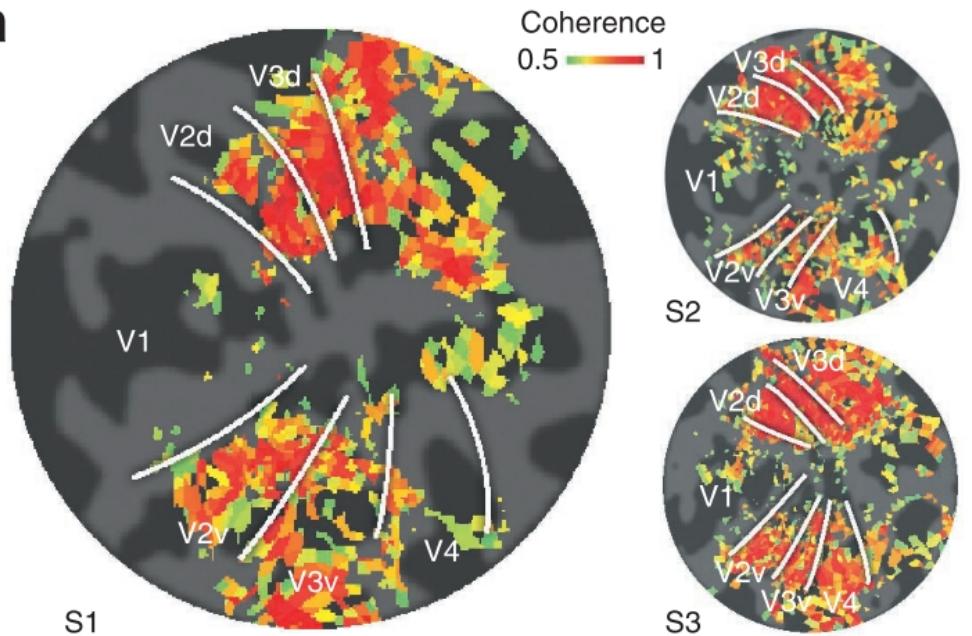
Processing of higher-order correlations



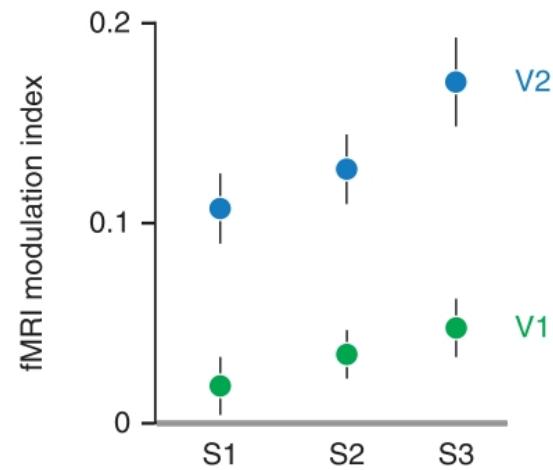
(Freeman et al. 2013)

Processing of higher-order correlations

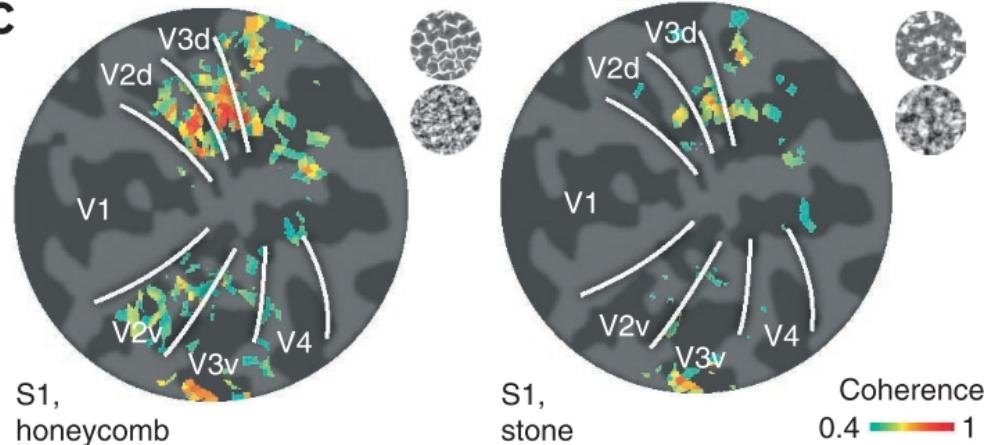
a



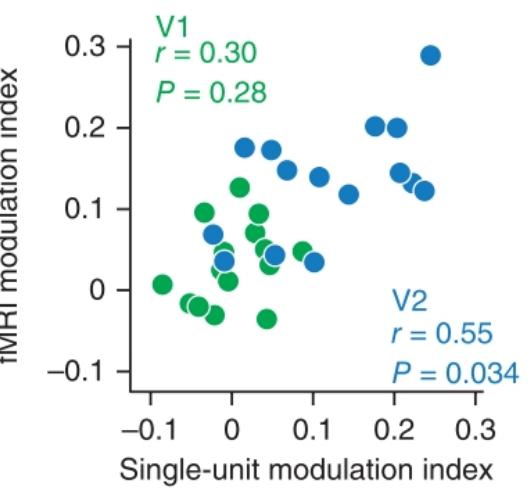
b



c

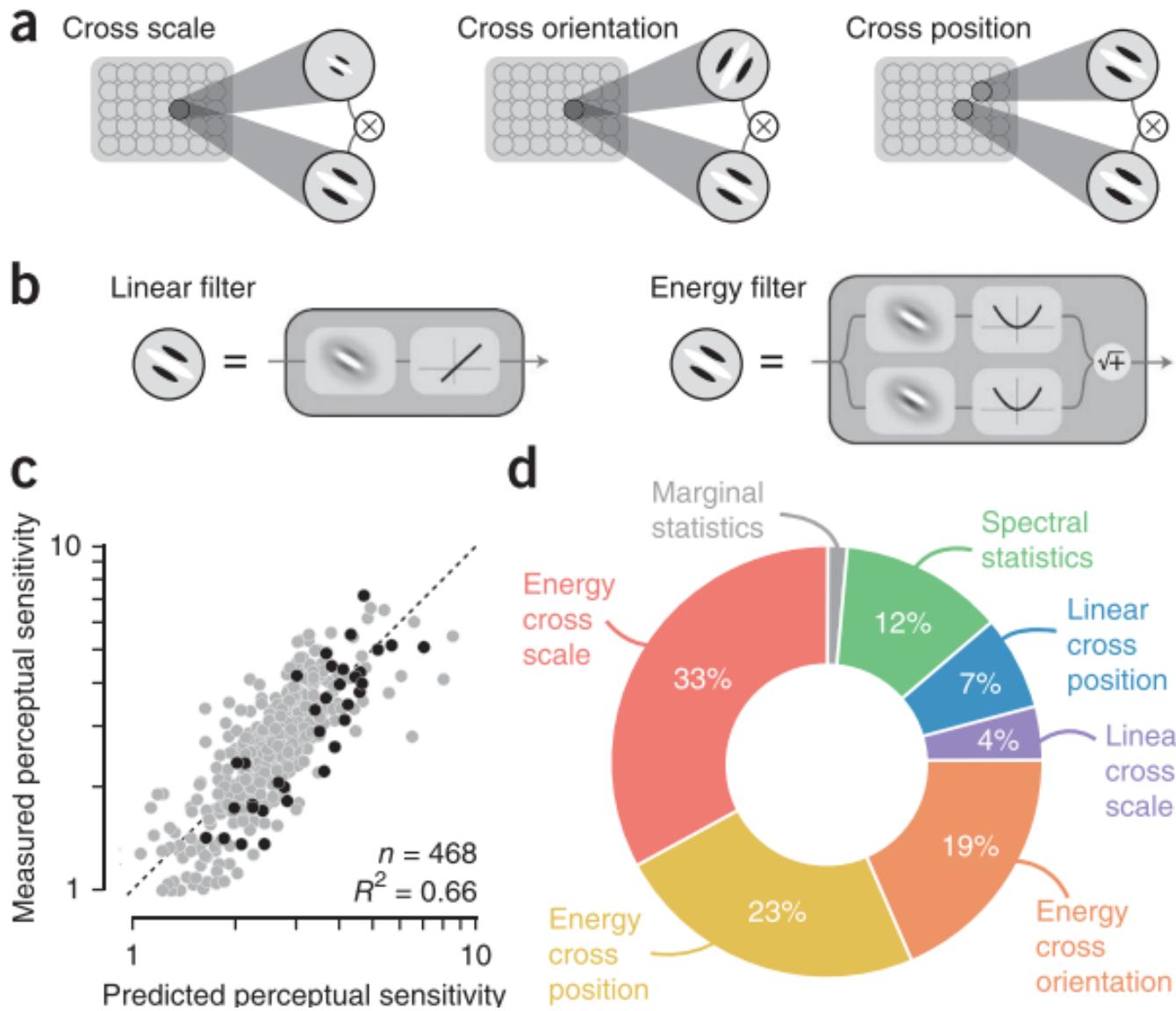


d



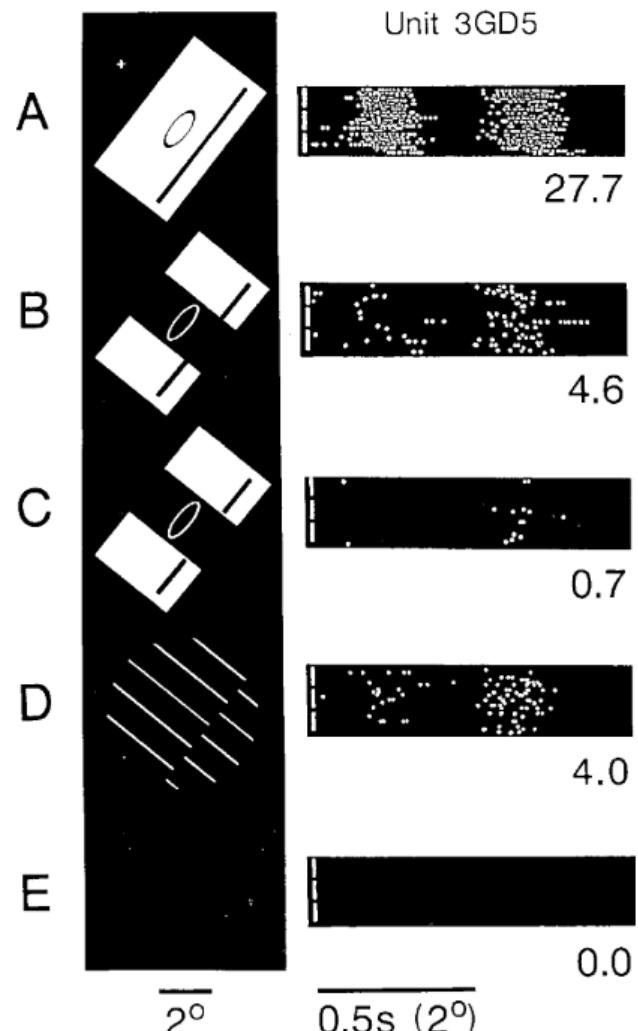
(Freeman et al. 2013)

Processing of higher-order correlations



(Freeman et al. 2013)

