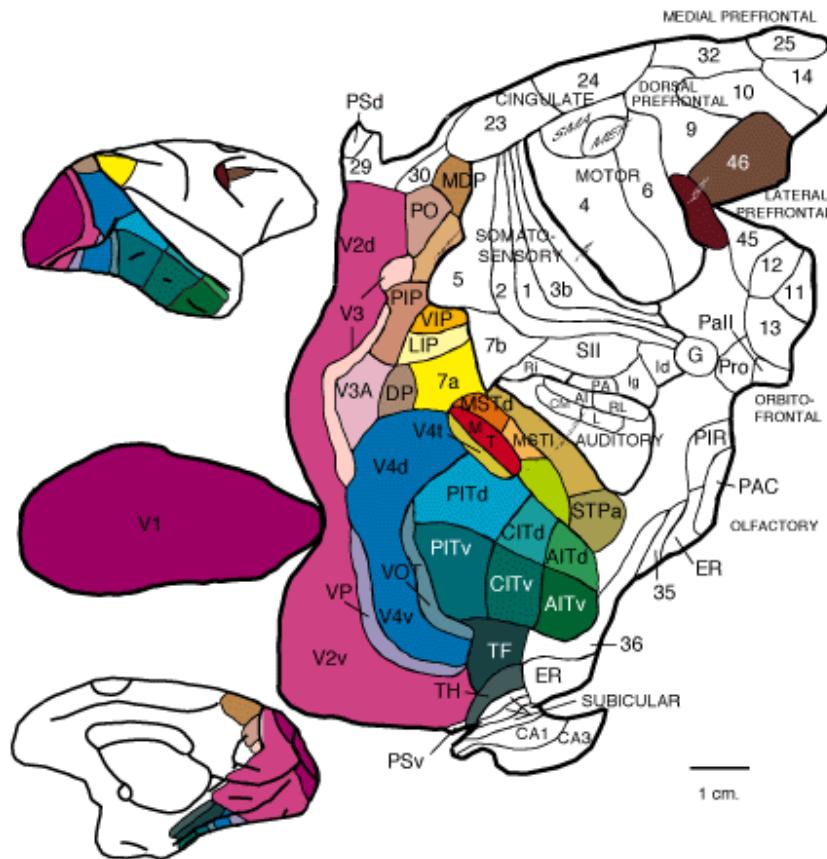
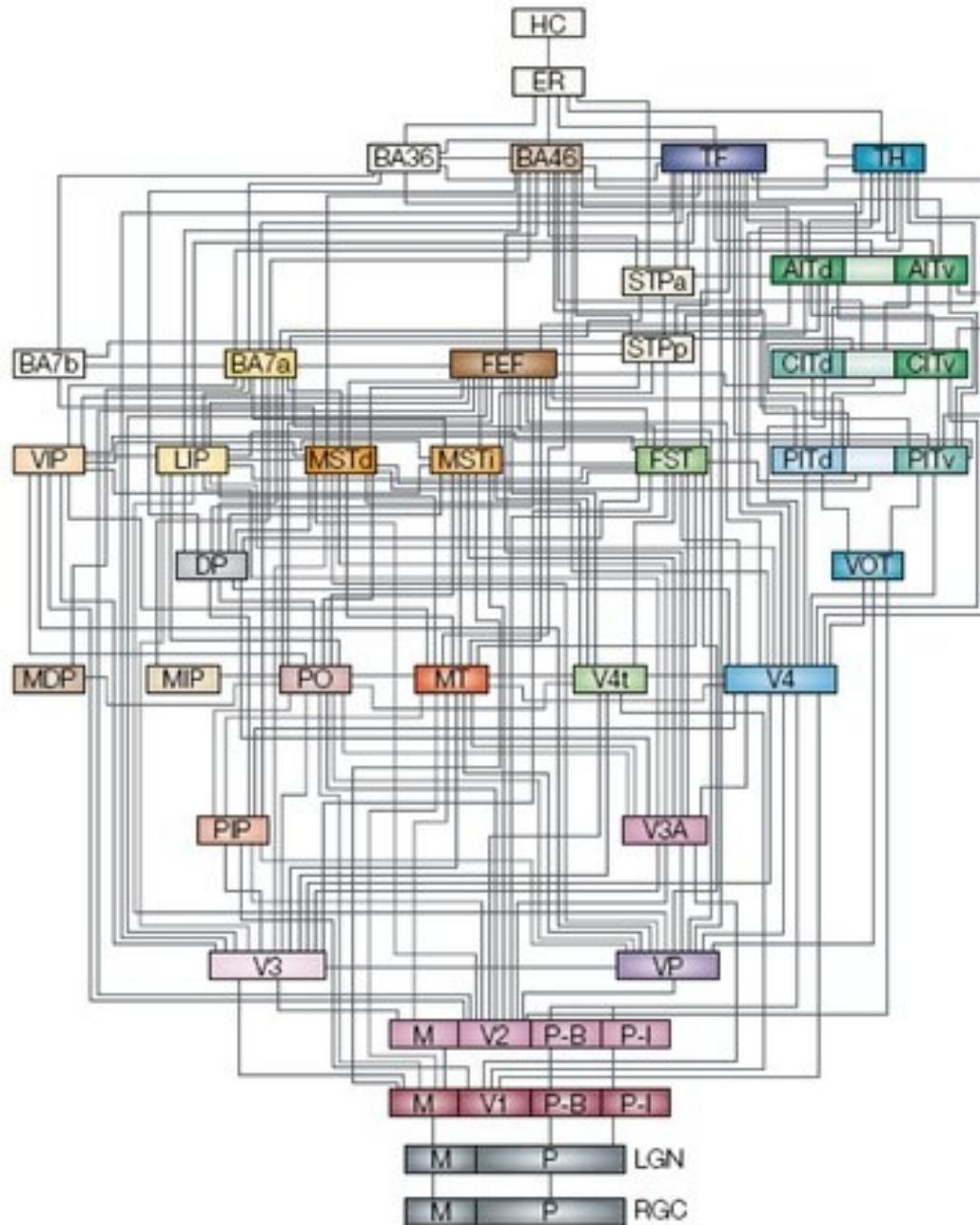
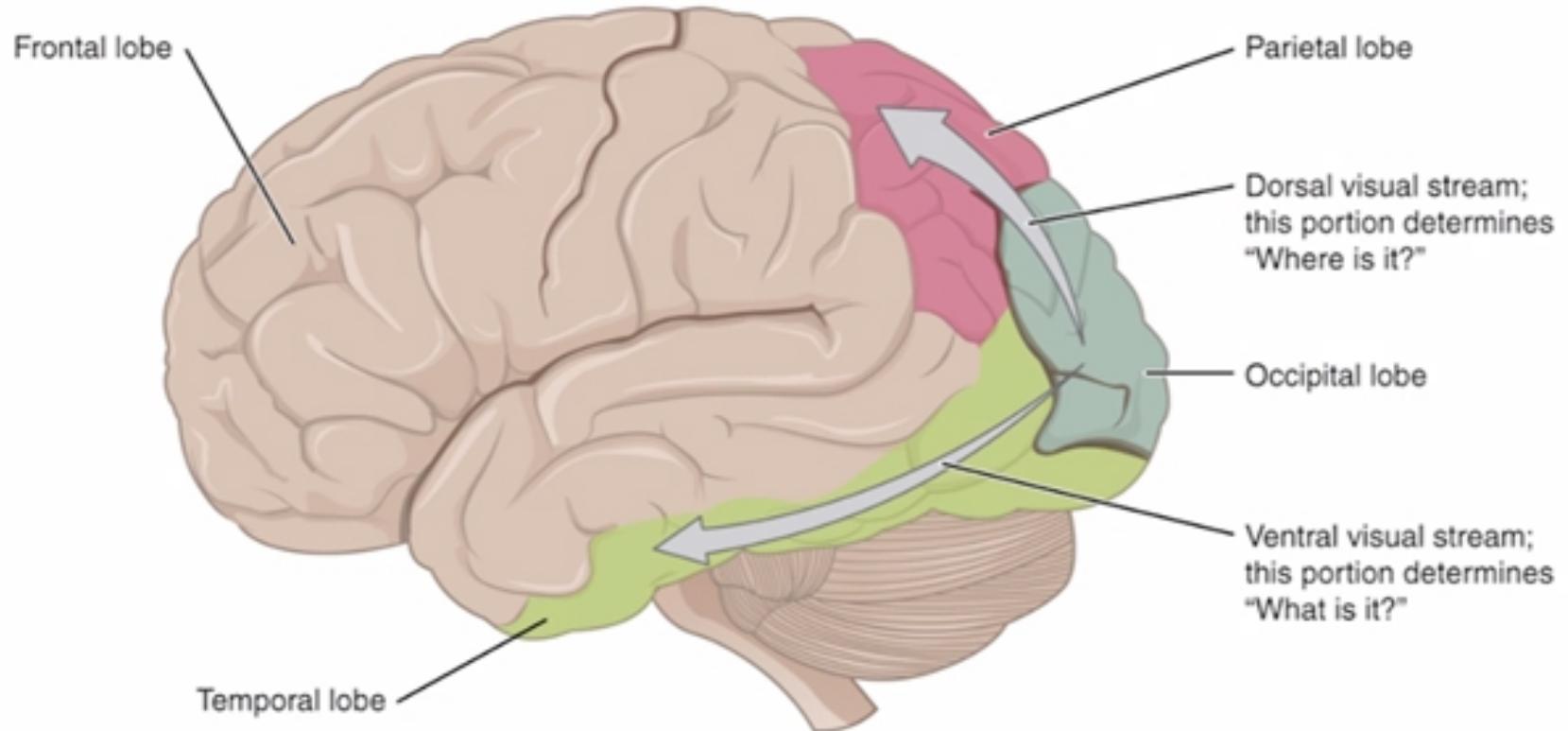


Anatomical segregation of visual system

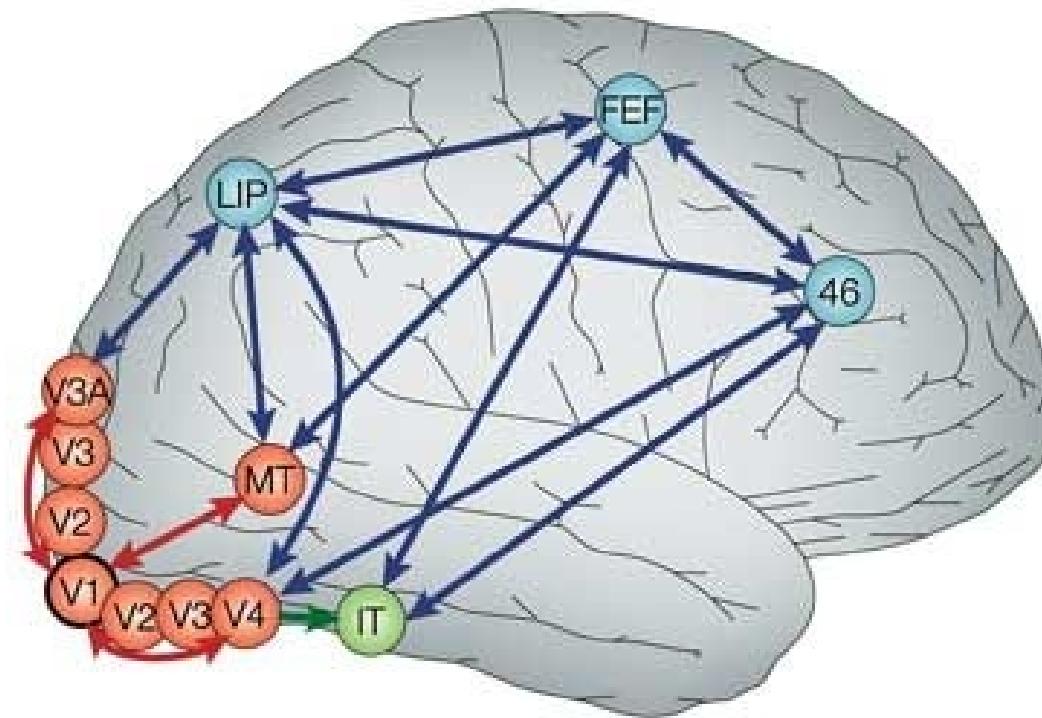




WHAT vs. WHERE

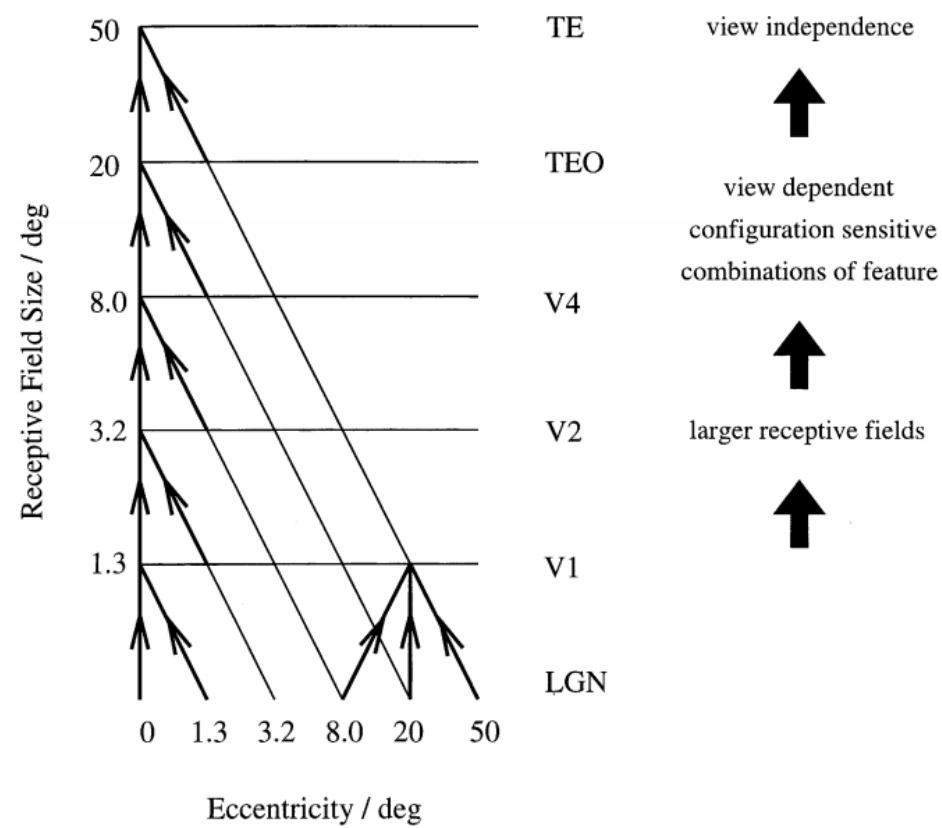
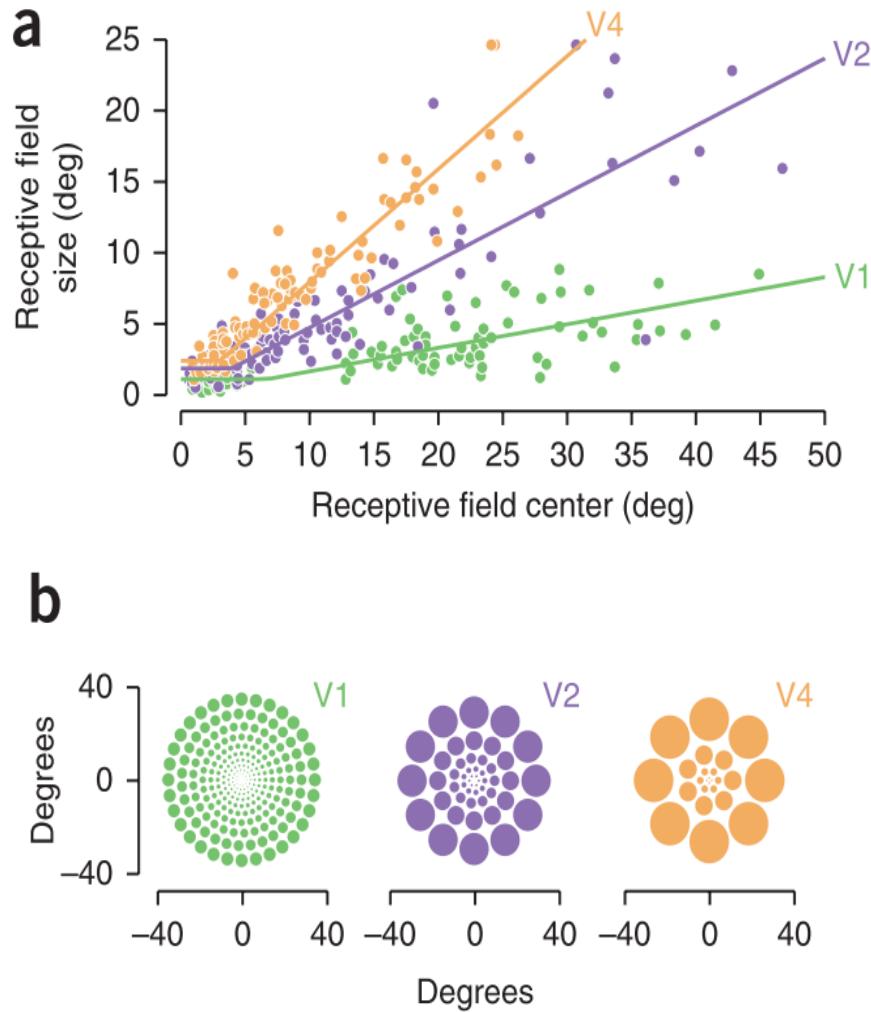