Representation of illusory contours



27.7

4.6

0.7

4.0

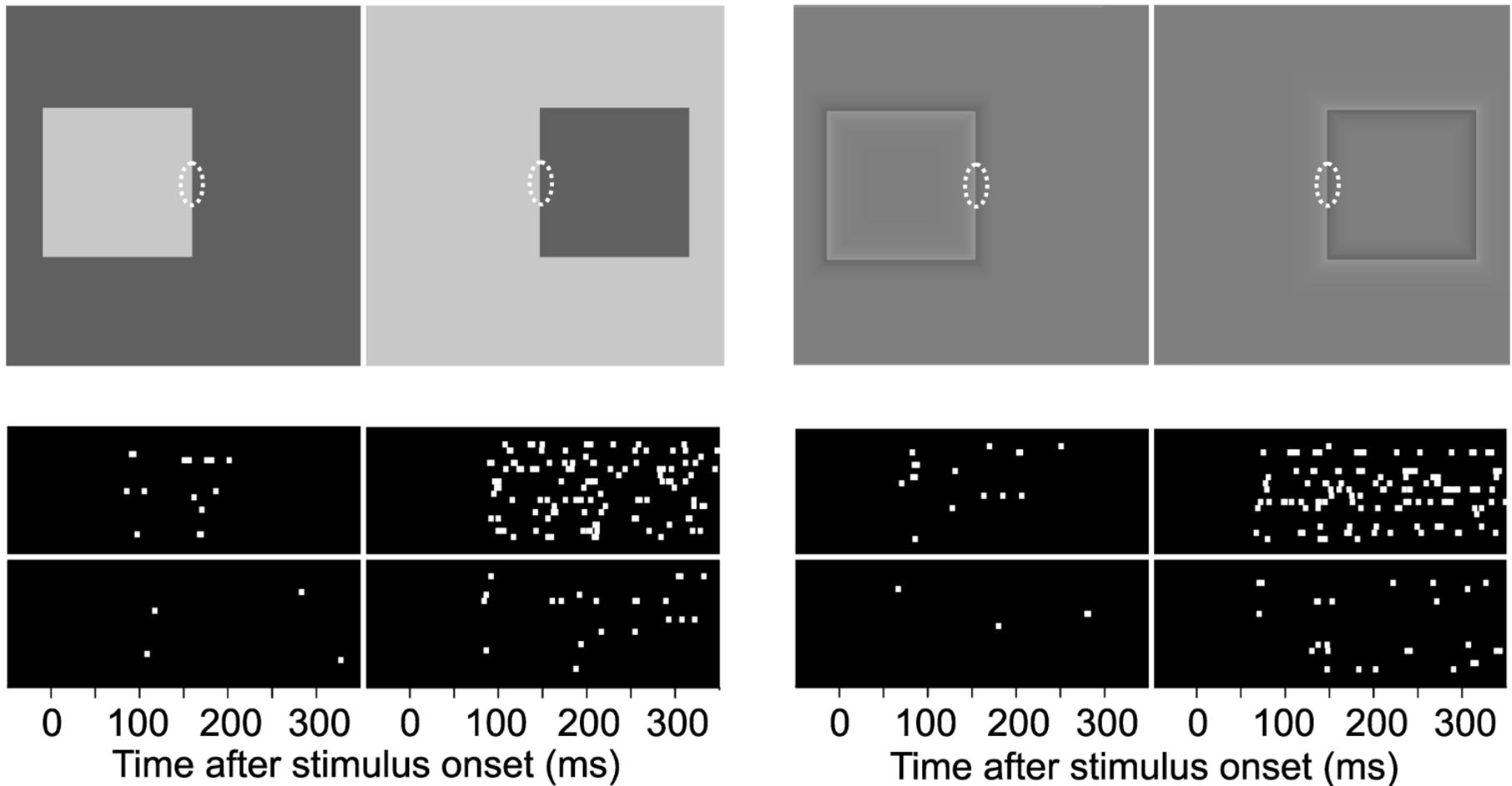
0.0

2°

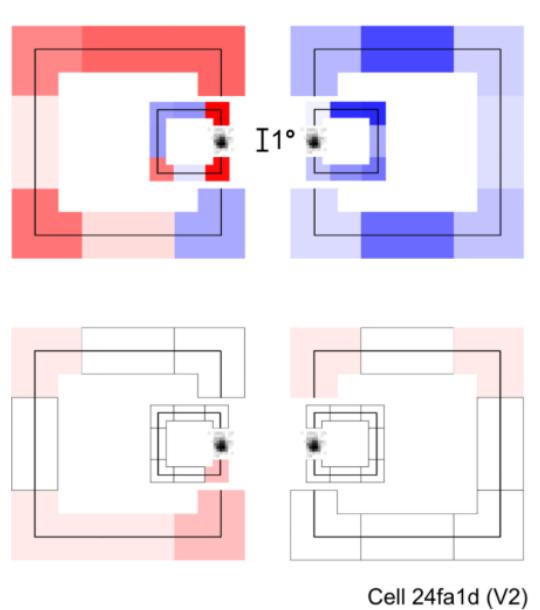
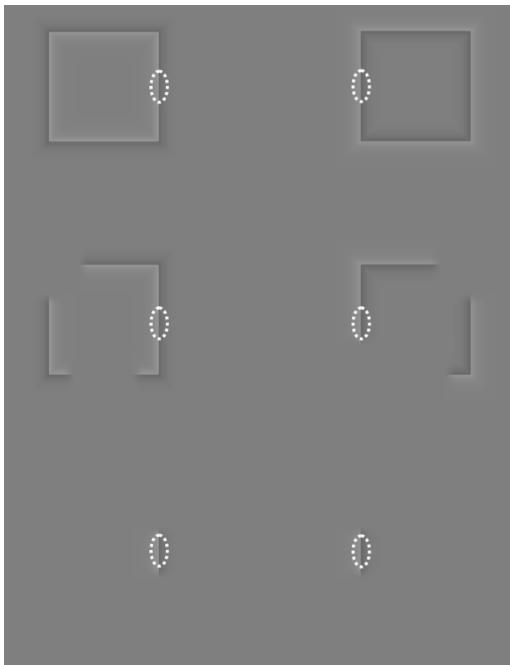
0.5s (2°)

V2, awake monkey, (Nieder 2002)

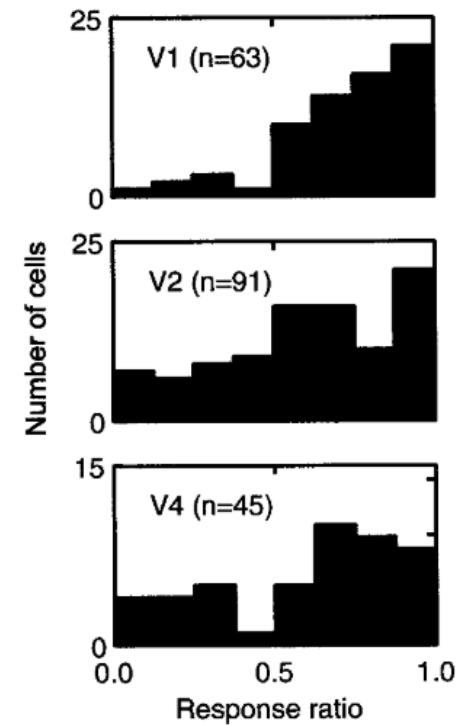
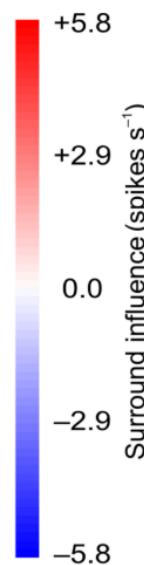
Representation of border ownership in V2



Representation of border ownership in V2



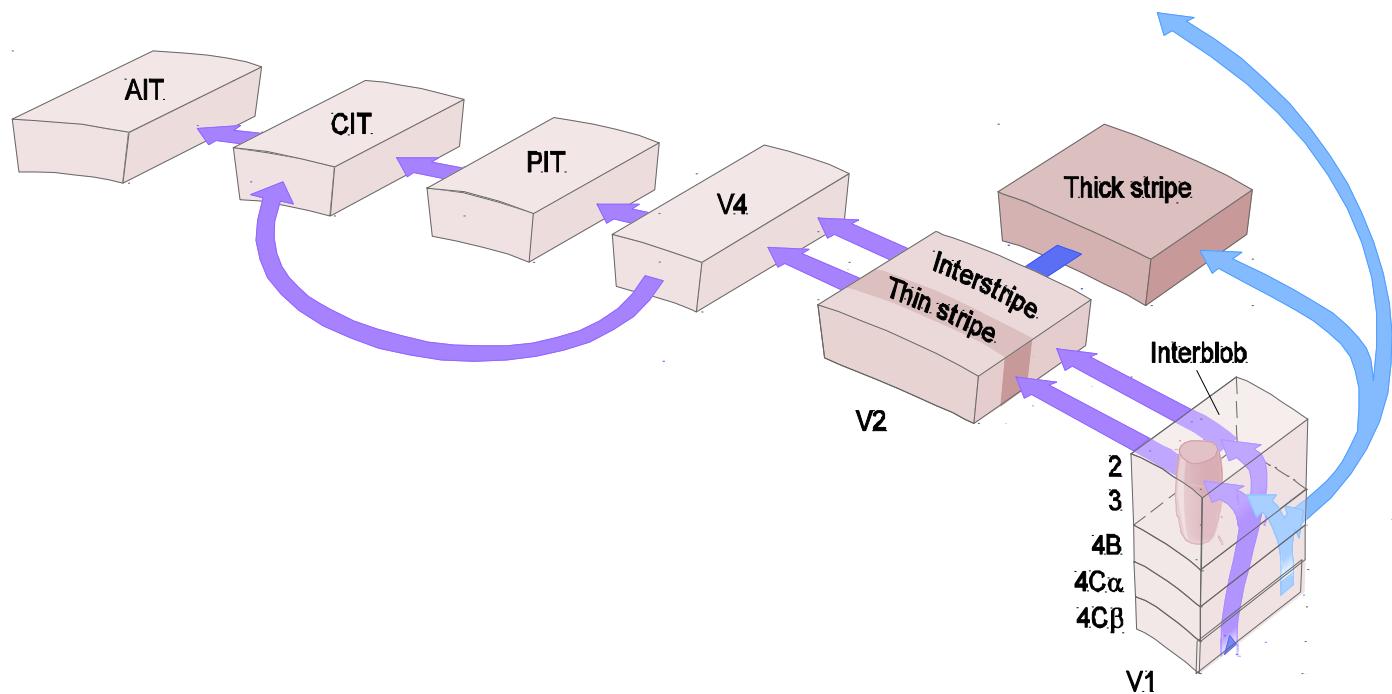
Cell 24fa1d (V2)