Visual Cortical Areas

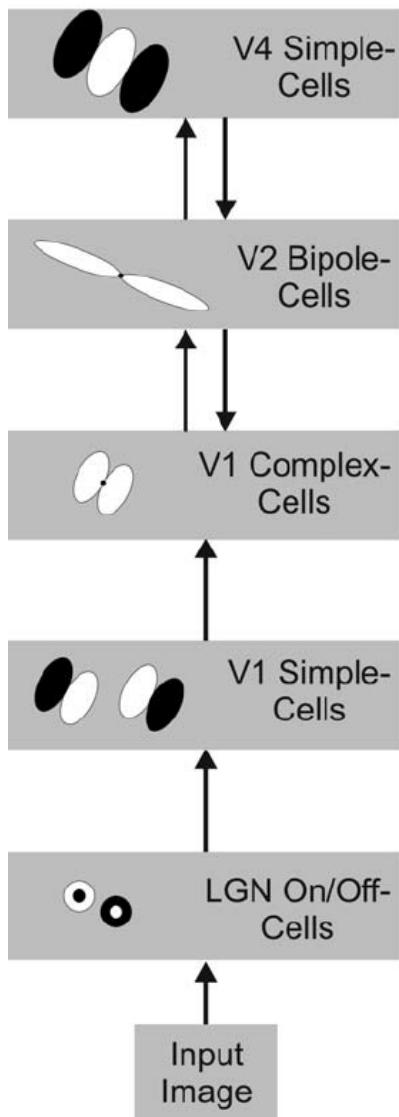


General Organizational Principles

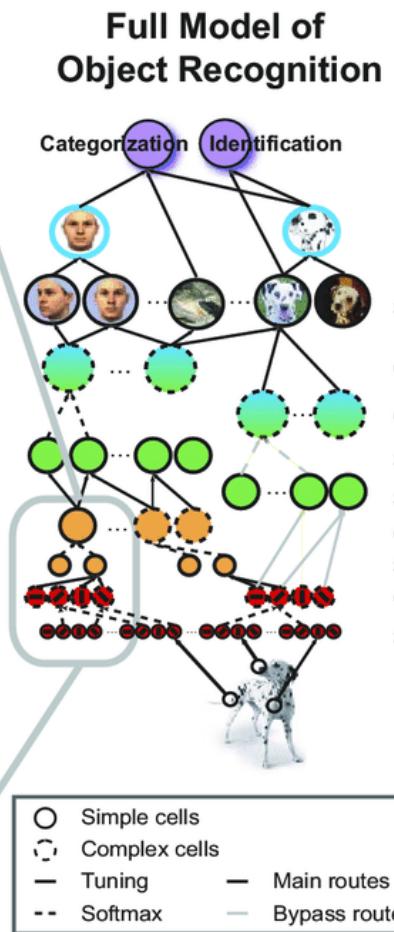
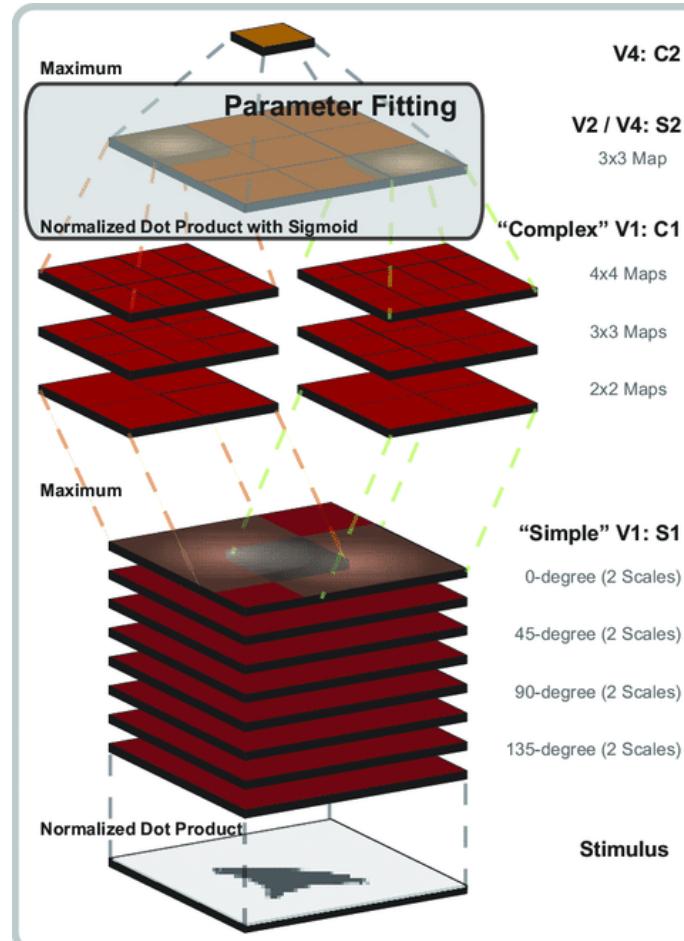
Receptive field size progression



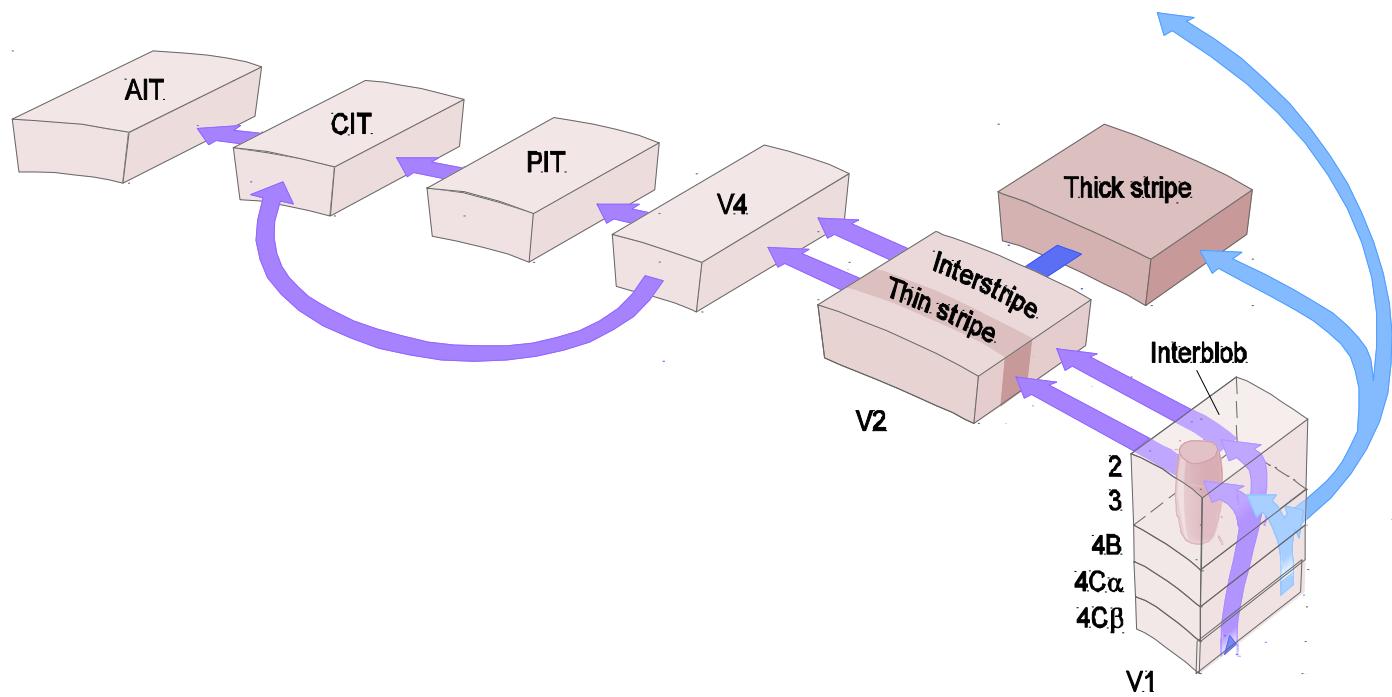
The theory of computational hierarchy



↑
Recurrent Texture Boundary Processing
↓
Preprocessing



Ventral ‘What’ Stream

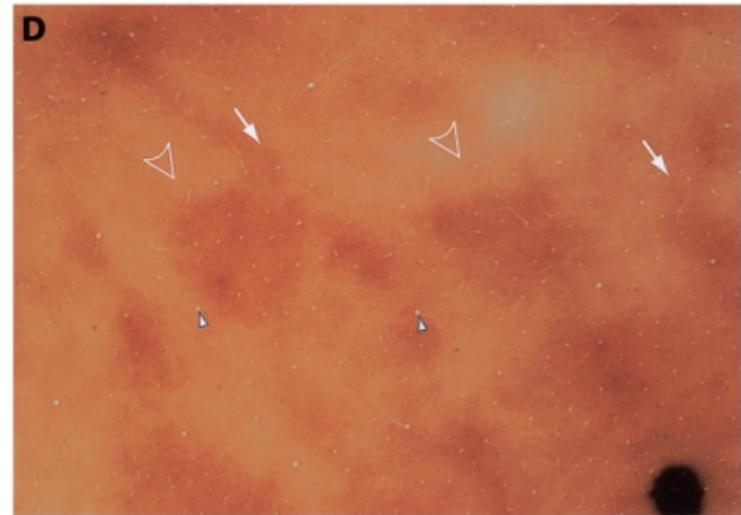
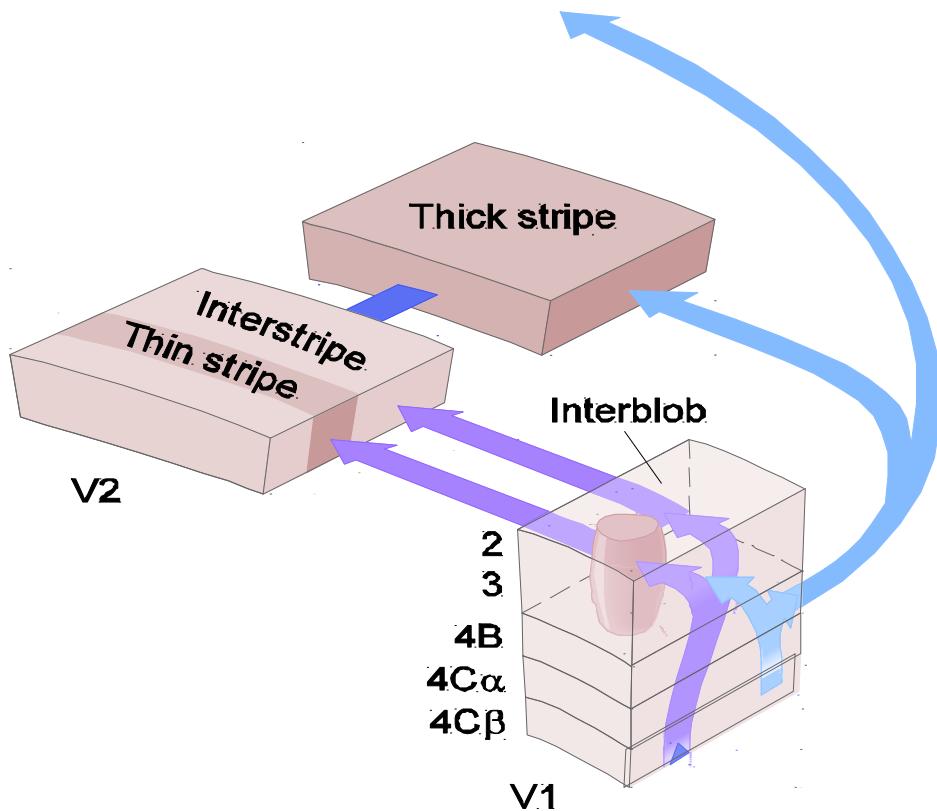


Secondary Visual Area

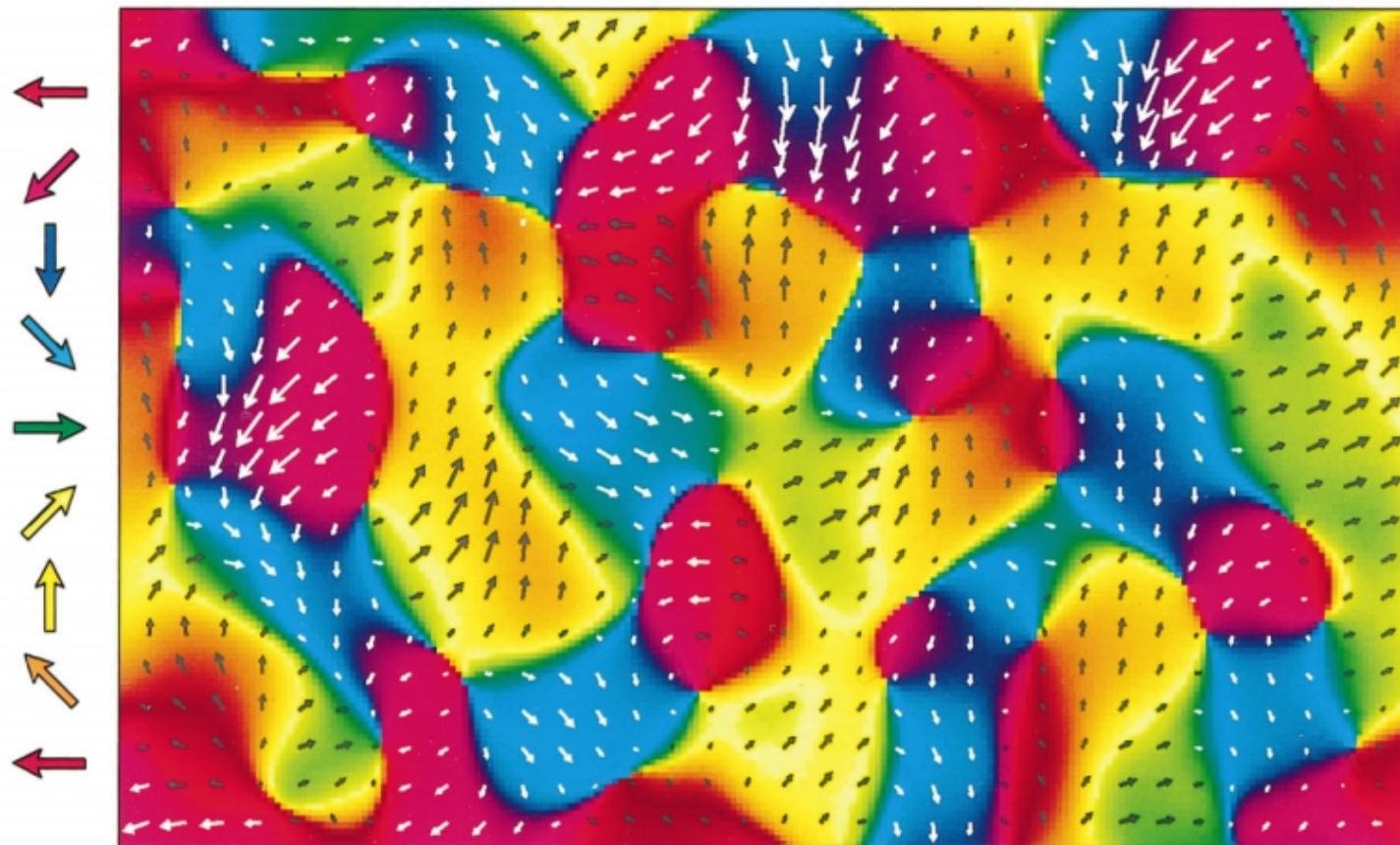
aka

V2

V1 → V2

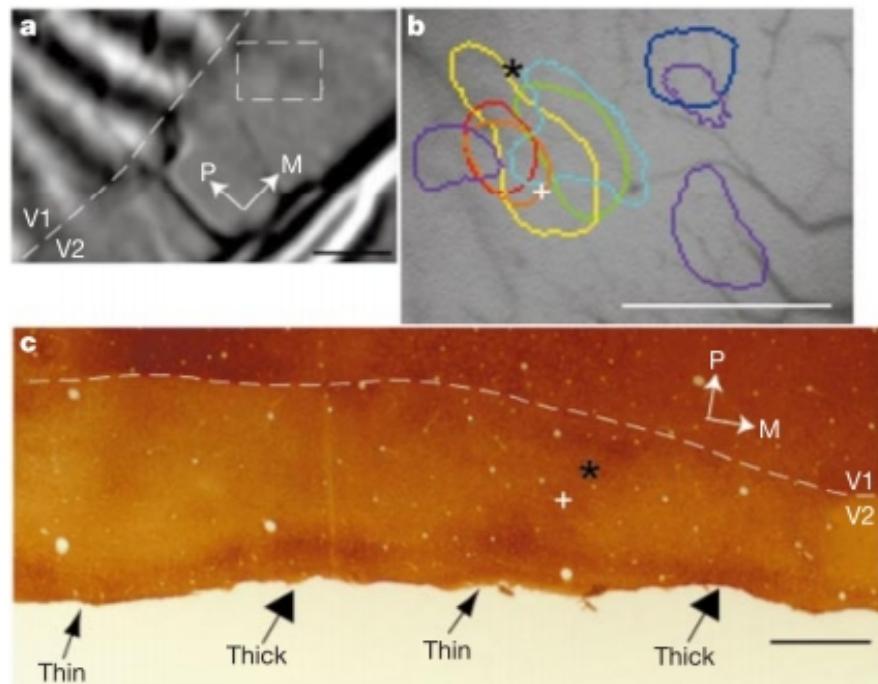
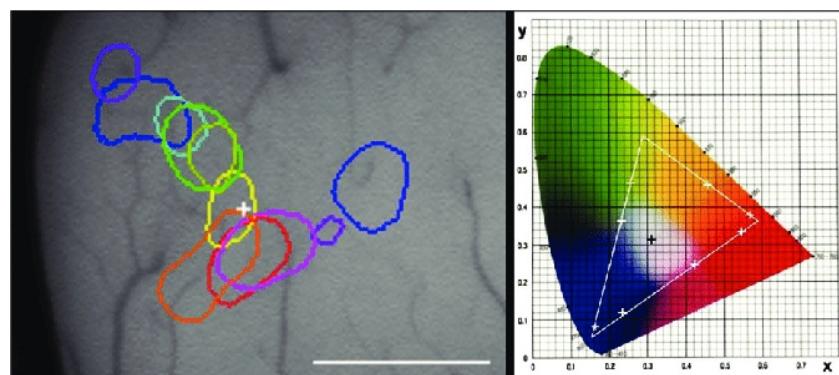
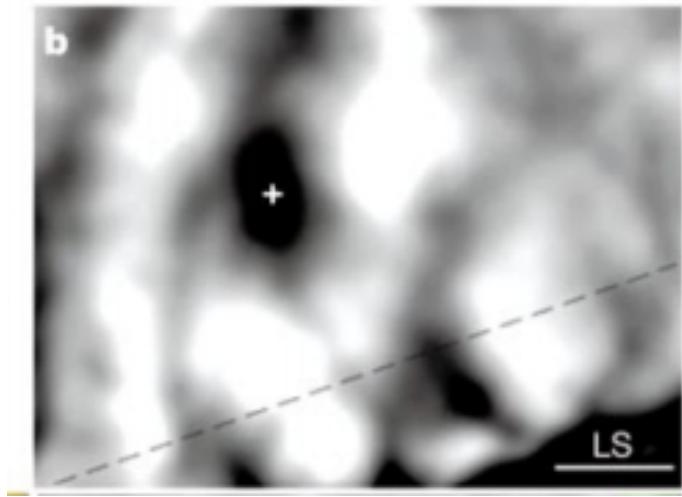


V2 functional organization



(Shumel & Grinvald 1996)

Color representation in V2



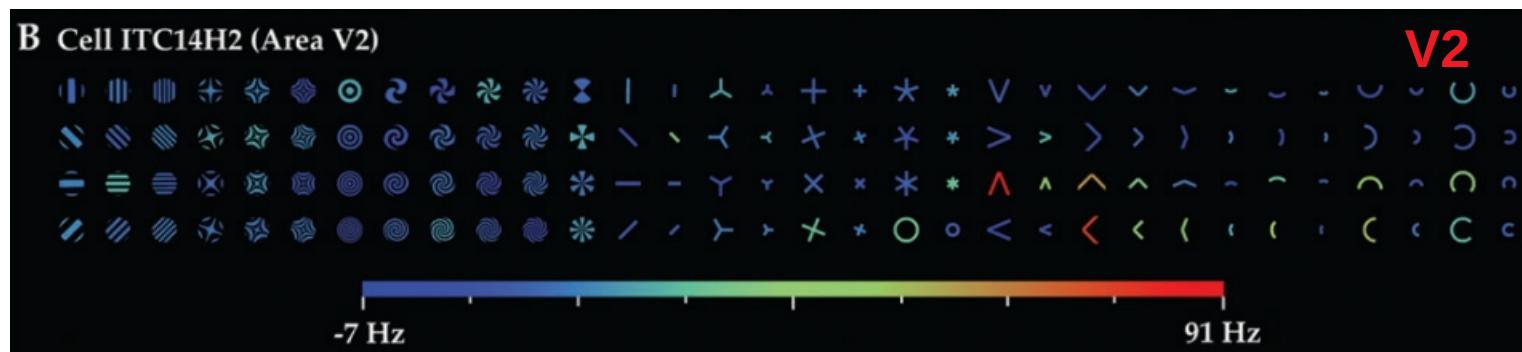
Receptive fields in V2

A Cell SCR30H3



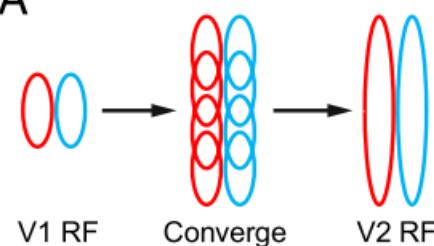
V1

B Cell ITC14H2 (Area V2)

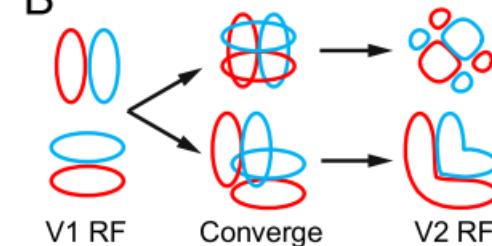


V2

A

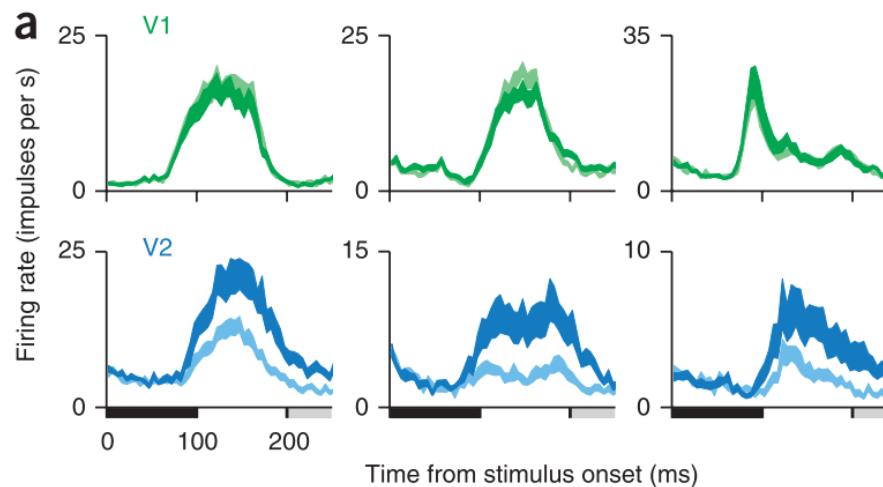
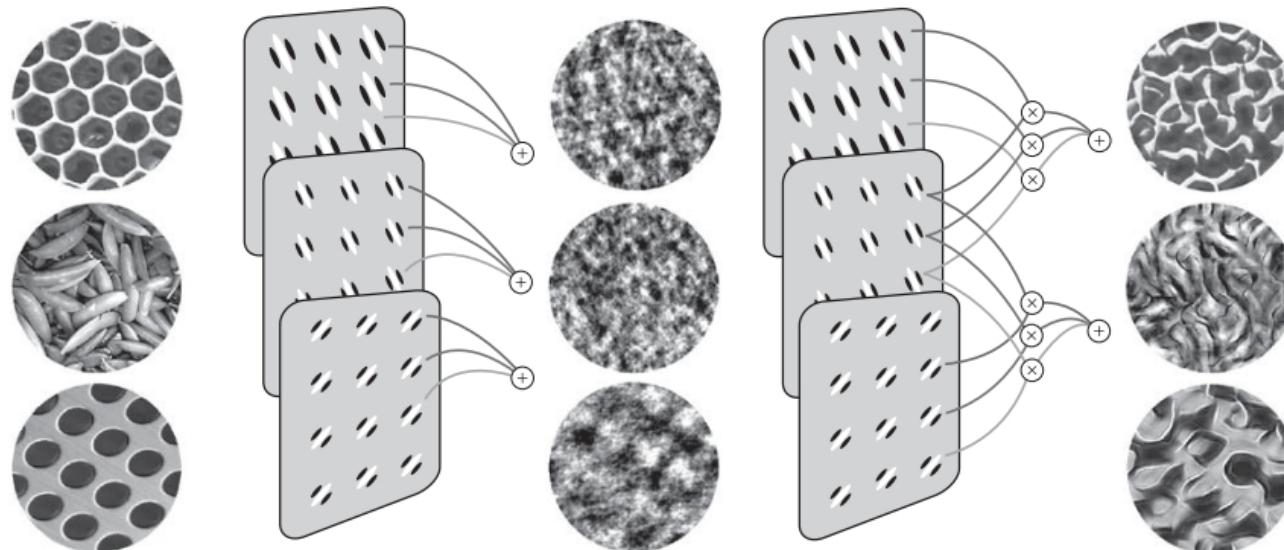


B



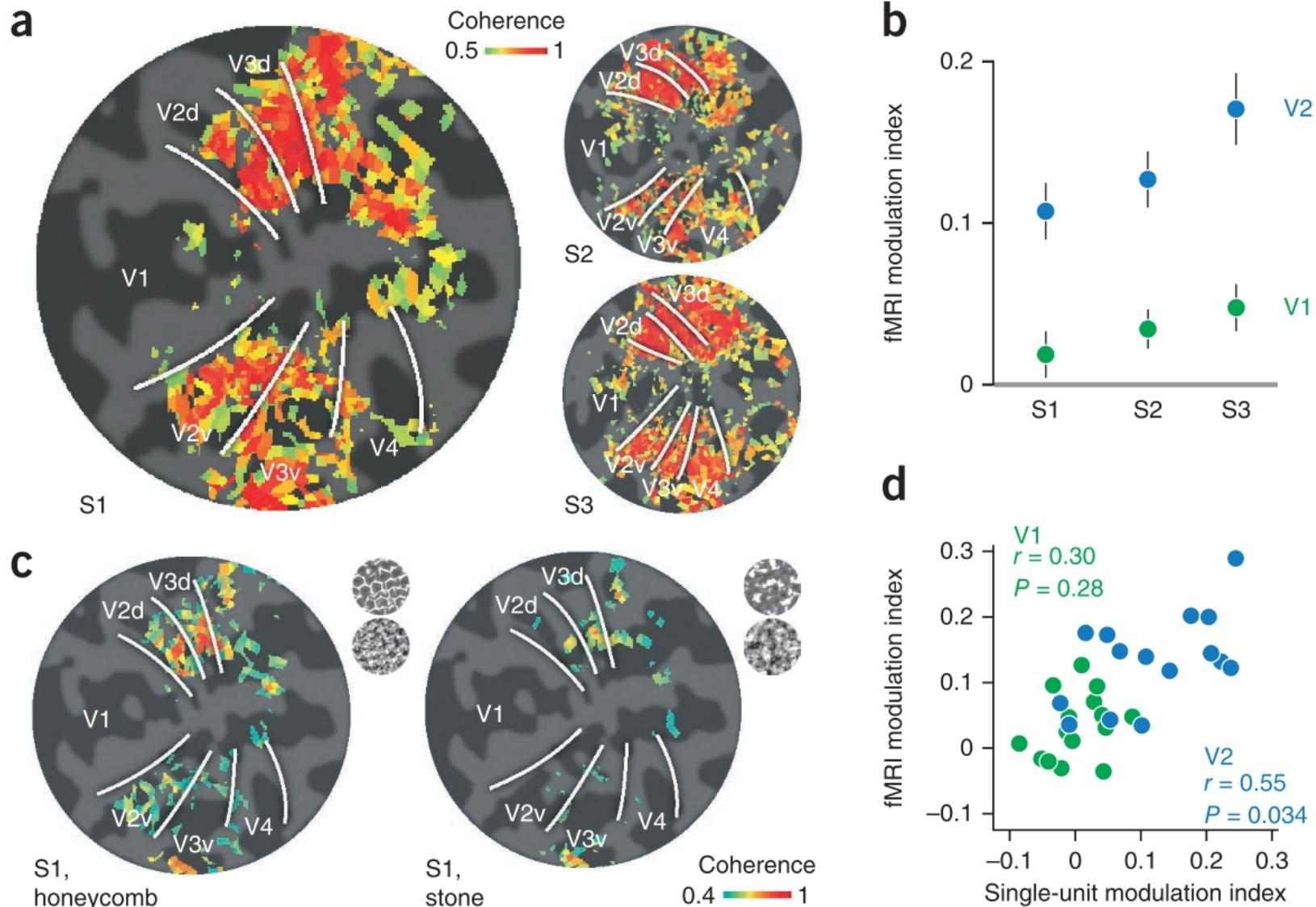
Processing of higher-order correlations

Original photographs V1-like filters matched:
spectrally matched noise Correlations matched:
naturalistic texture