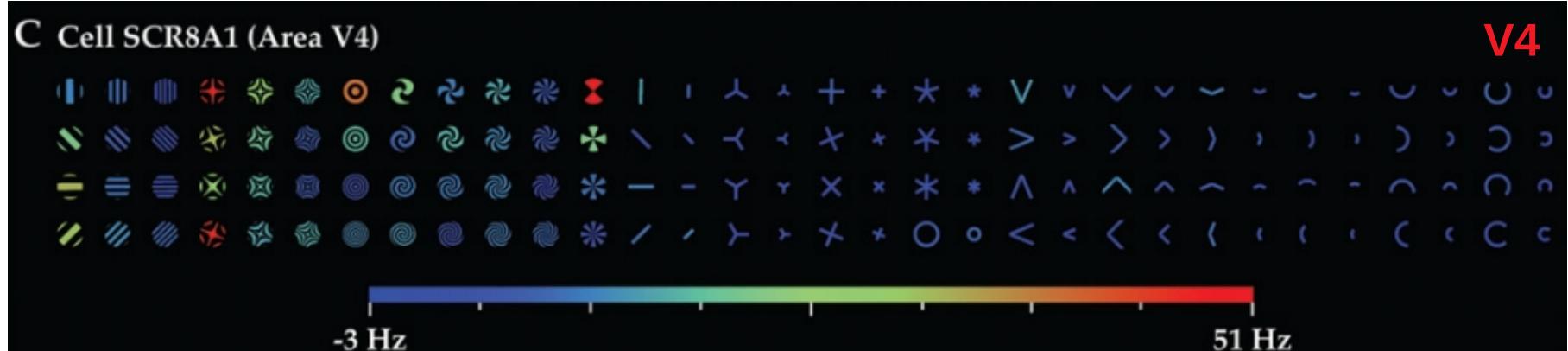
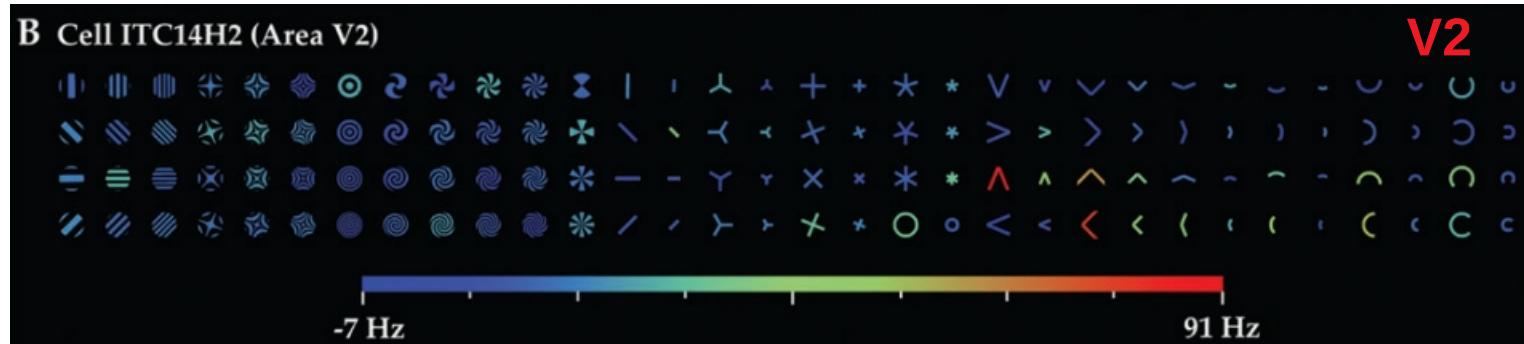
Summary: higher processing in V2

- Illusory contours
- Higher-level statistics
- Binocular disparity
- Border ownership
- Some figure-ground segregation signal
- Small amount of attentional modulation