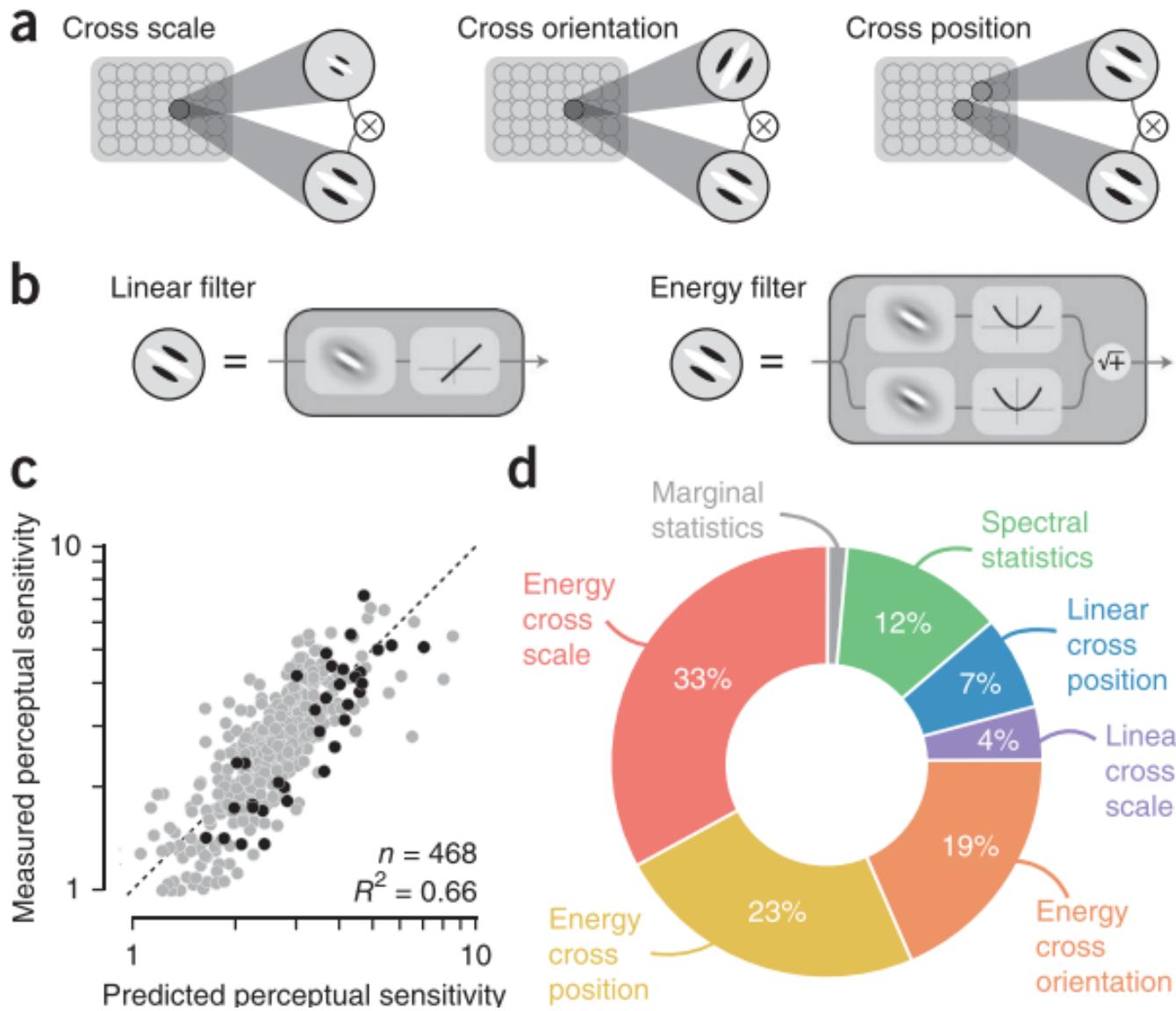
(Freeman et al. 2013)

Processing of higher-order correlations



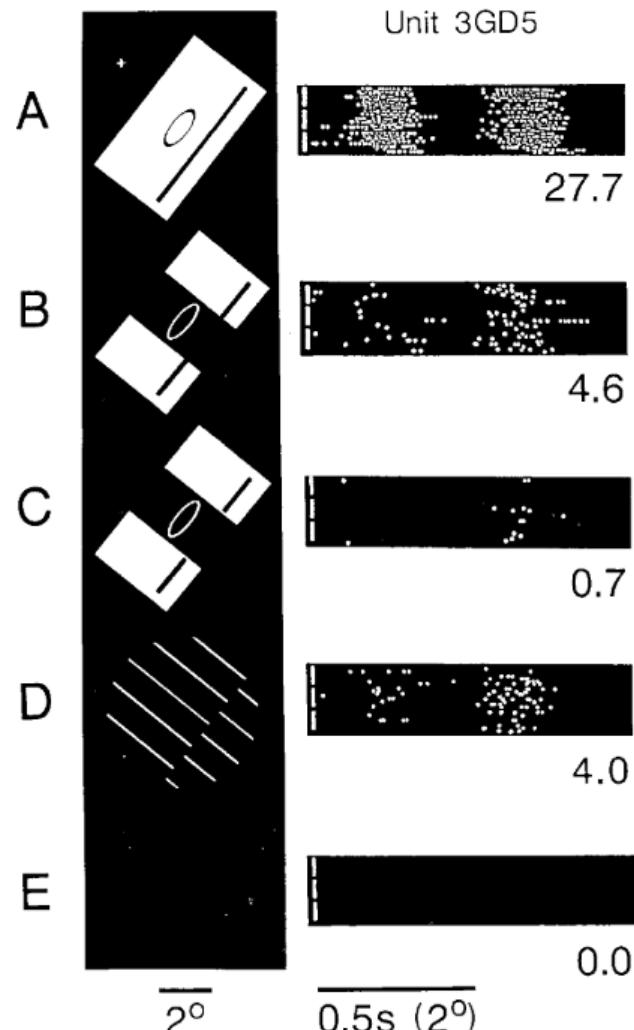
(Freeman et al. 2013)

Processing of higher-order correlations



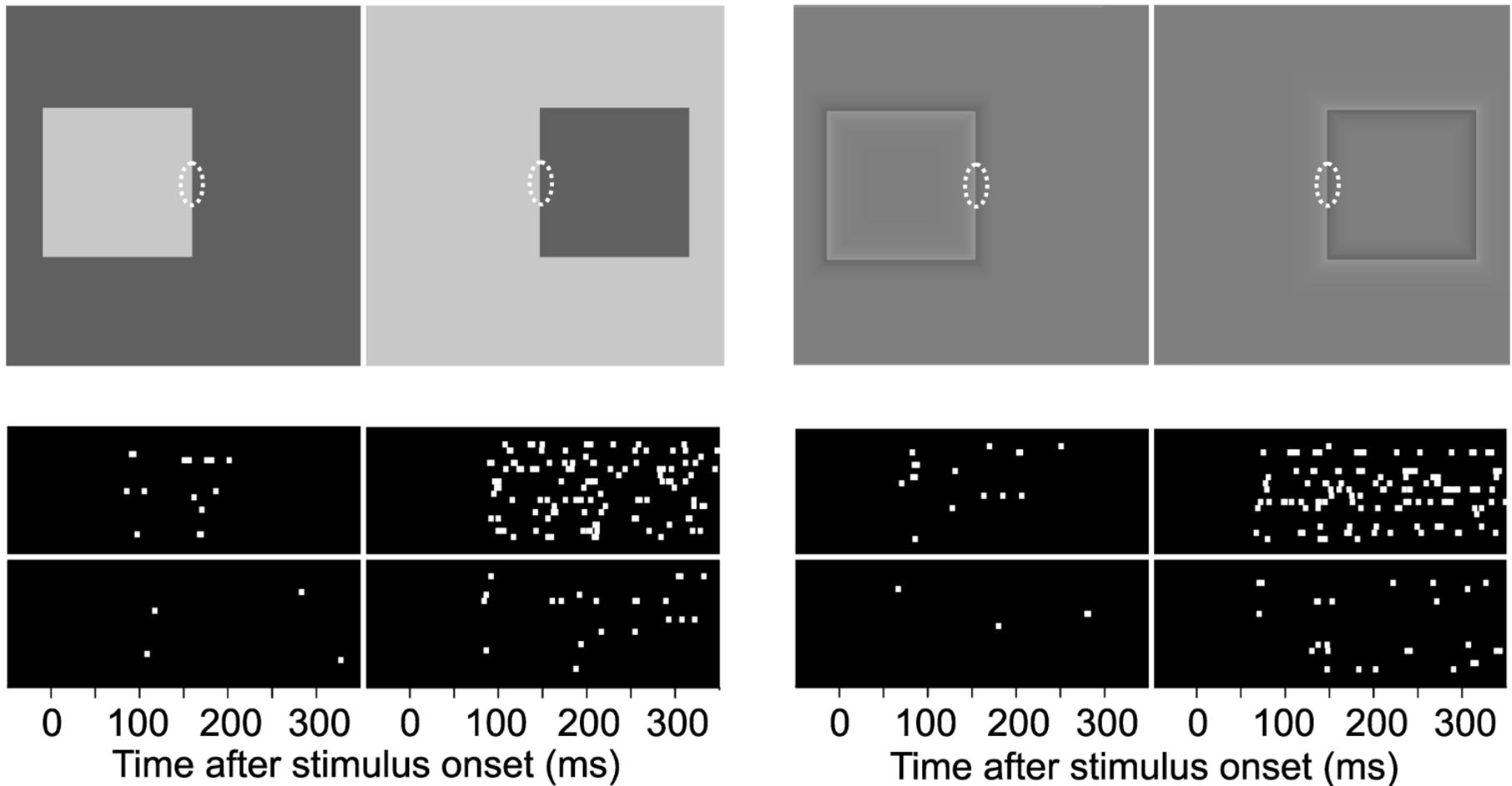
(Freeman et al. 2013)

Representation of illusory contours

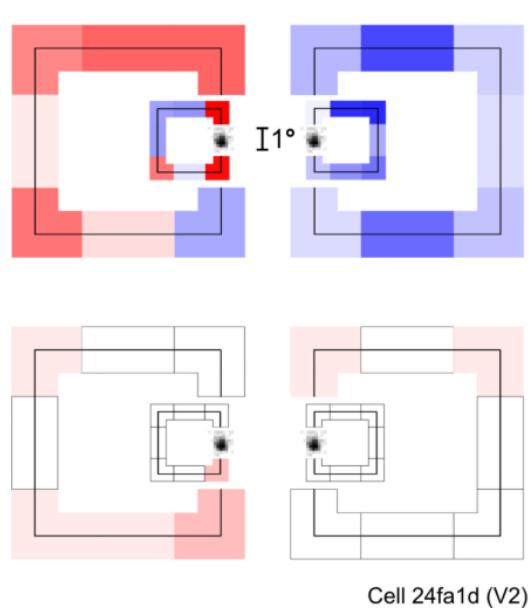
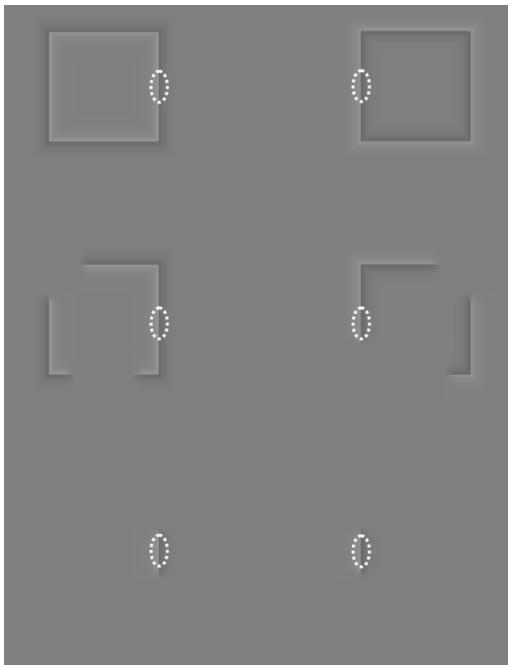


V2, awake monkey, (Nieder 2002)

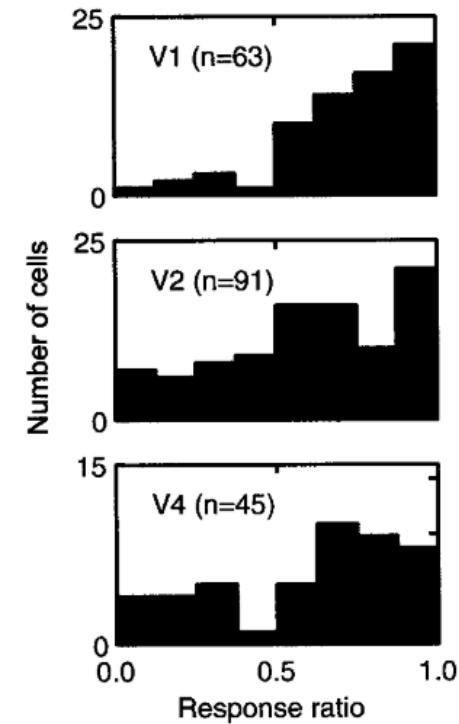
Representation of border ownership in V2



Representation of border ownership in V2



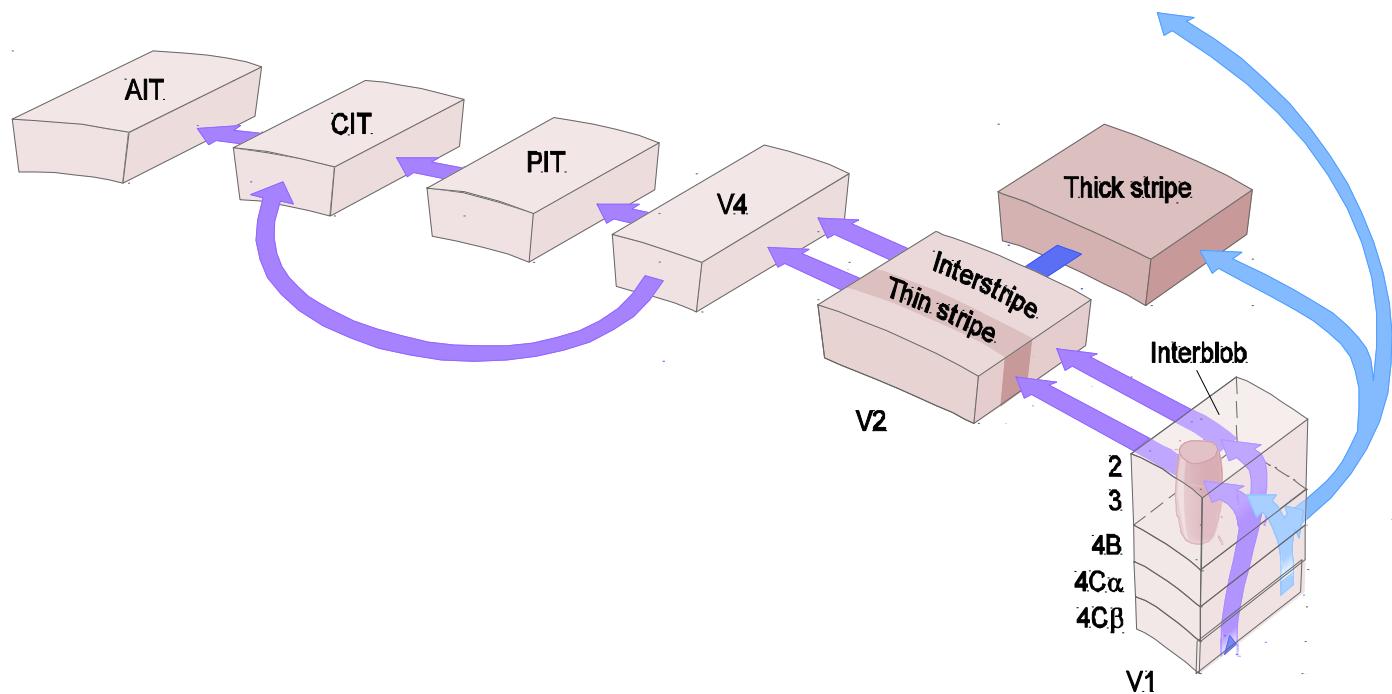
Cell 24fa1d (V2)



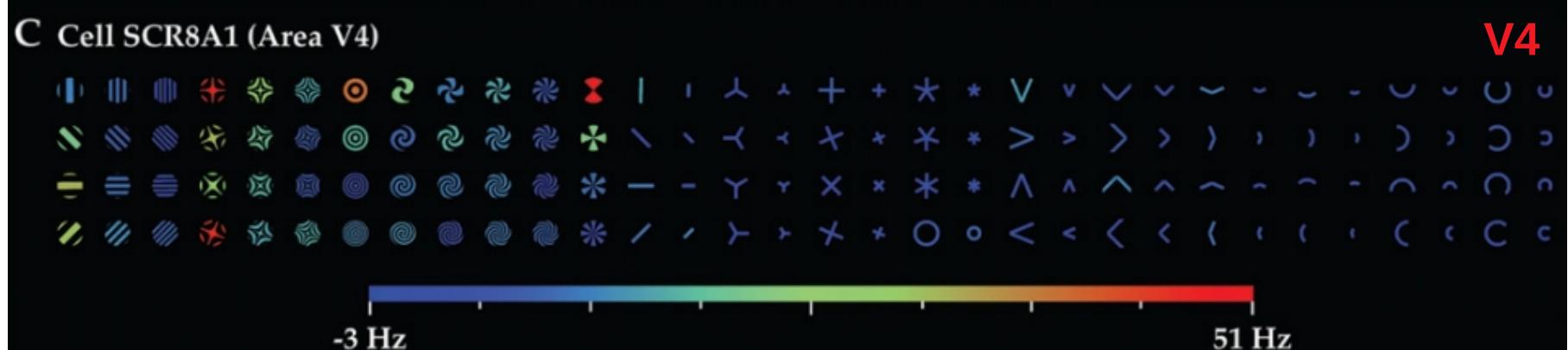
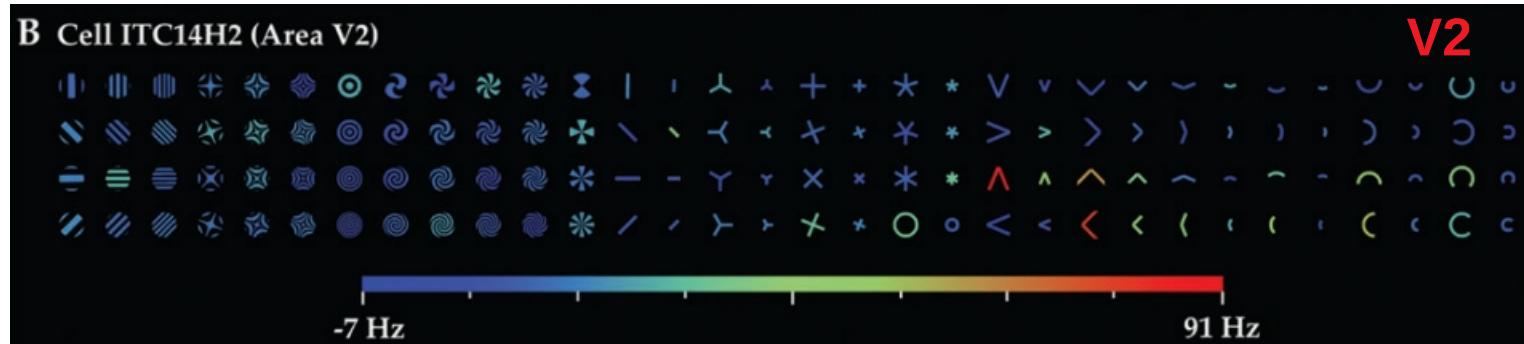
Summary: higher processing in V2

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

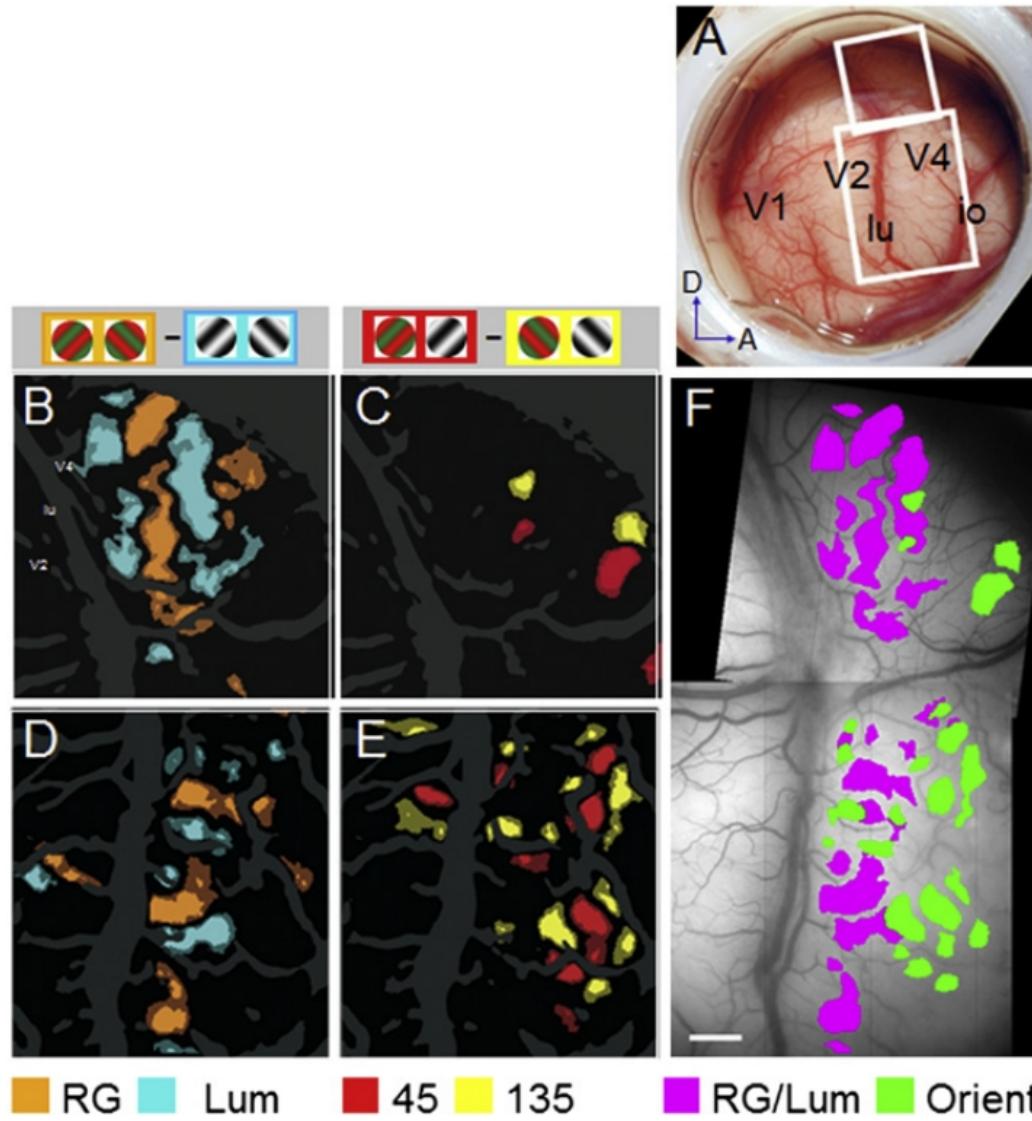
V2->V4



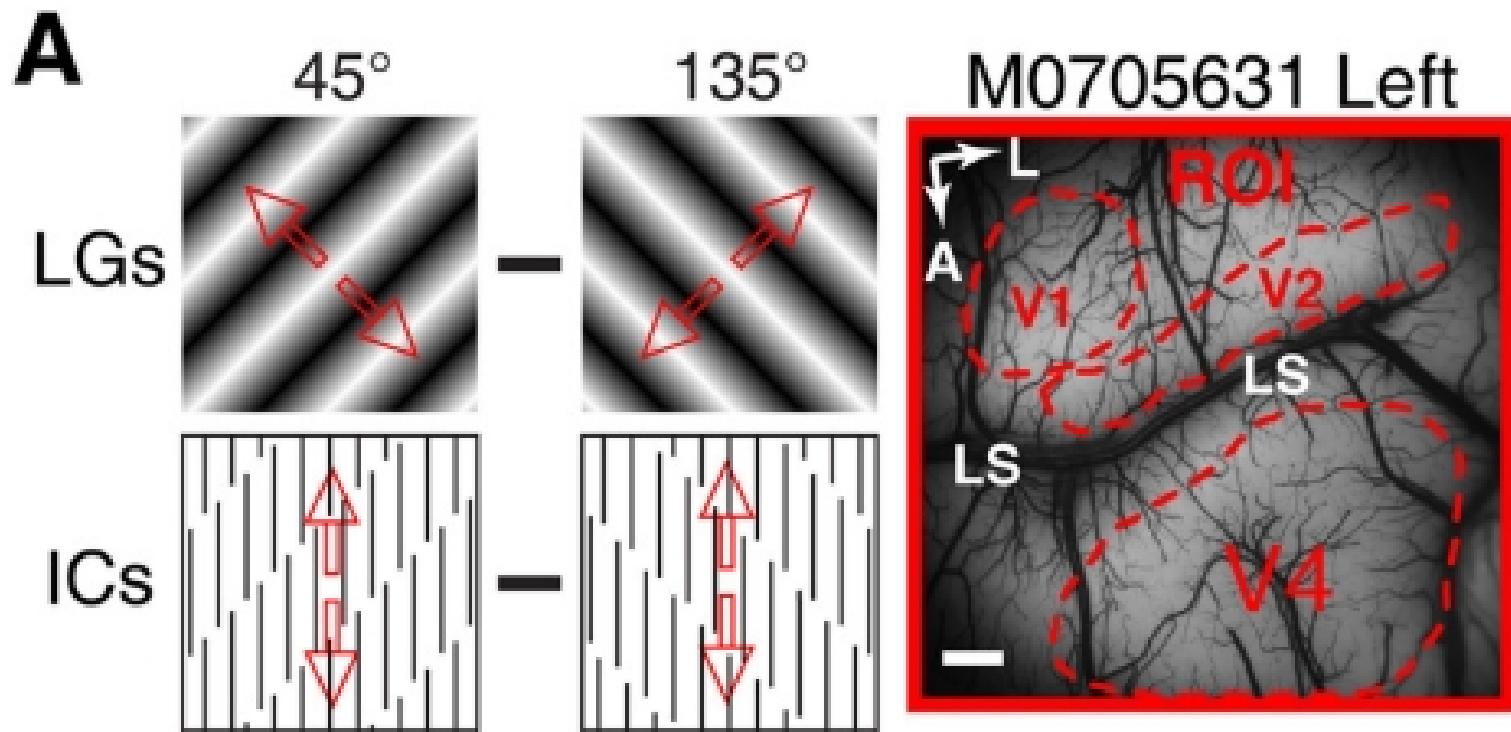
Receptive fields in V4



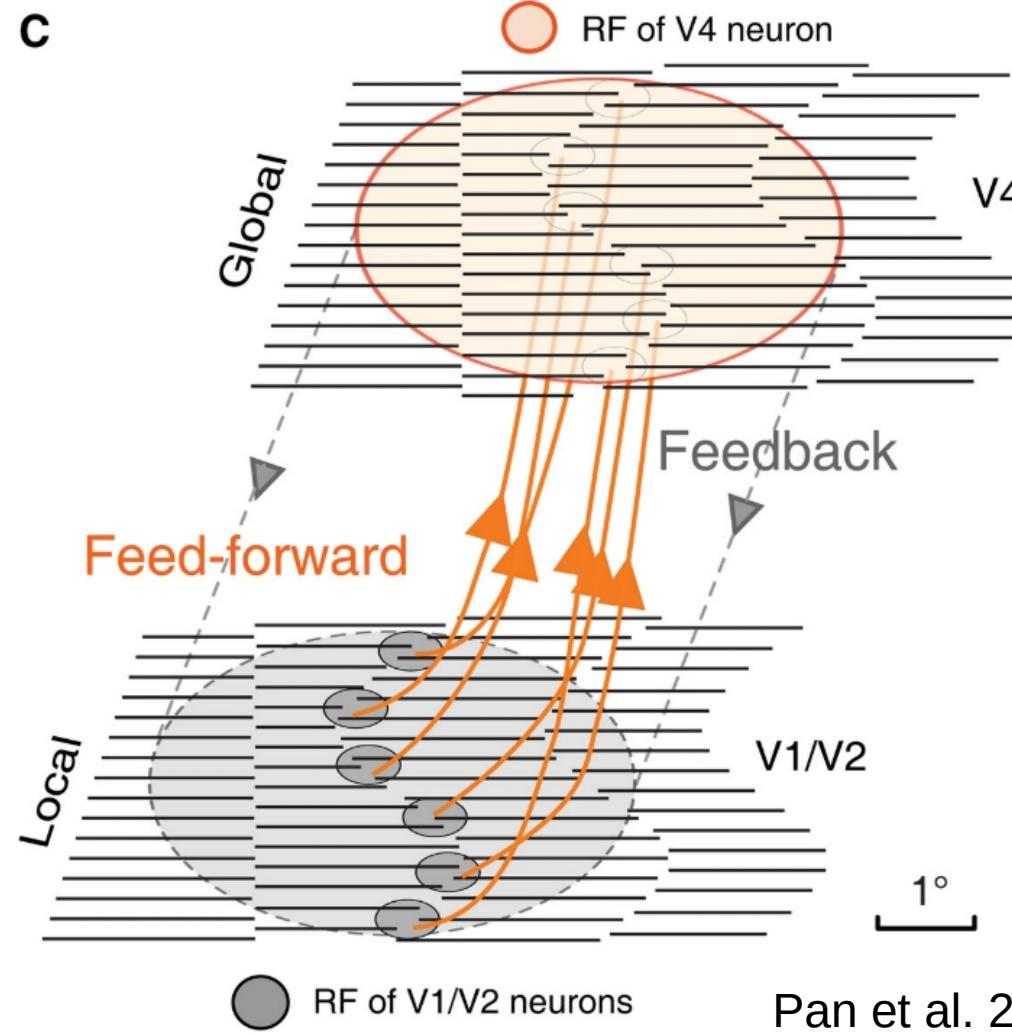
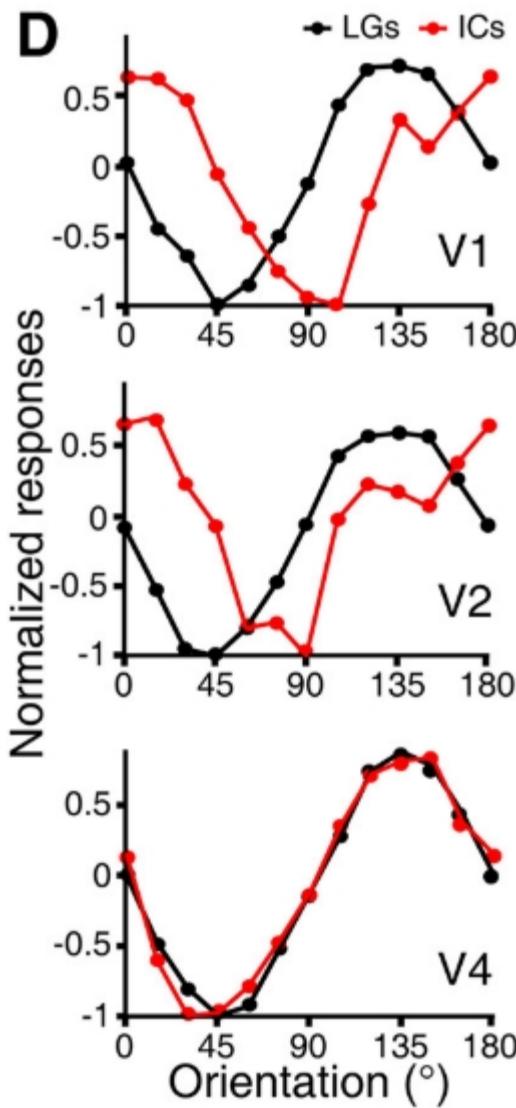
Functional organization of V4