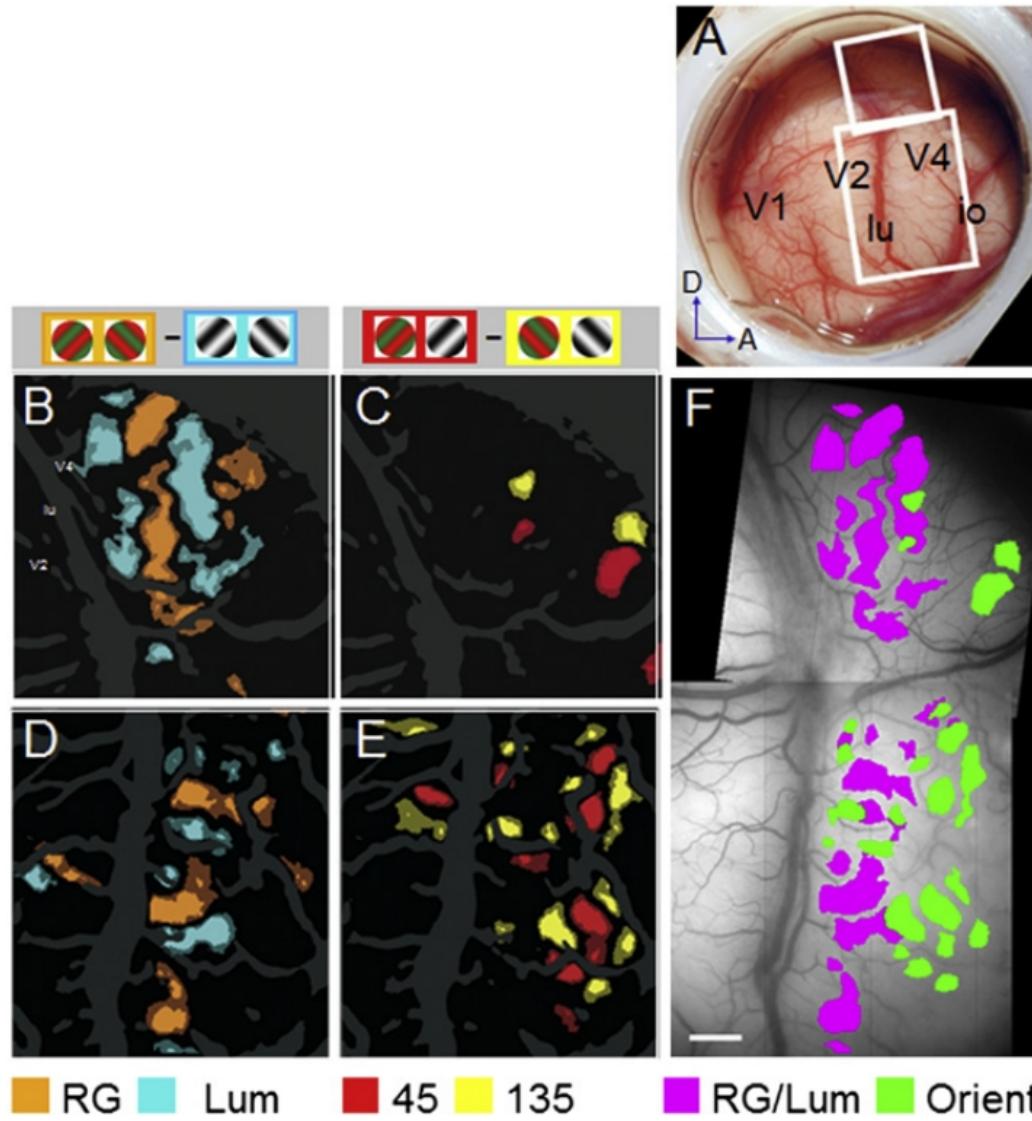
V2->V4



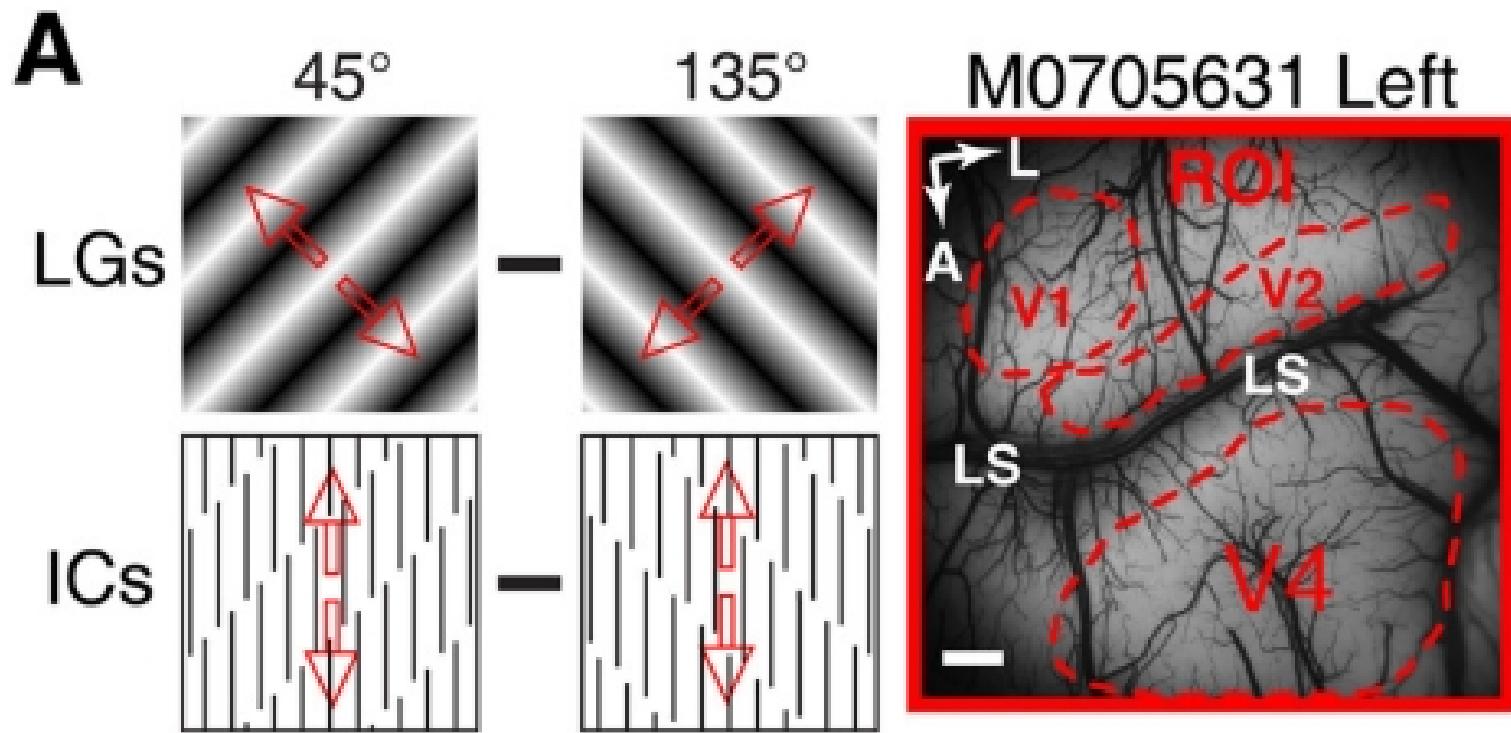
Receptive fields in V4



Functional organization of V4



Illusory Contours in V4



Illusory Contours in V4

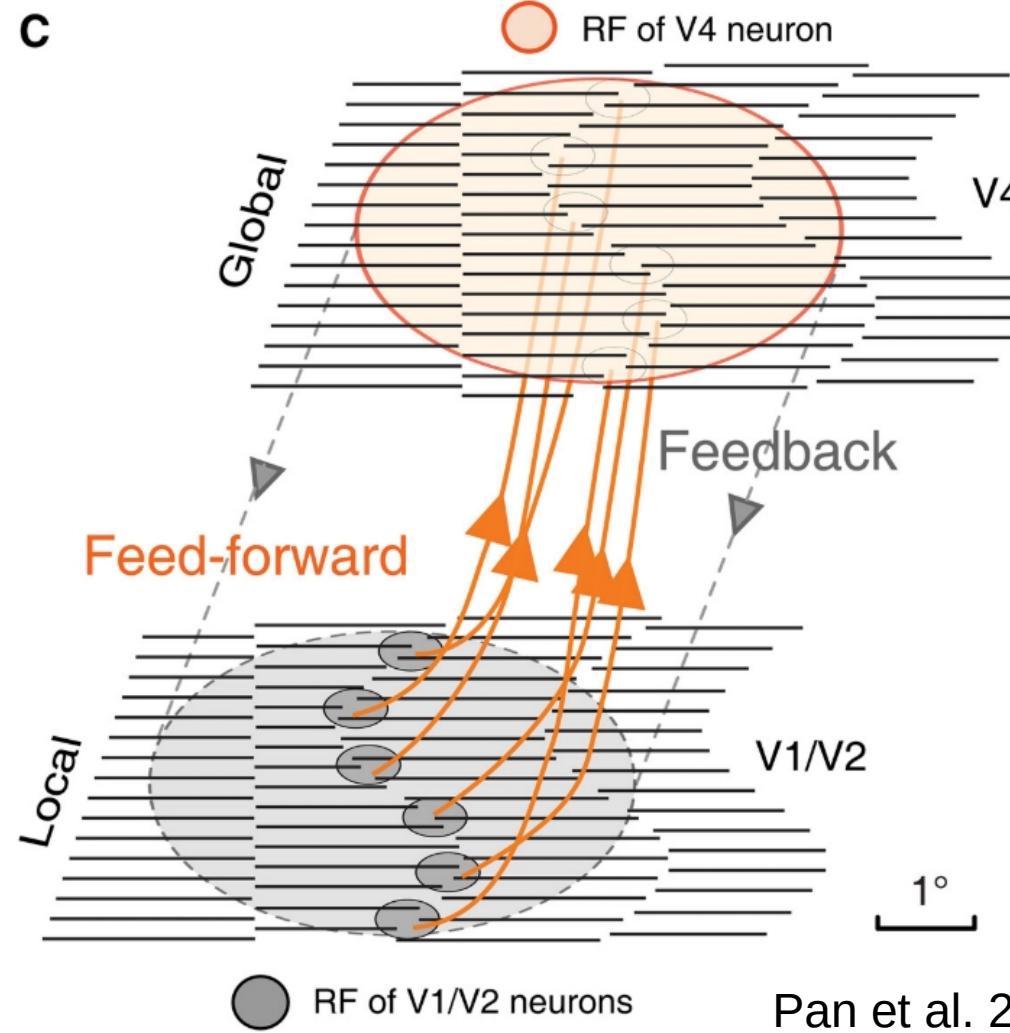
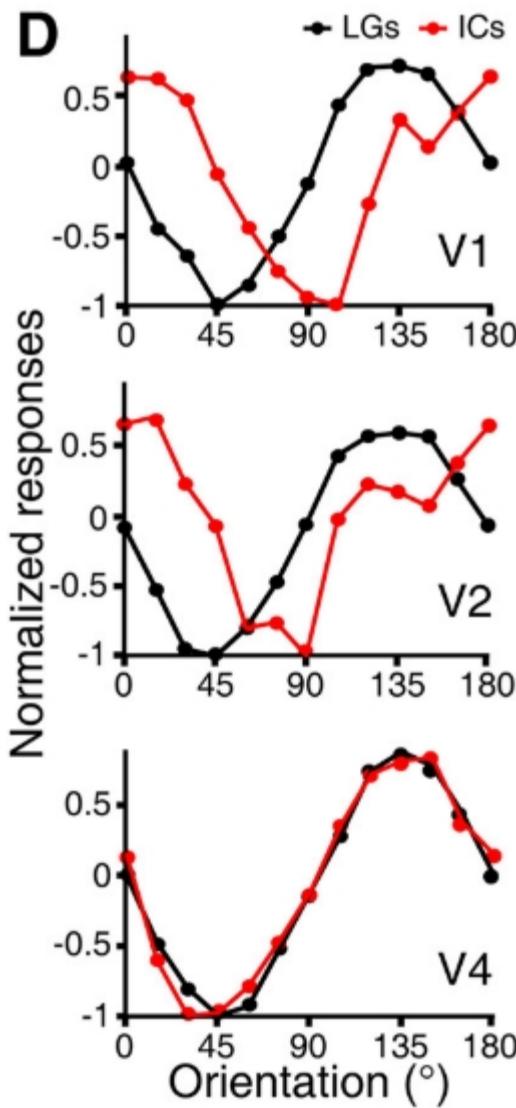
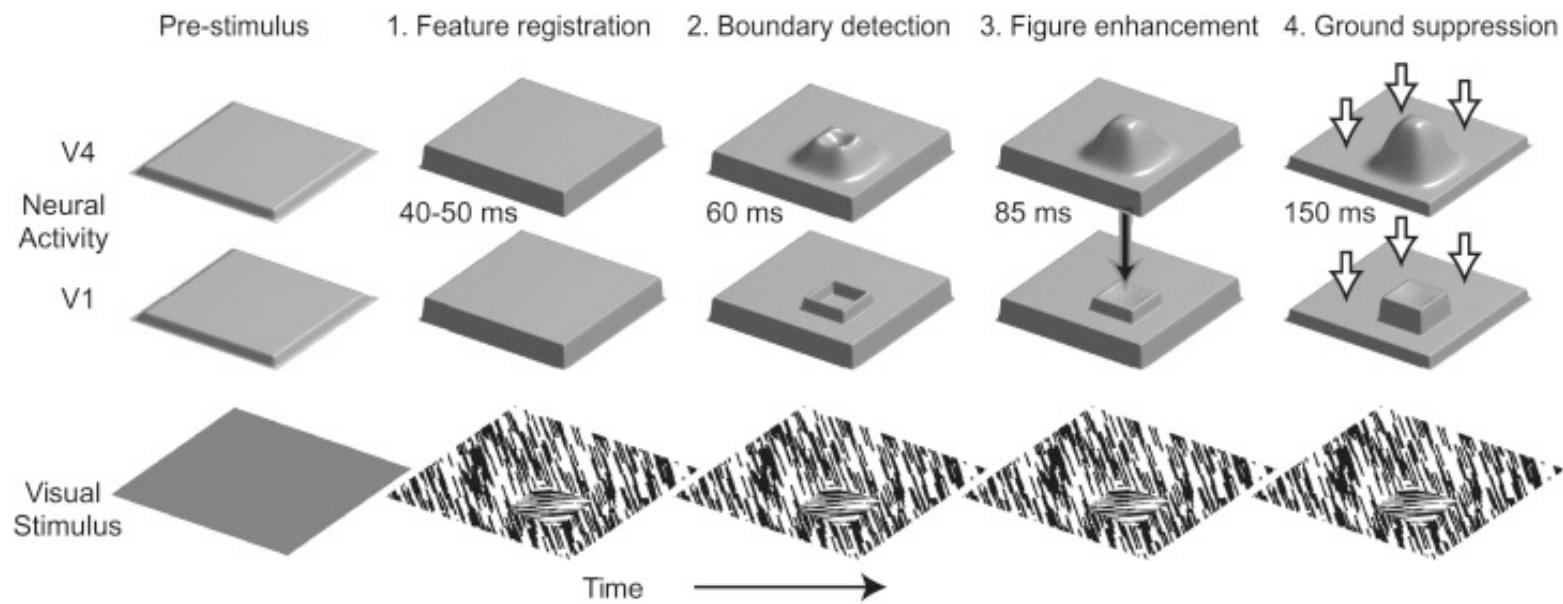
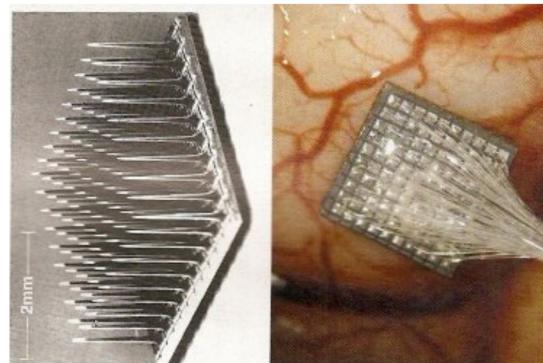


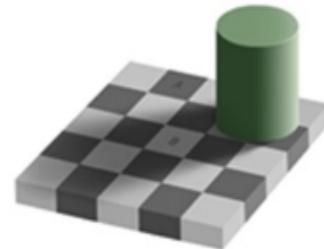
Figure-ground segregation



Higher-level representation in V4

A

Color



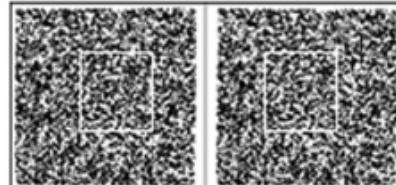
B

Shape



C

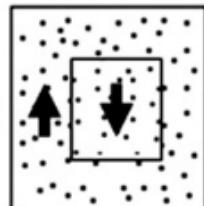
Depth



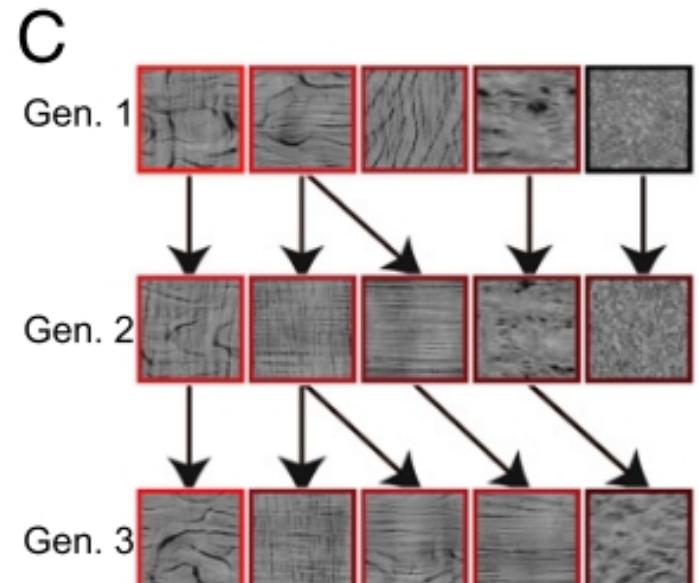
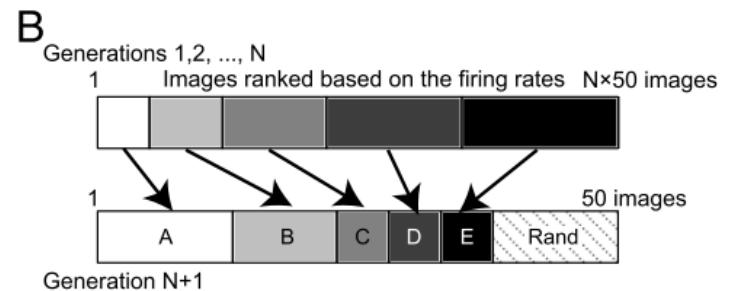
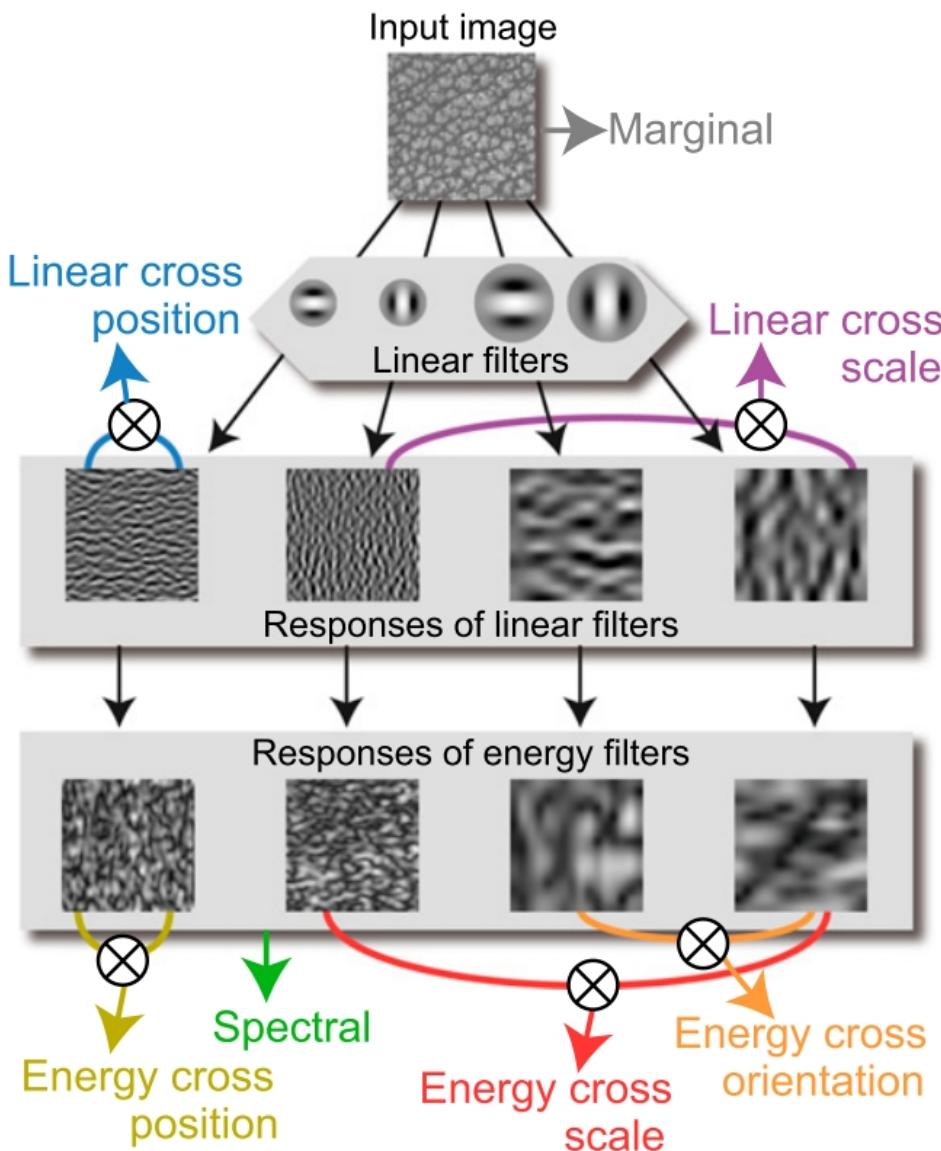
Illusions