Illusory Contours in V4

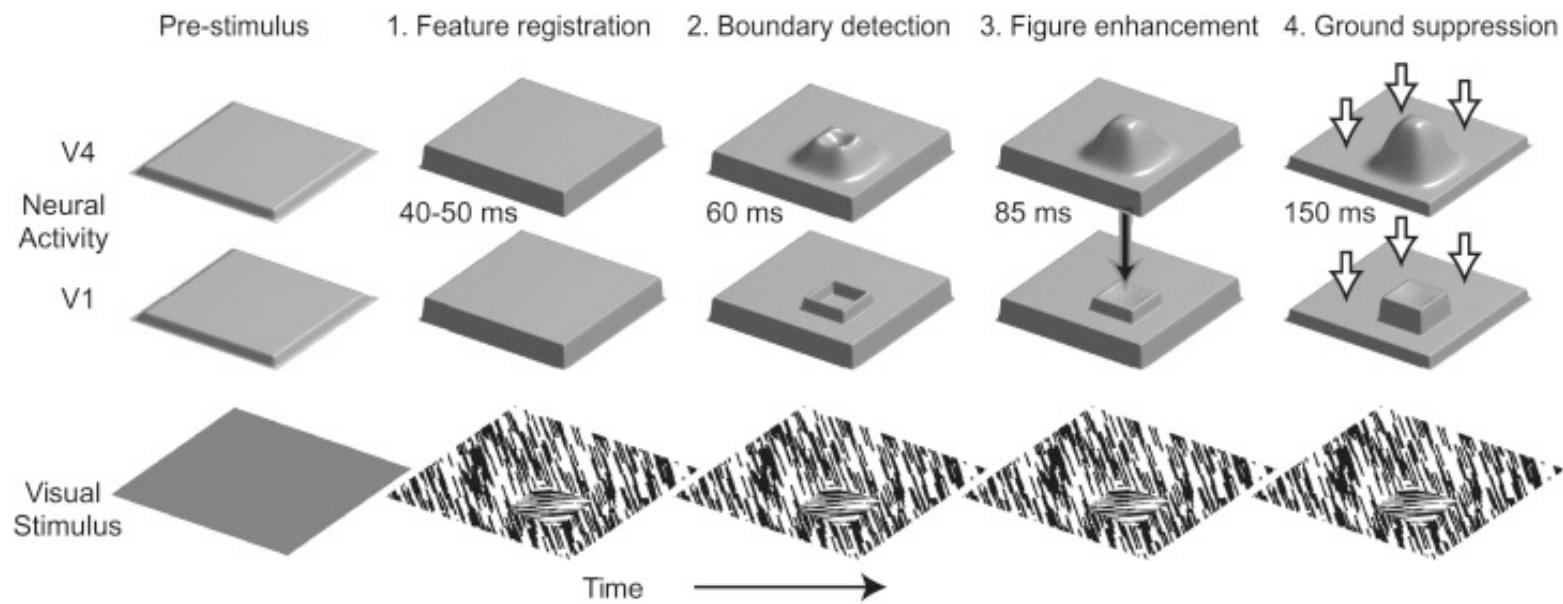
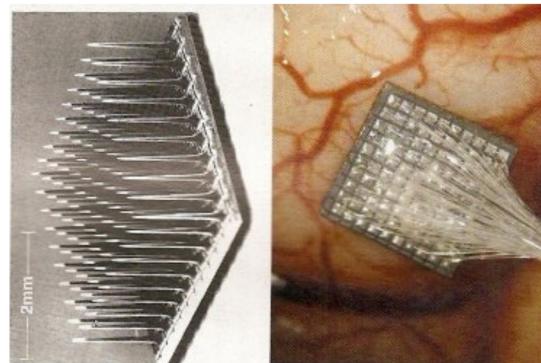


Illusory Contours in V4



Pan et al. 2012

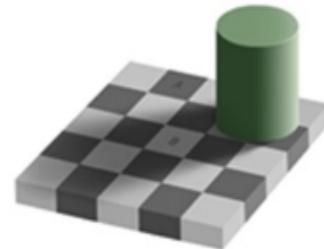
Figure-ground segregation



Higher-level representation in V4

A

Color



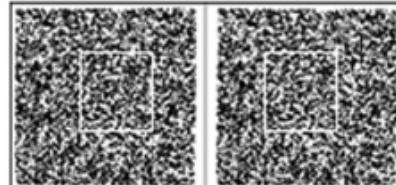
B

Shape



C

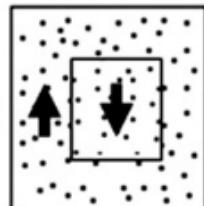
Depth



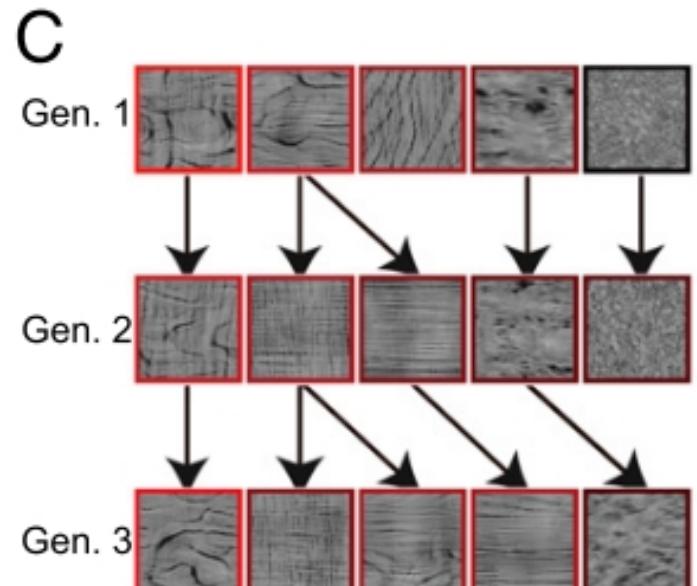
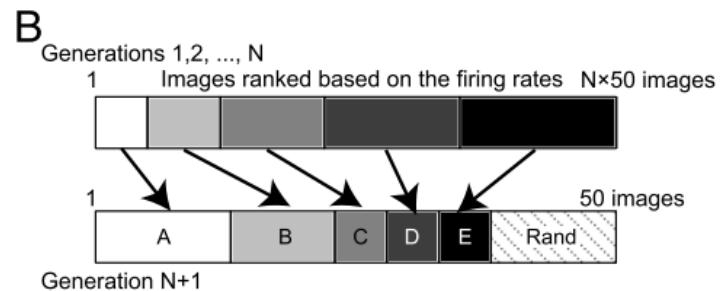
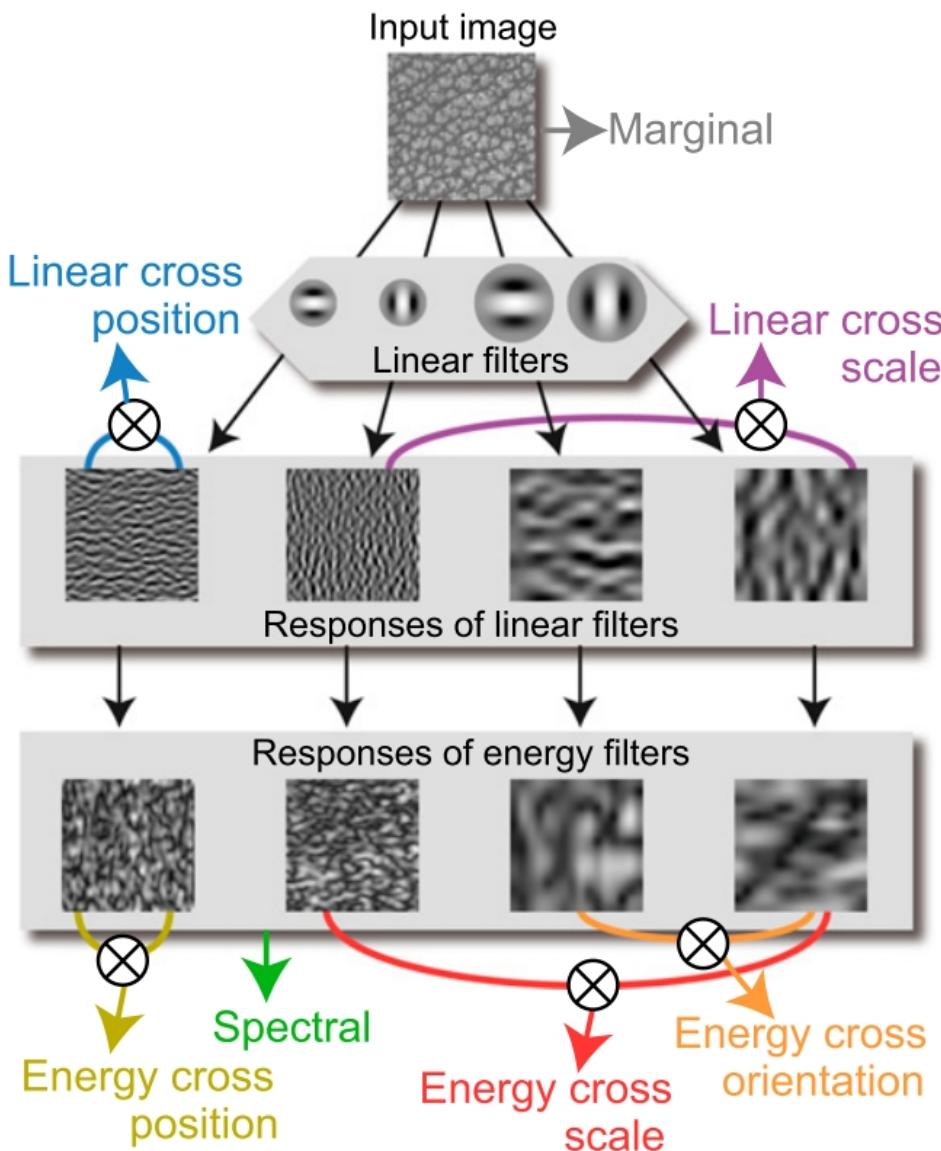
Illusions

D

Motion



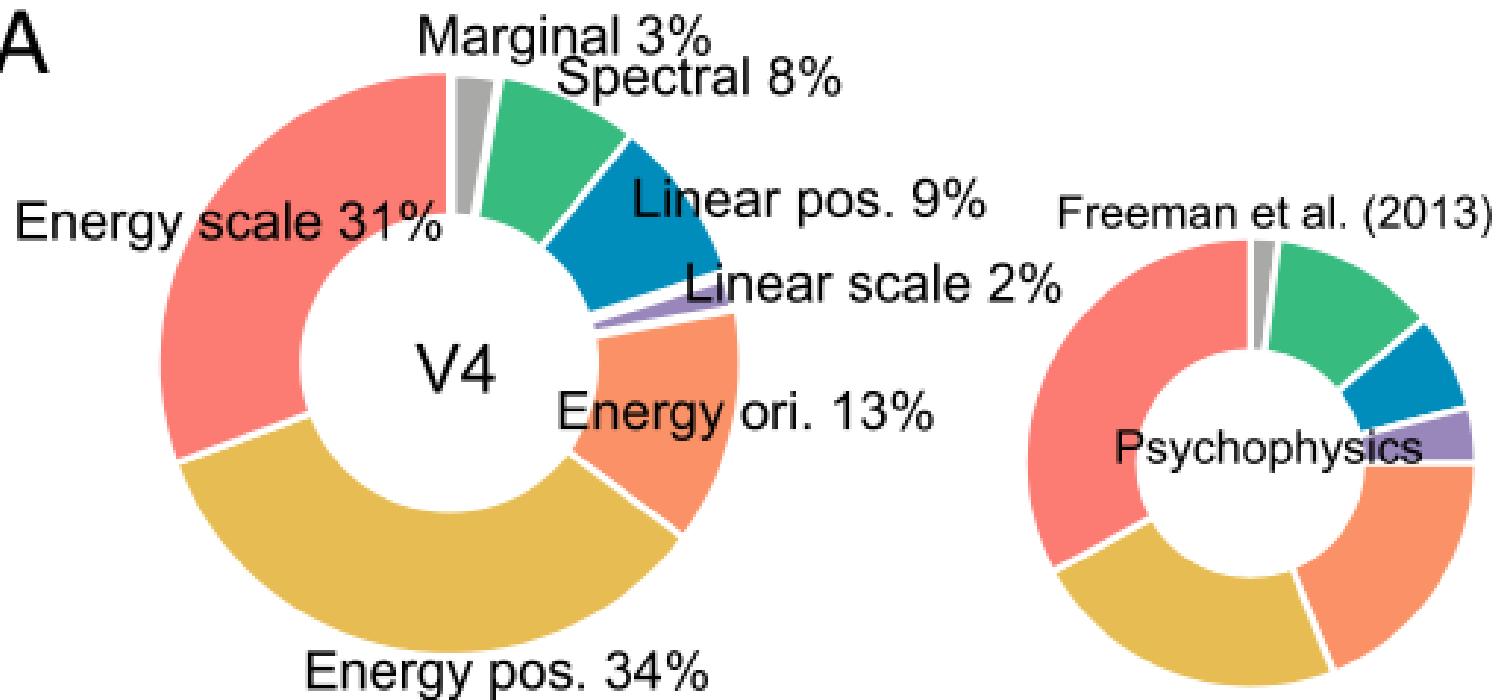
Texture representation in V4



(Okazawa et al. 2015)

Texture representation in V4

A

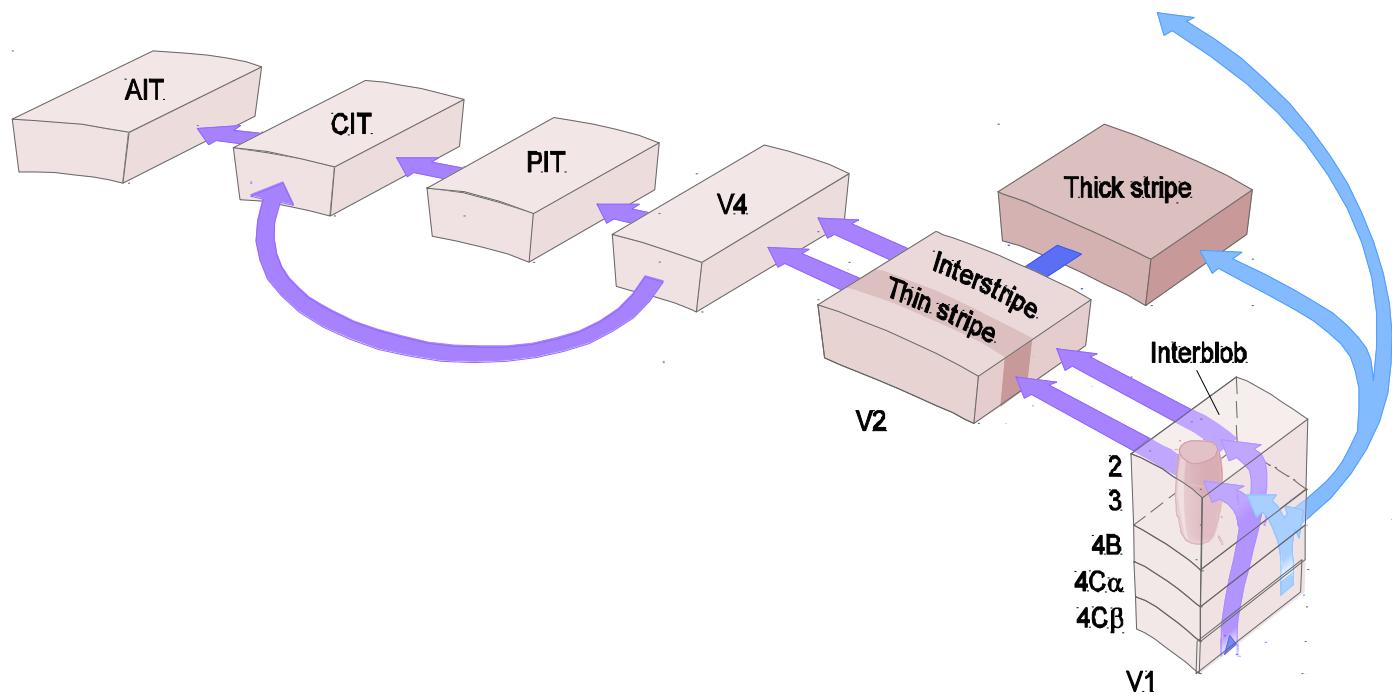


(Okazawa et al. 2015)