D

Motion



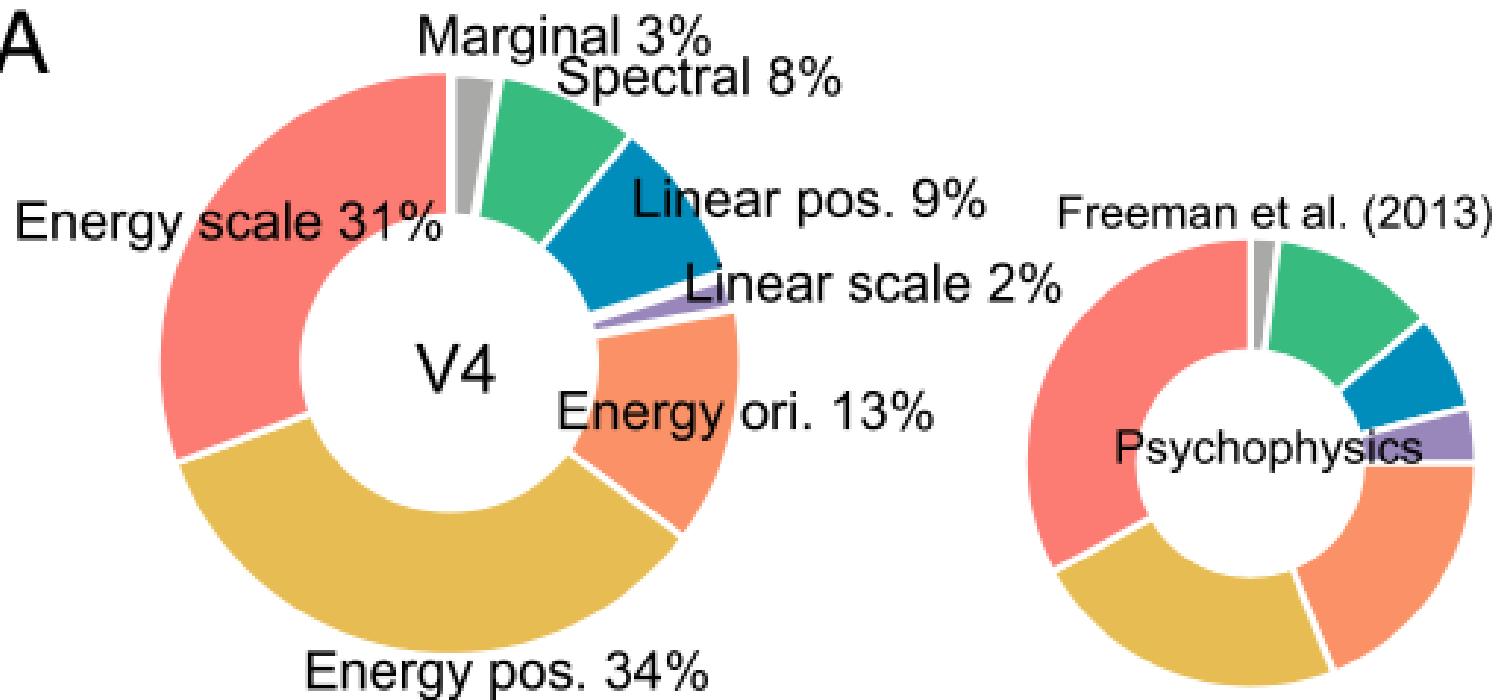
Texture representation in V4



(Okazawa et al. 2015)

Texture representation in V4

A

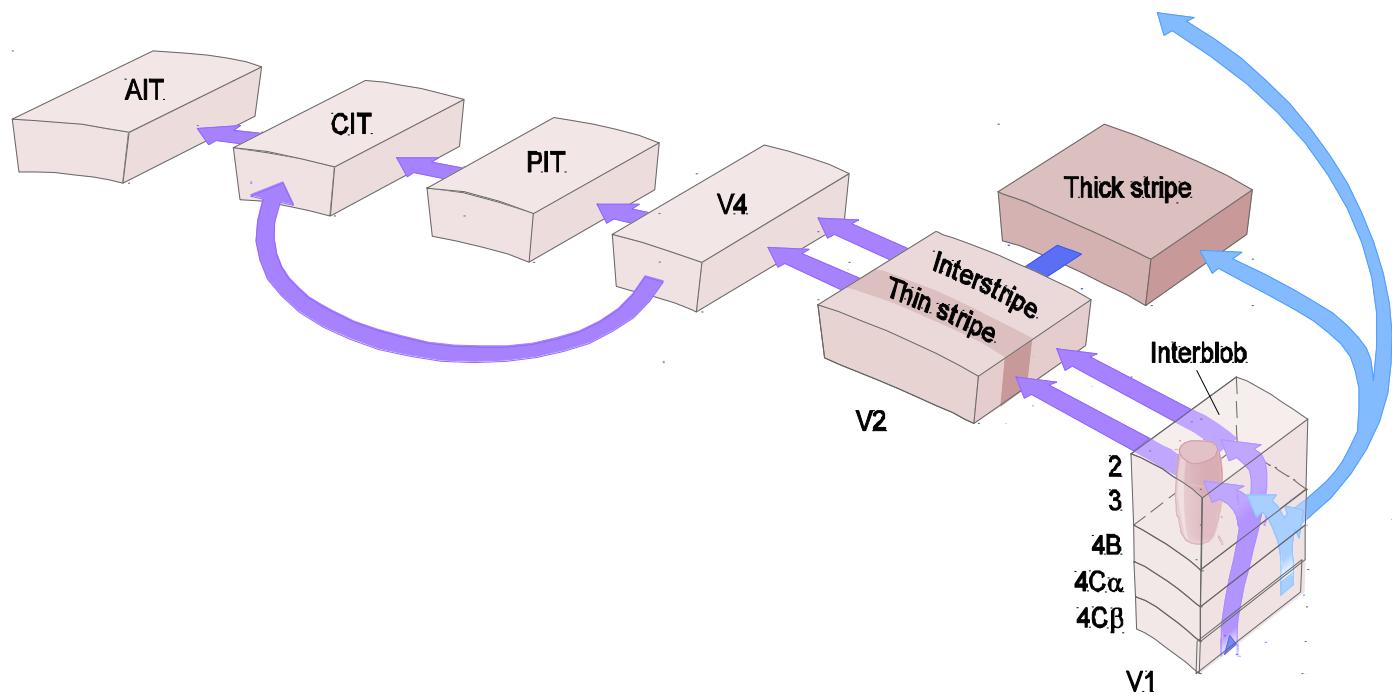


(Okazawa et al. 2015)

Summary: higher processing in V4

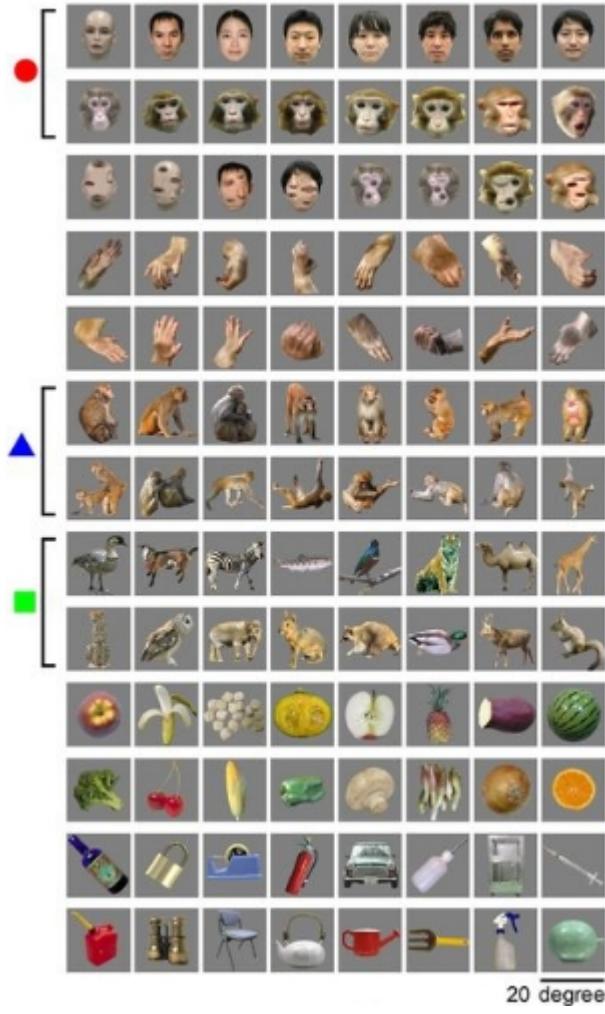
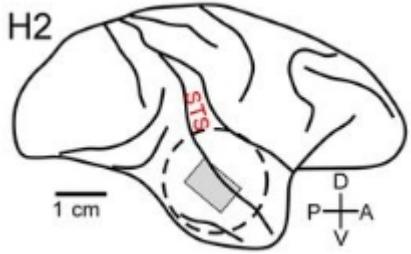
- More global Illusory contours
- Higher-level statistics
- Texture representation
- Strong figure-ground modulation signals
- Strong attentional modulation