Summary: higher processing in V4

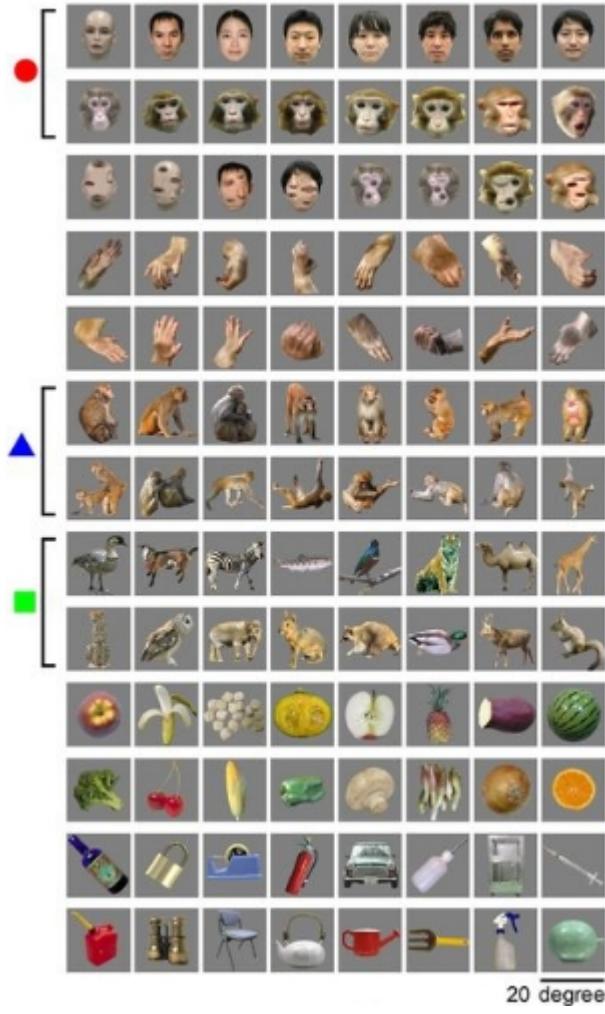
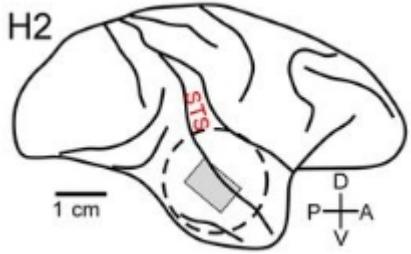
- More global Illusory contours
- Higher-level statistics
- Texture representation
- Strong figure-ground modulation signals
- Strong attentional modulation

V4->IT

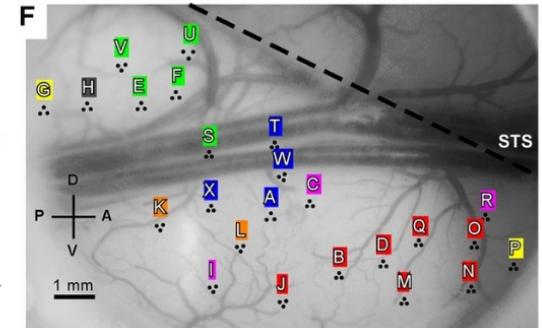
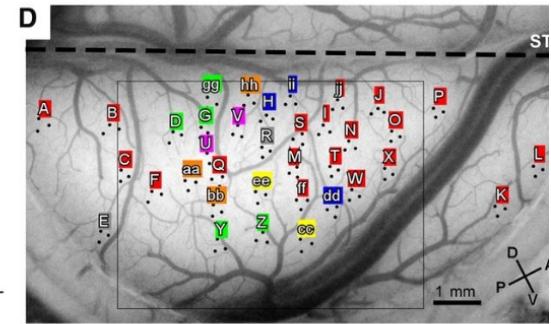
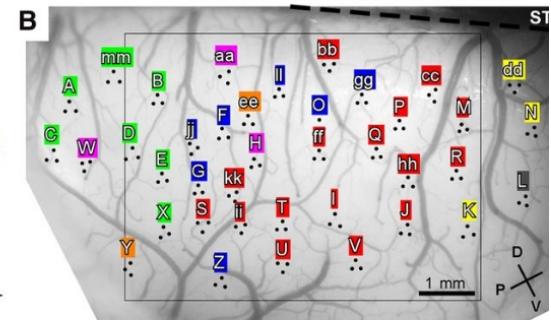
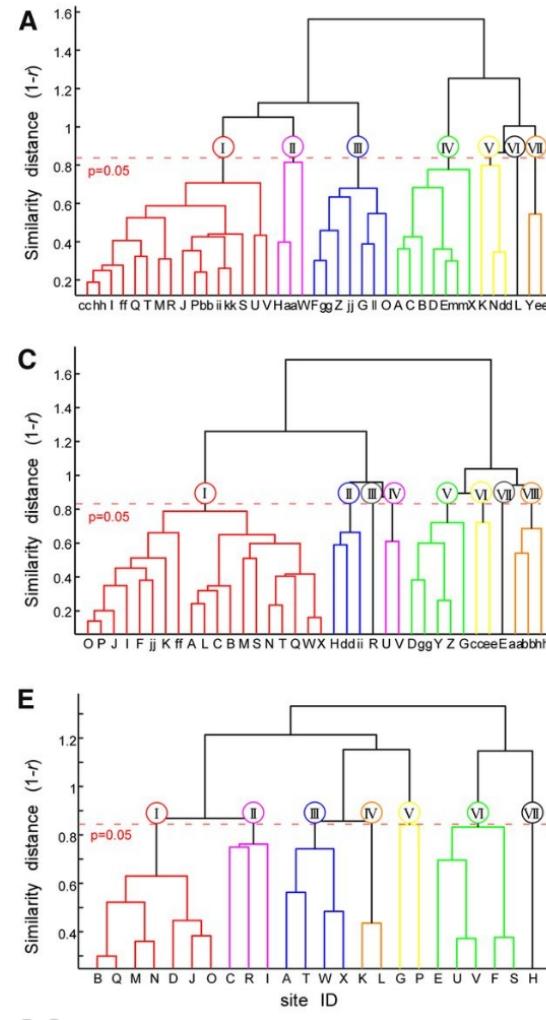


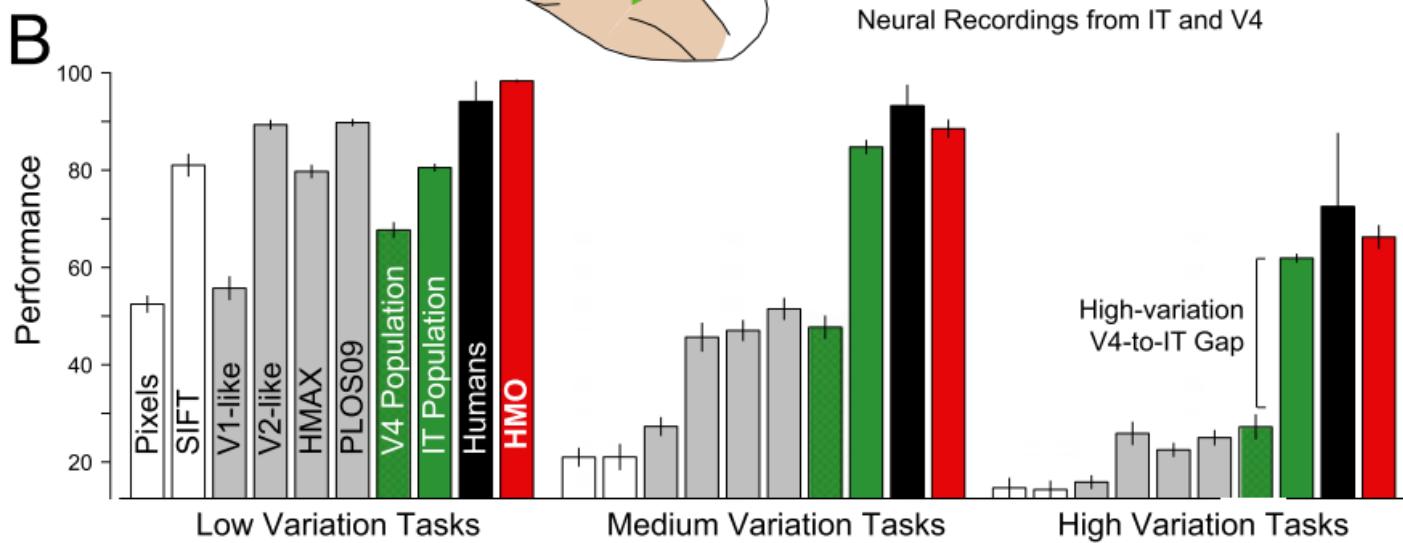
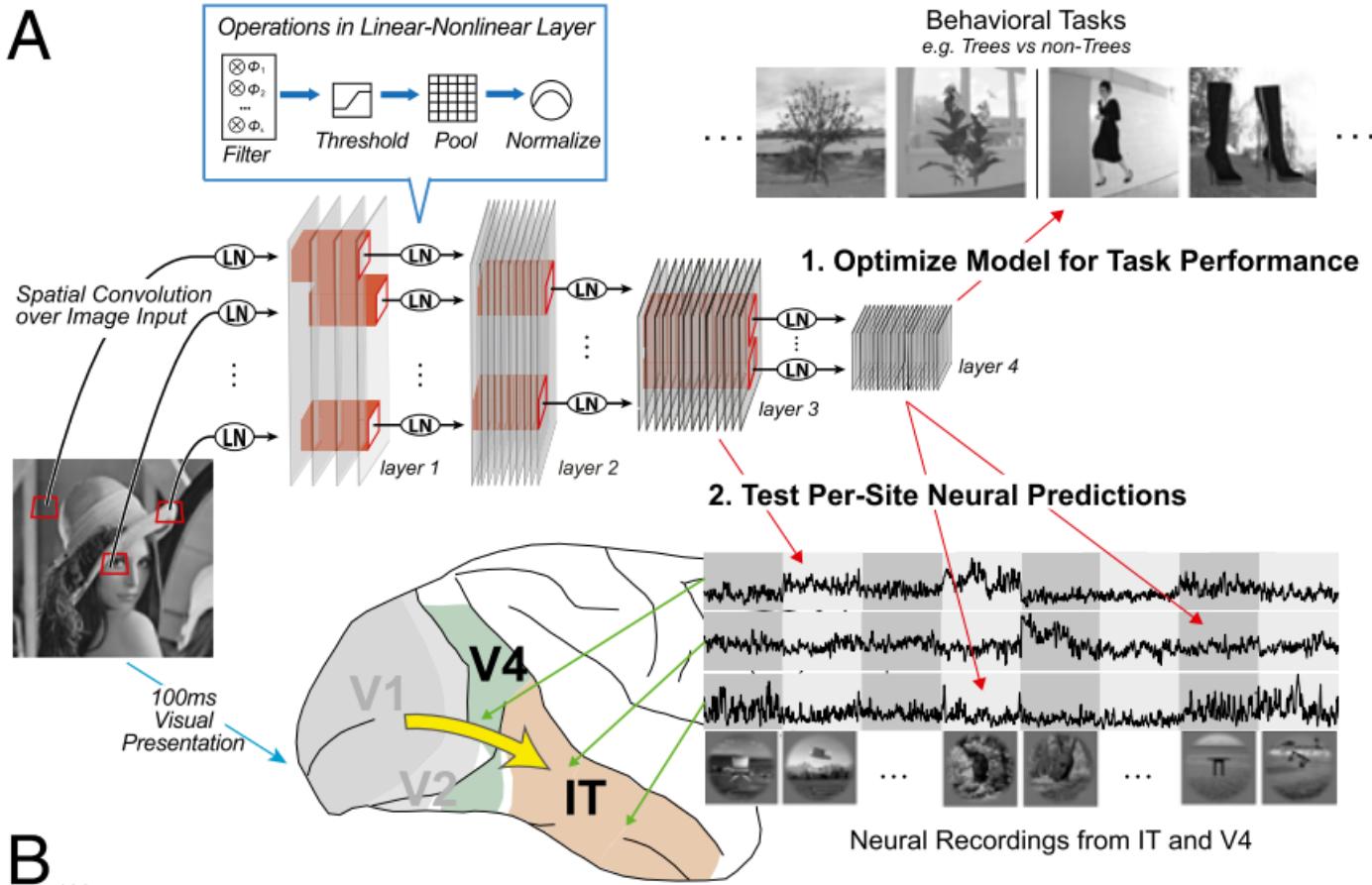
Inferior temporal (IT) cortex

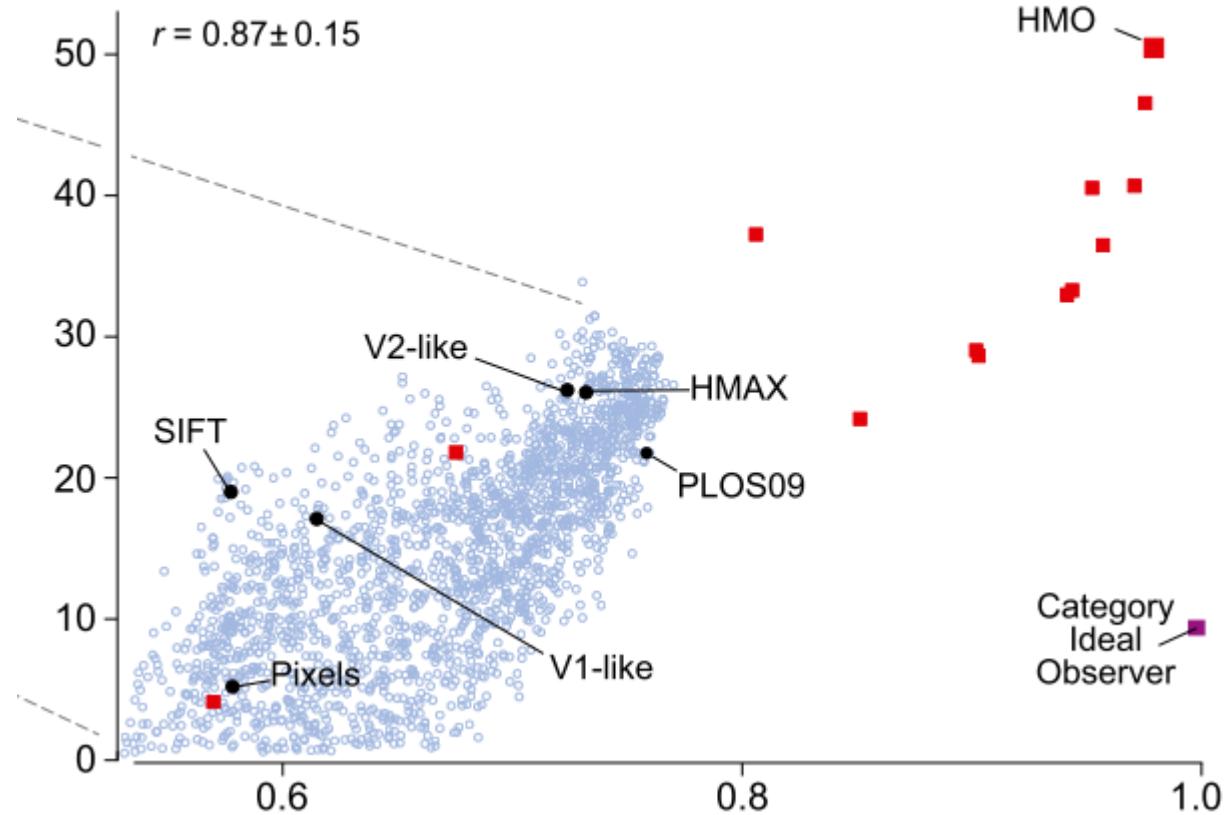
- Final stage of ventral visual stream
- Represents higher level features
 - Faces
 - Objects
- More selective than only to simple shapes
- Invariant to size, contrast, color, and position
- Topologically organized
- Role in visual memory
- Lesion leads to impairment in learning and remembering to recognize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