V4->IT

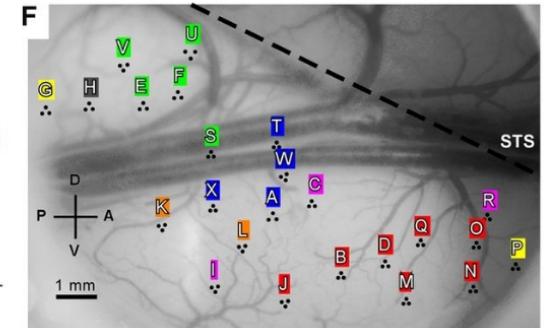
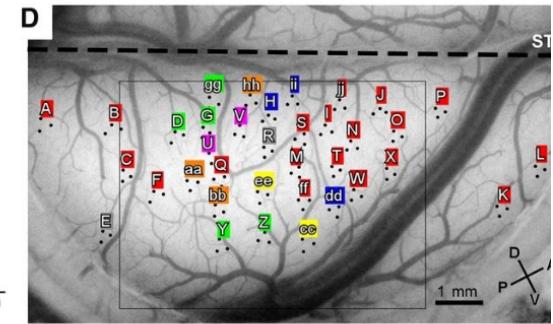
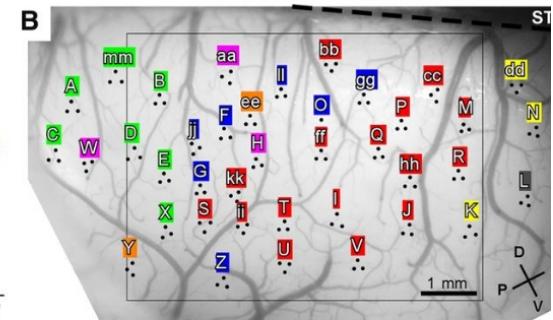
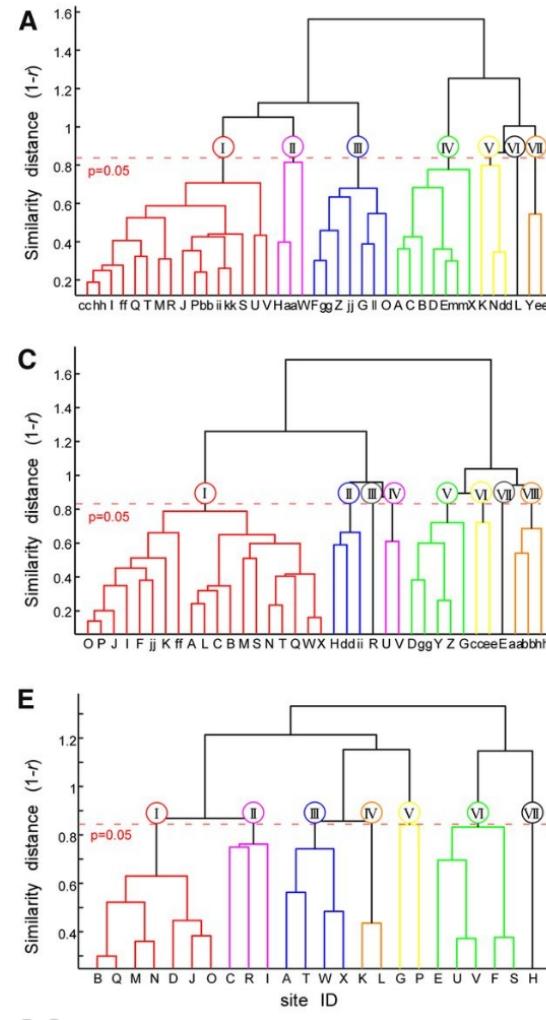


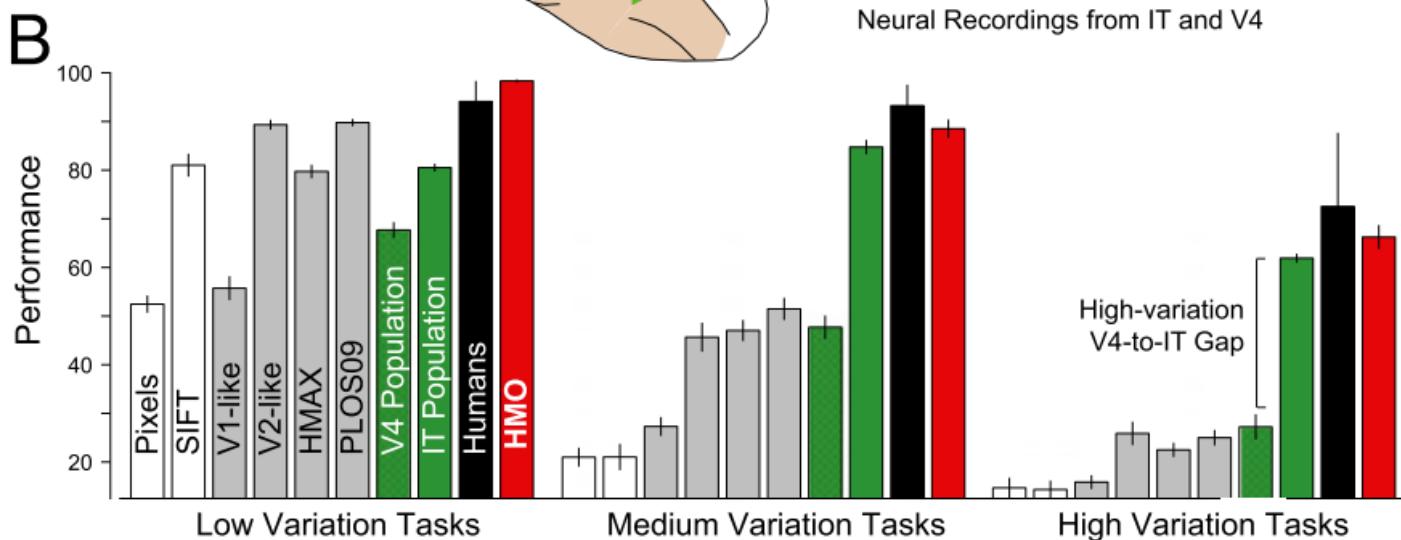
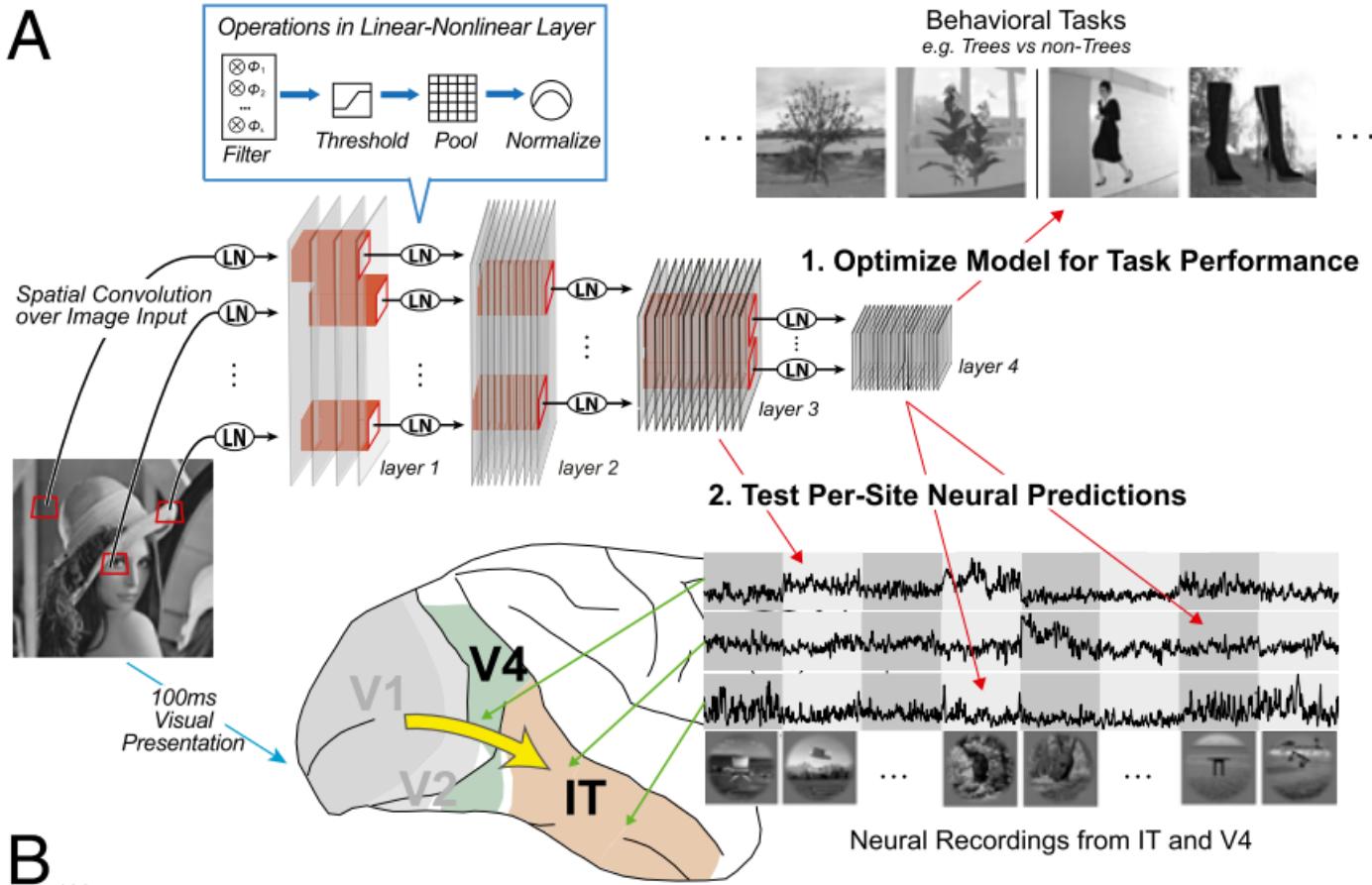
Inferior temporal (IT) cortex

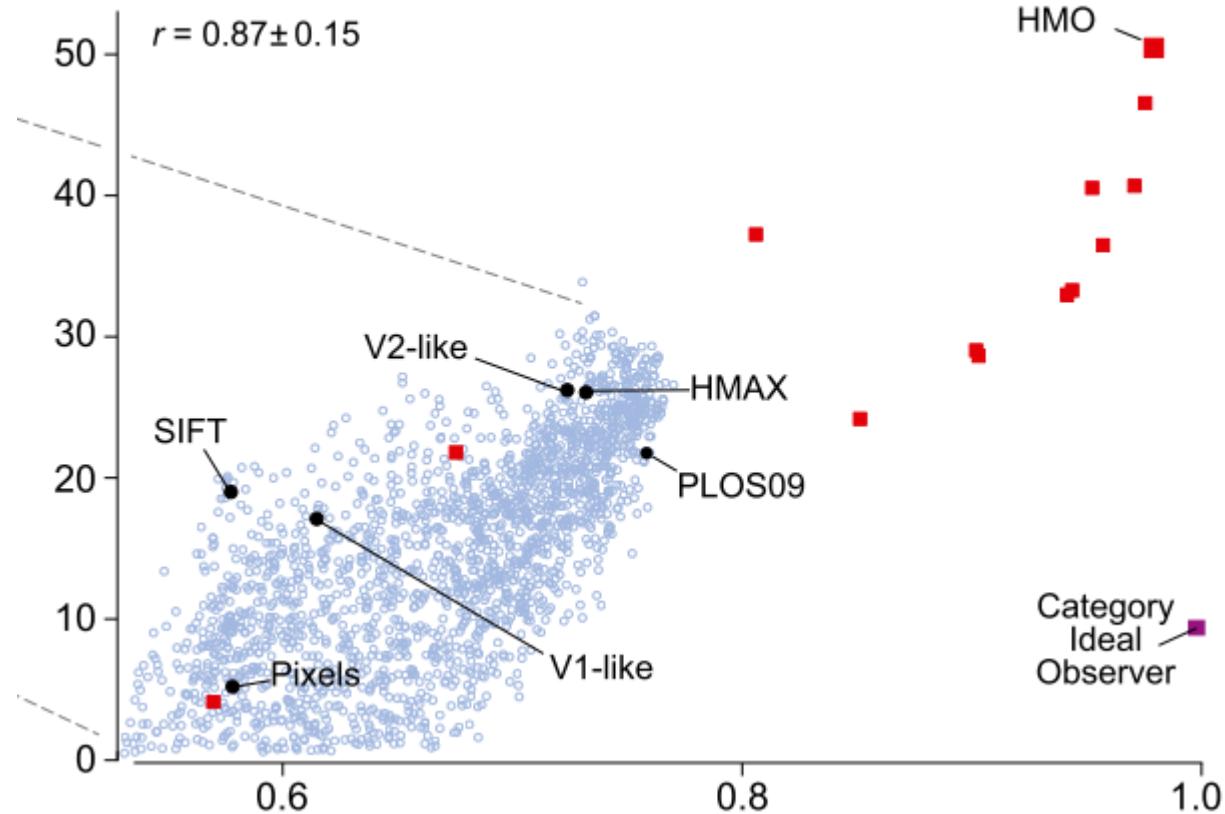
- Final stage of ventral visual stream
- Represents higher level features
 - Faces
 - Objects
- More selective than only to simple shapes
- Invariant to size, contrast, color, and position
- Topologically organized
- Role in visual memory
- Lesion leads to impairment in learning and remembering to recognize visual stimuli



Object representation

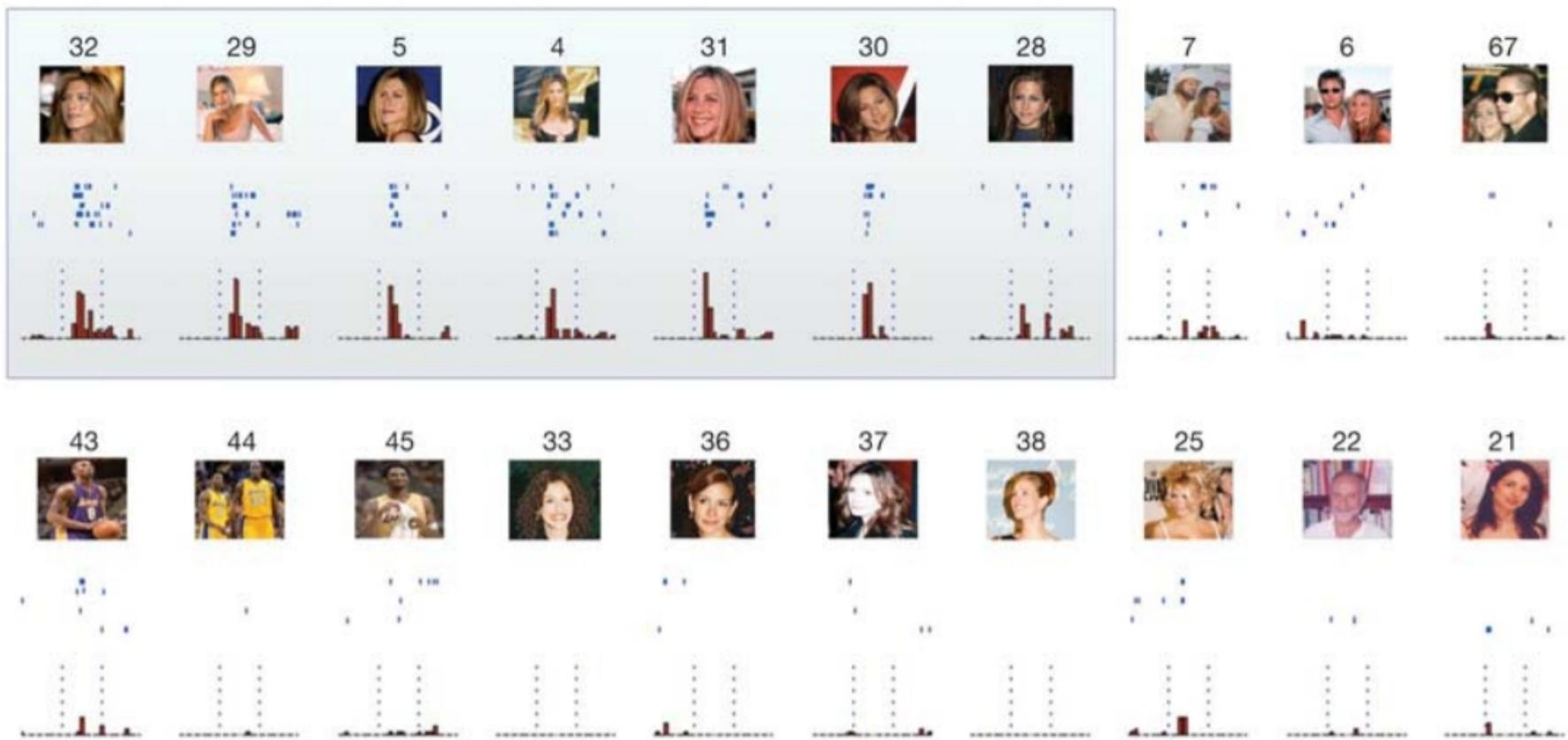




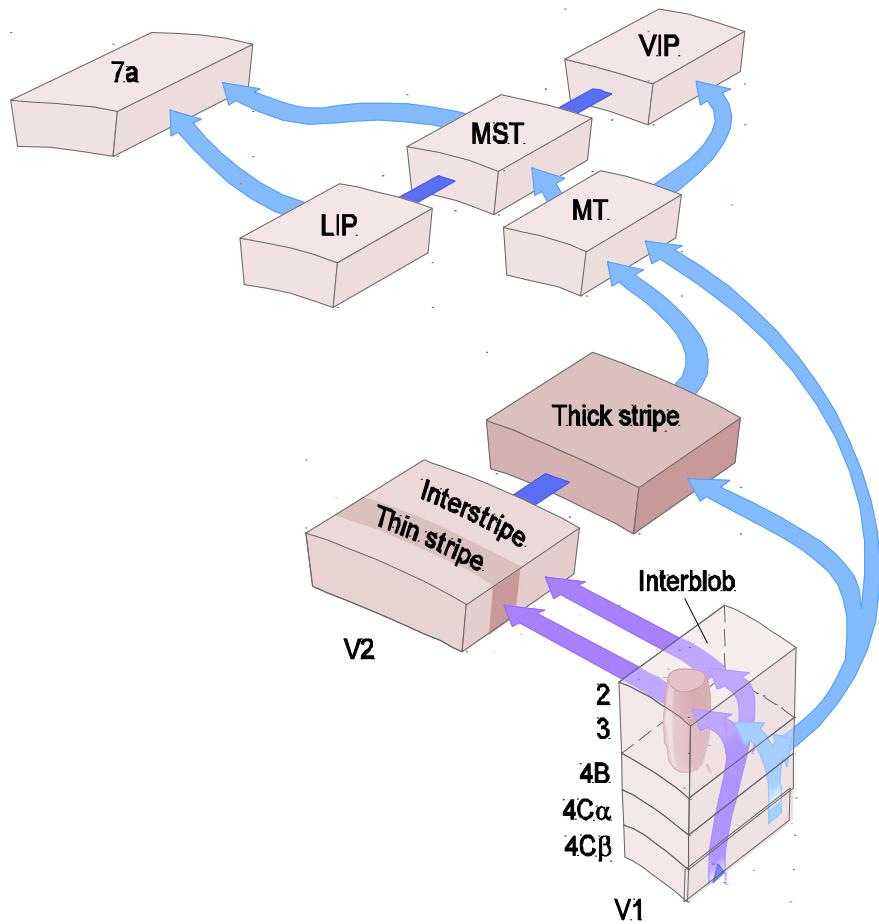
B

MTL cortex

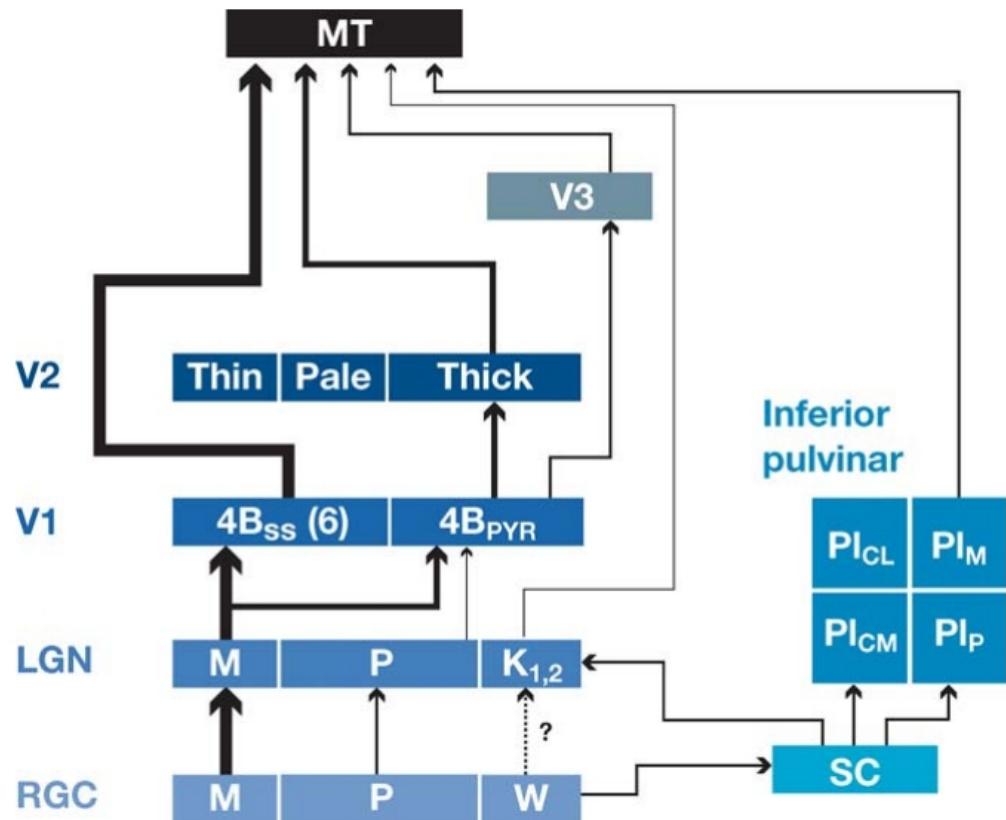
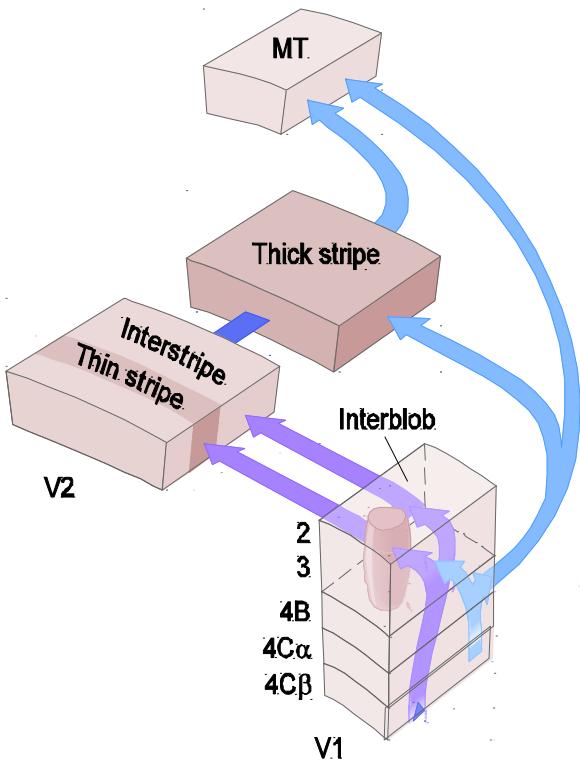
Jennifer Aniston Neuron



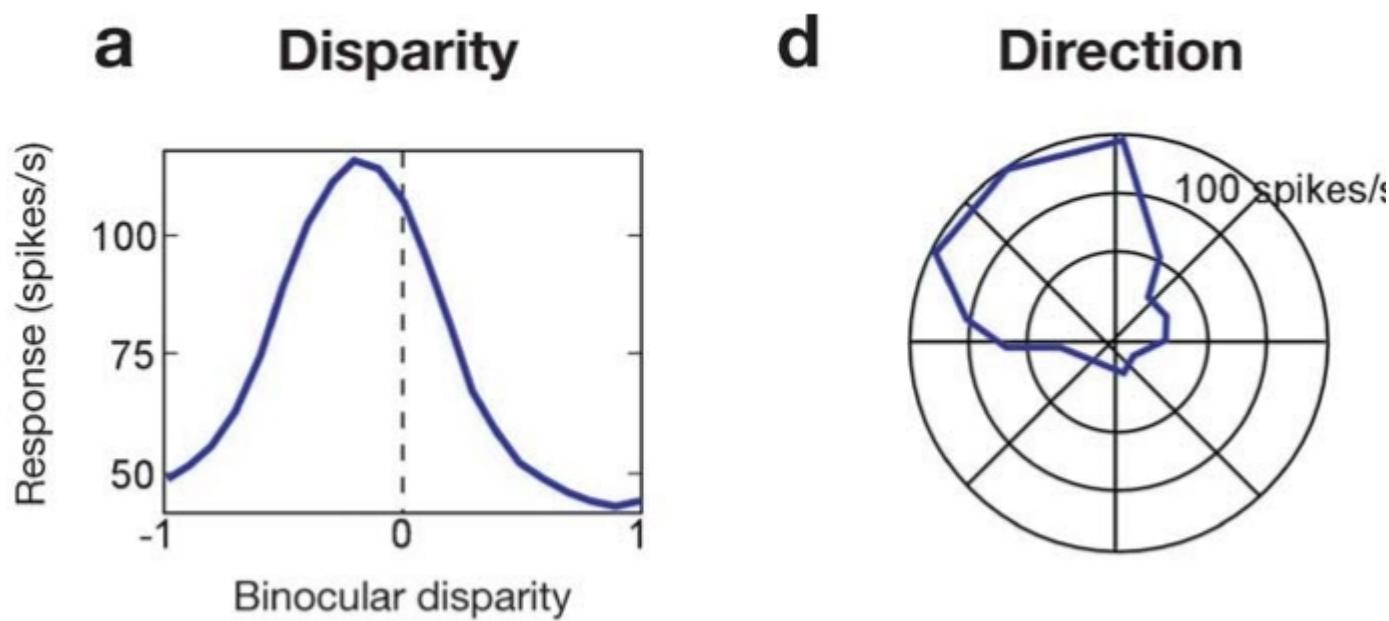
Dorsal stream - ‘where and why’



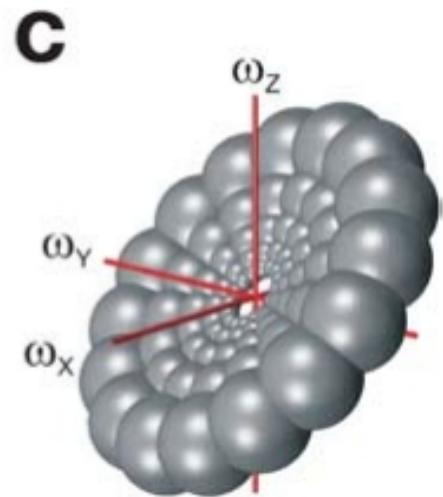
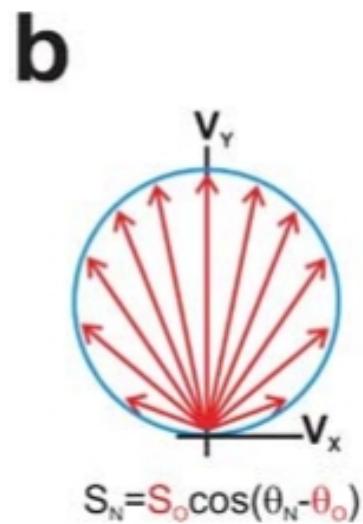
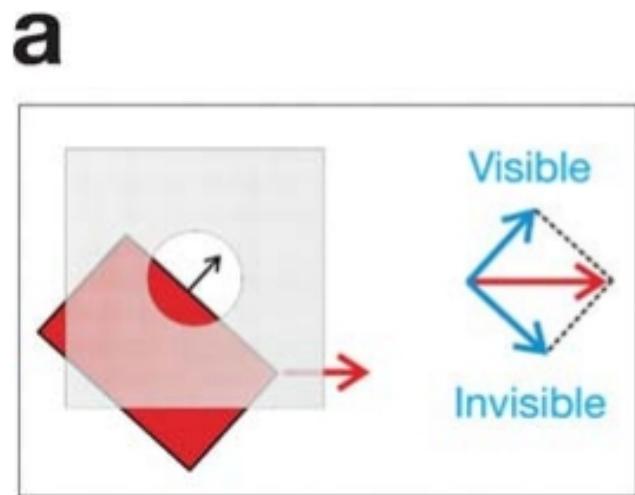
V2 → Middle temporal (MT/V5) visual area

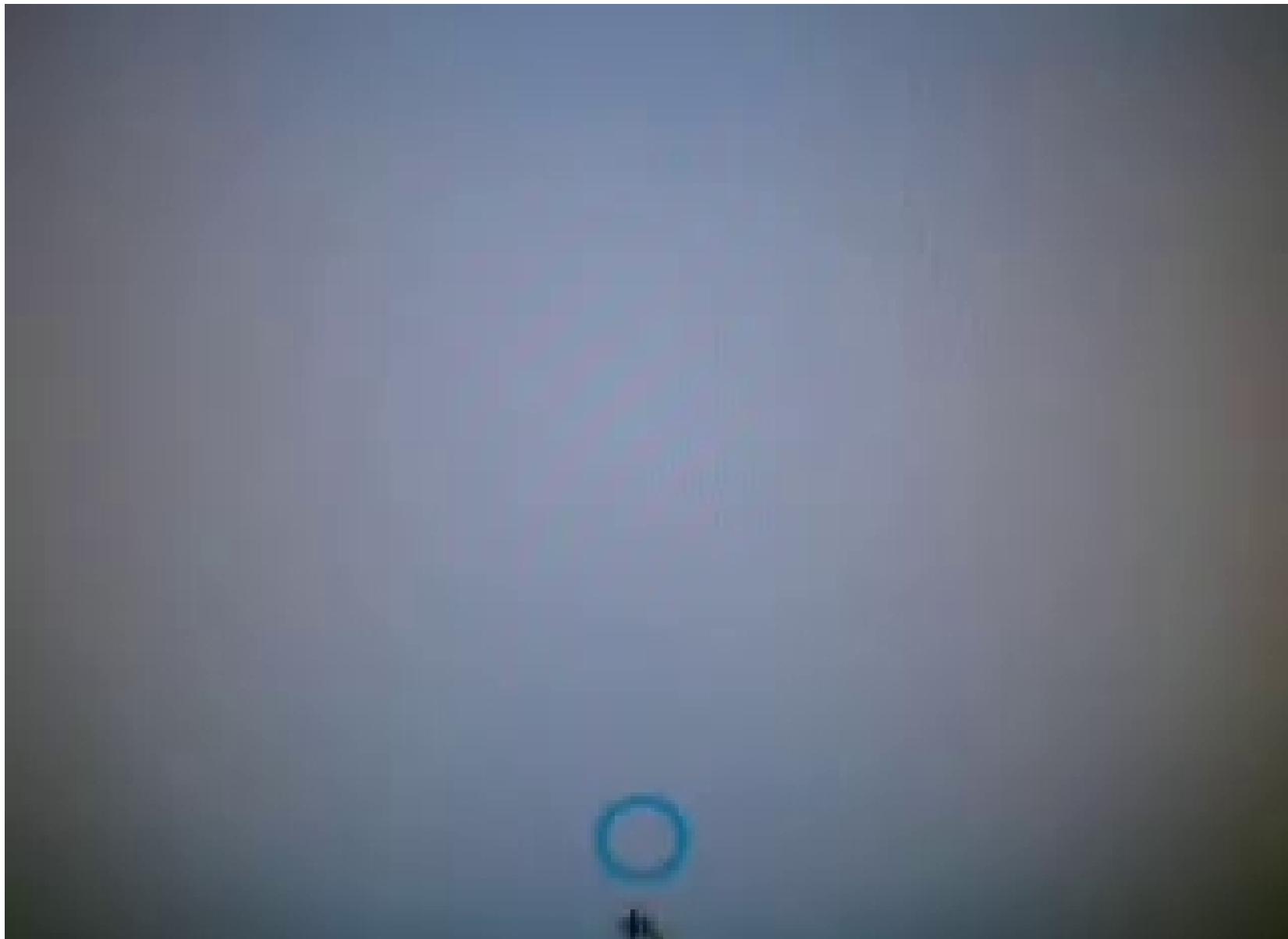


Direction and disparity



Local vs. global motion

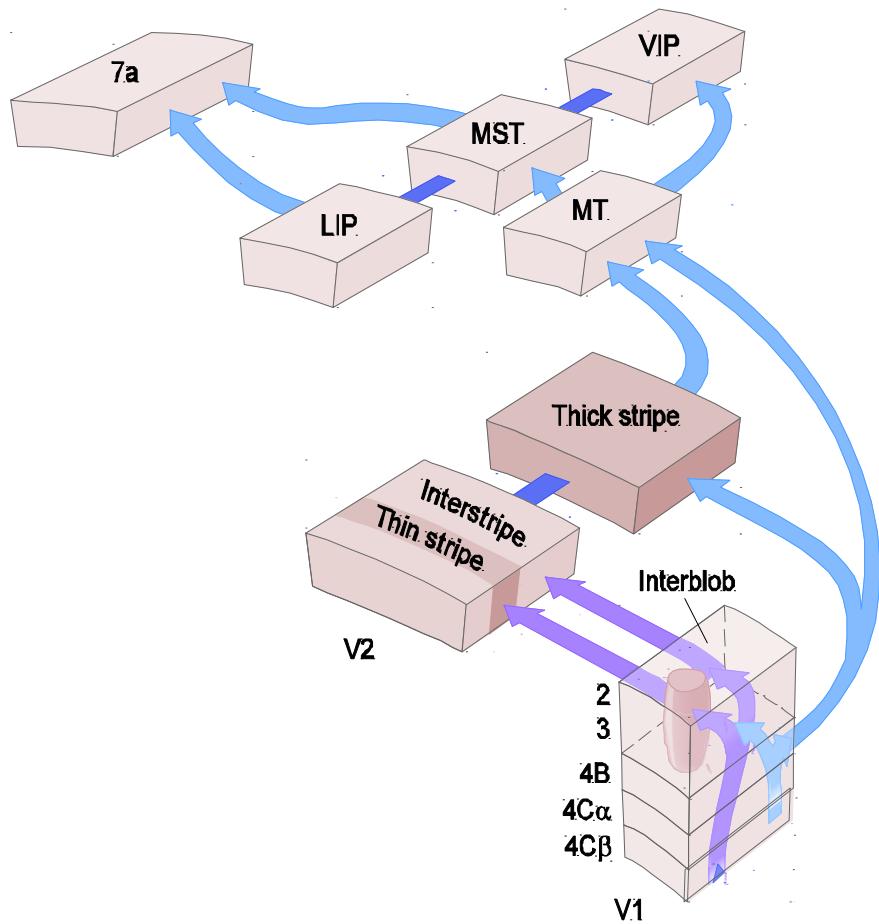




MT: Summary

- Motion area
- All neurons are direction selective
- Representation of speed
- Eye-movements
- Local vs. global motion
- Disparity

Dorsal stream - ‘where and why’



And of course they are interconnected