Object representation

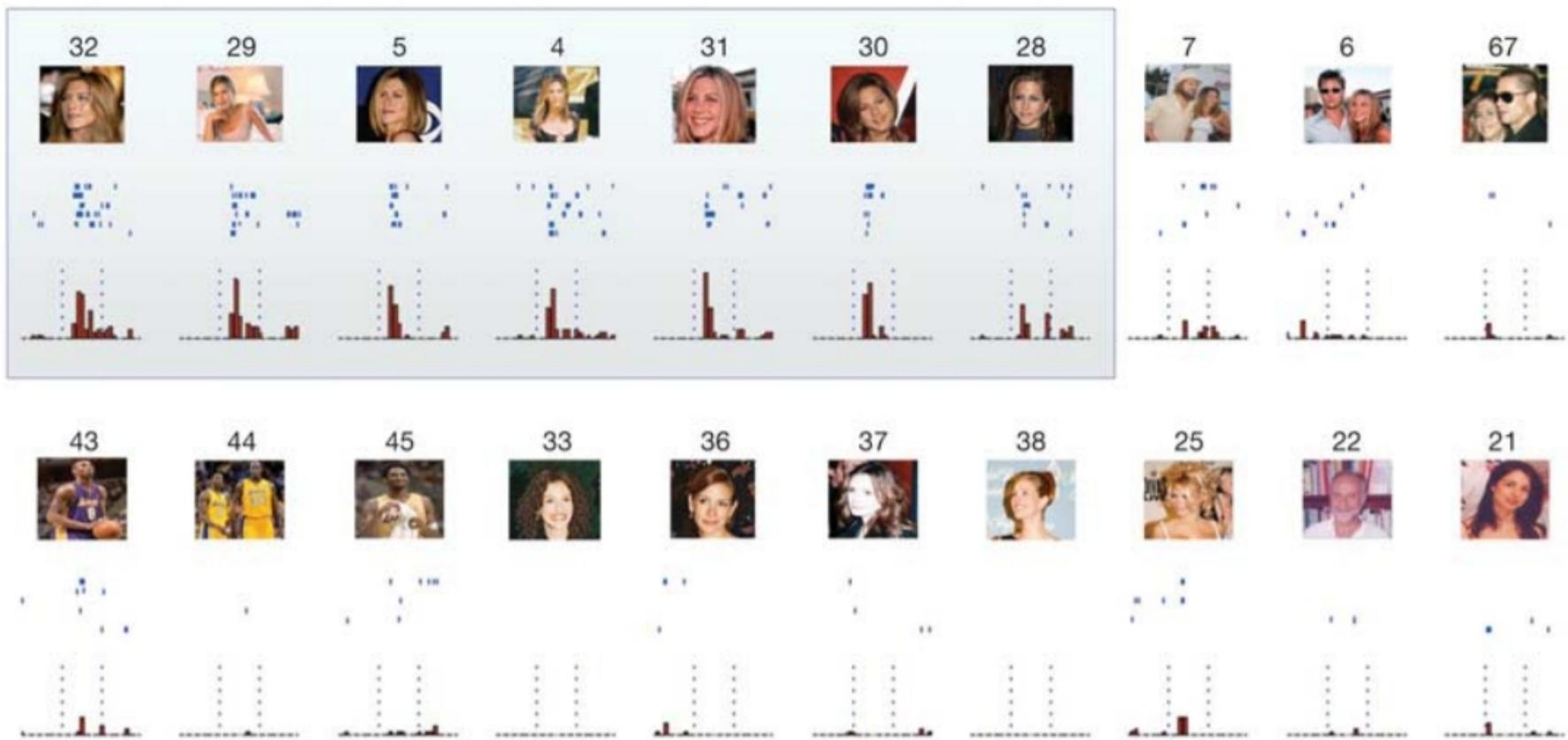




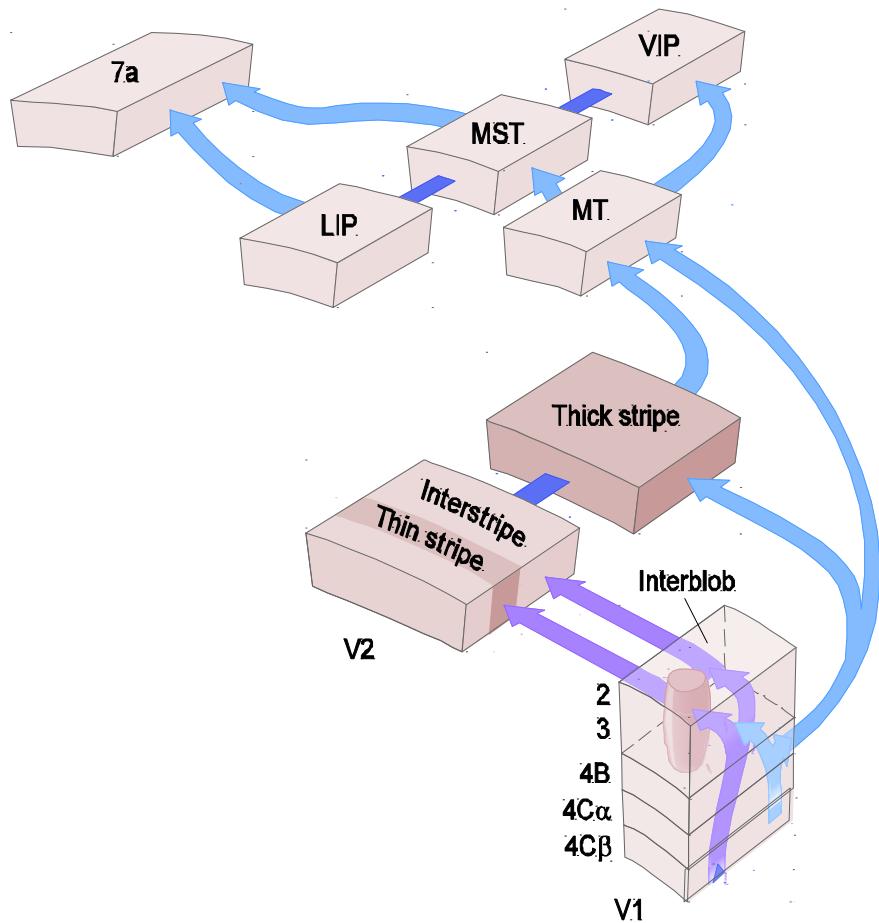
B

MTL cortex

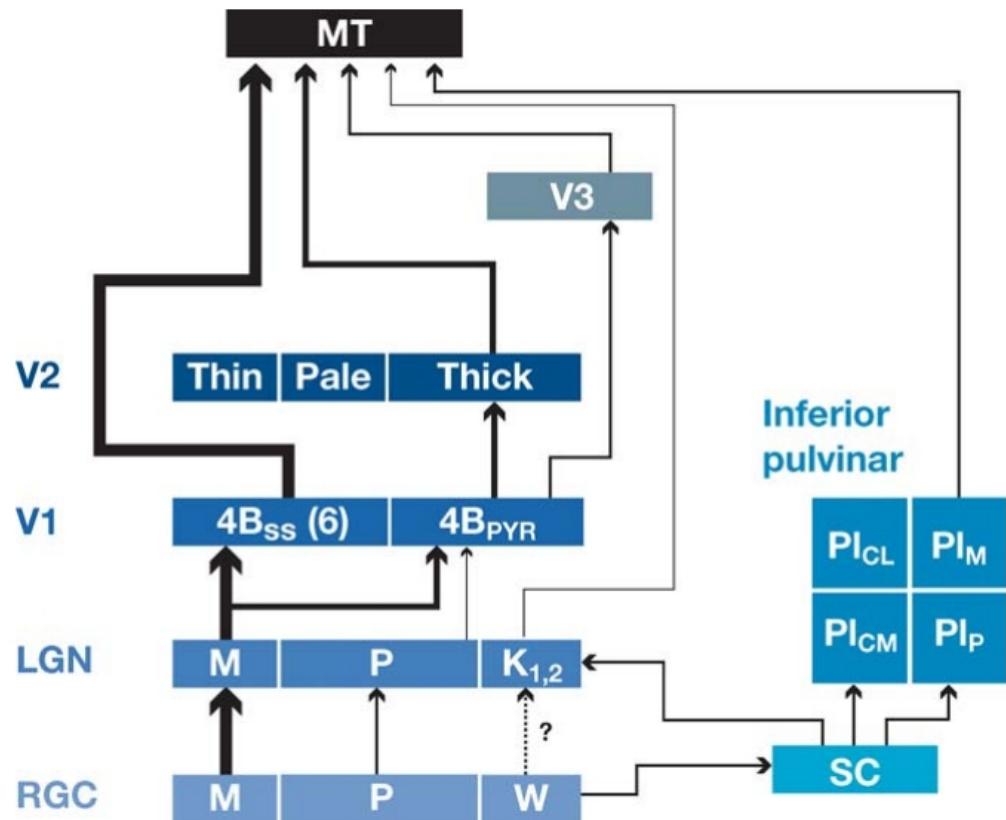
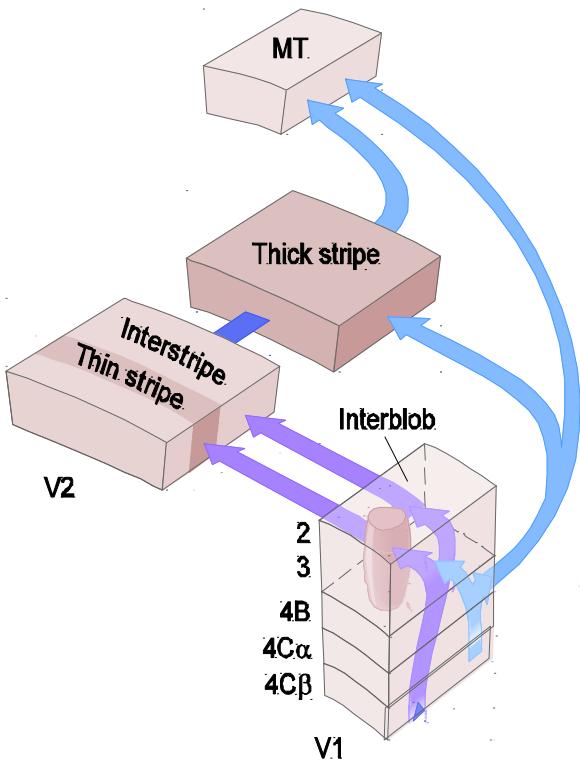
Jennifer Aniston Neuron



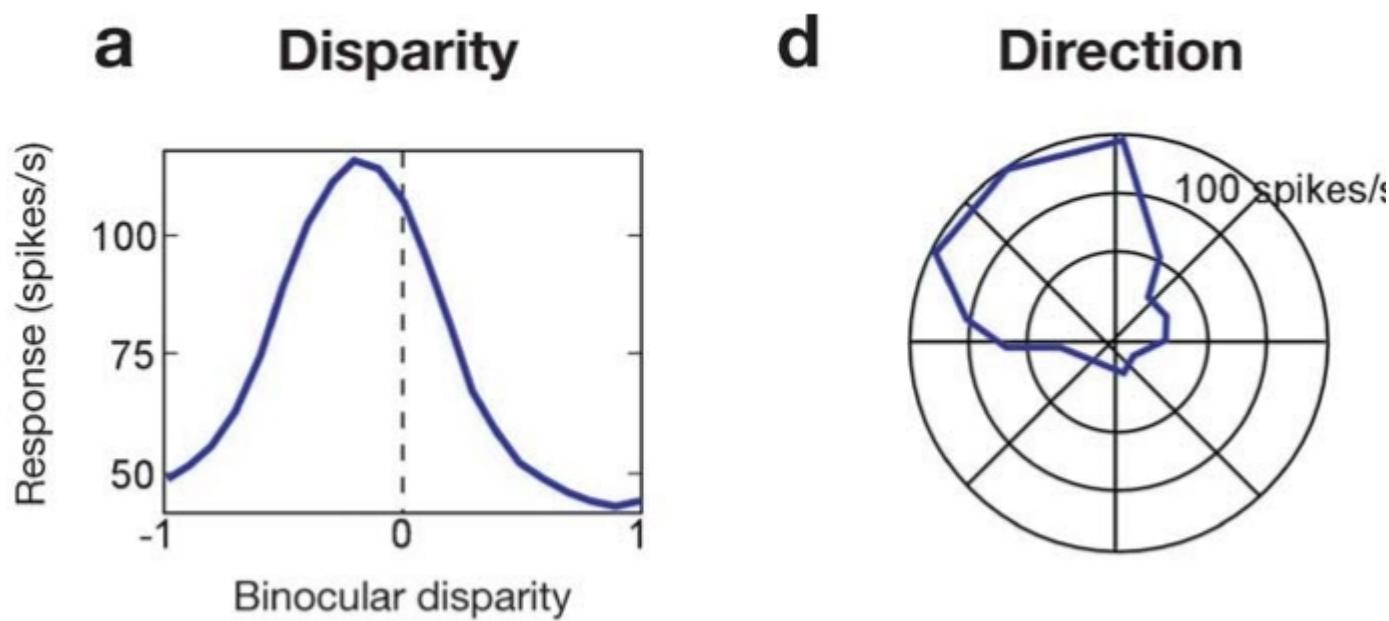
Dorsal stream - ‘where and why’



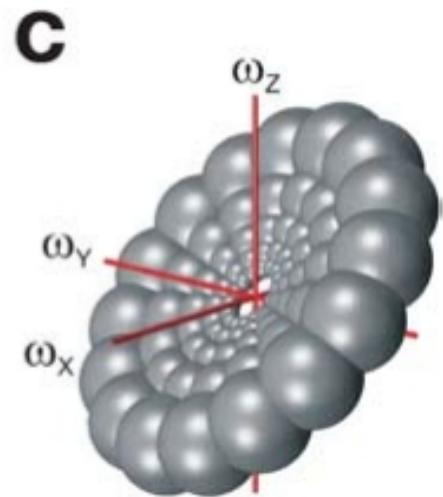
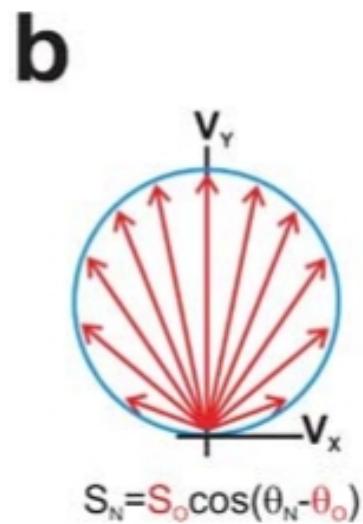
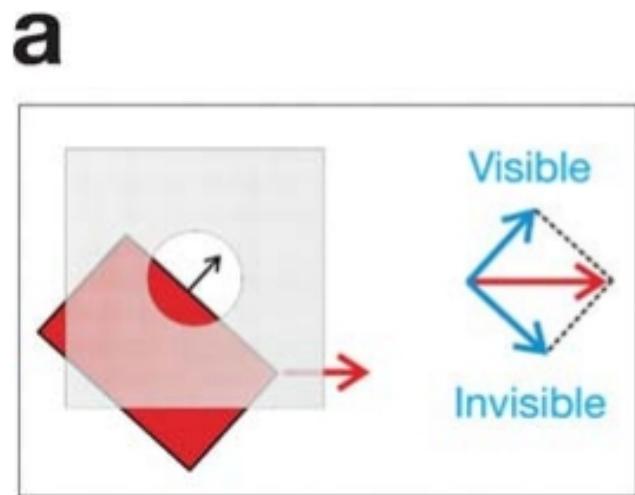
V2 → Middle temporal (MT/V5) visual area

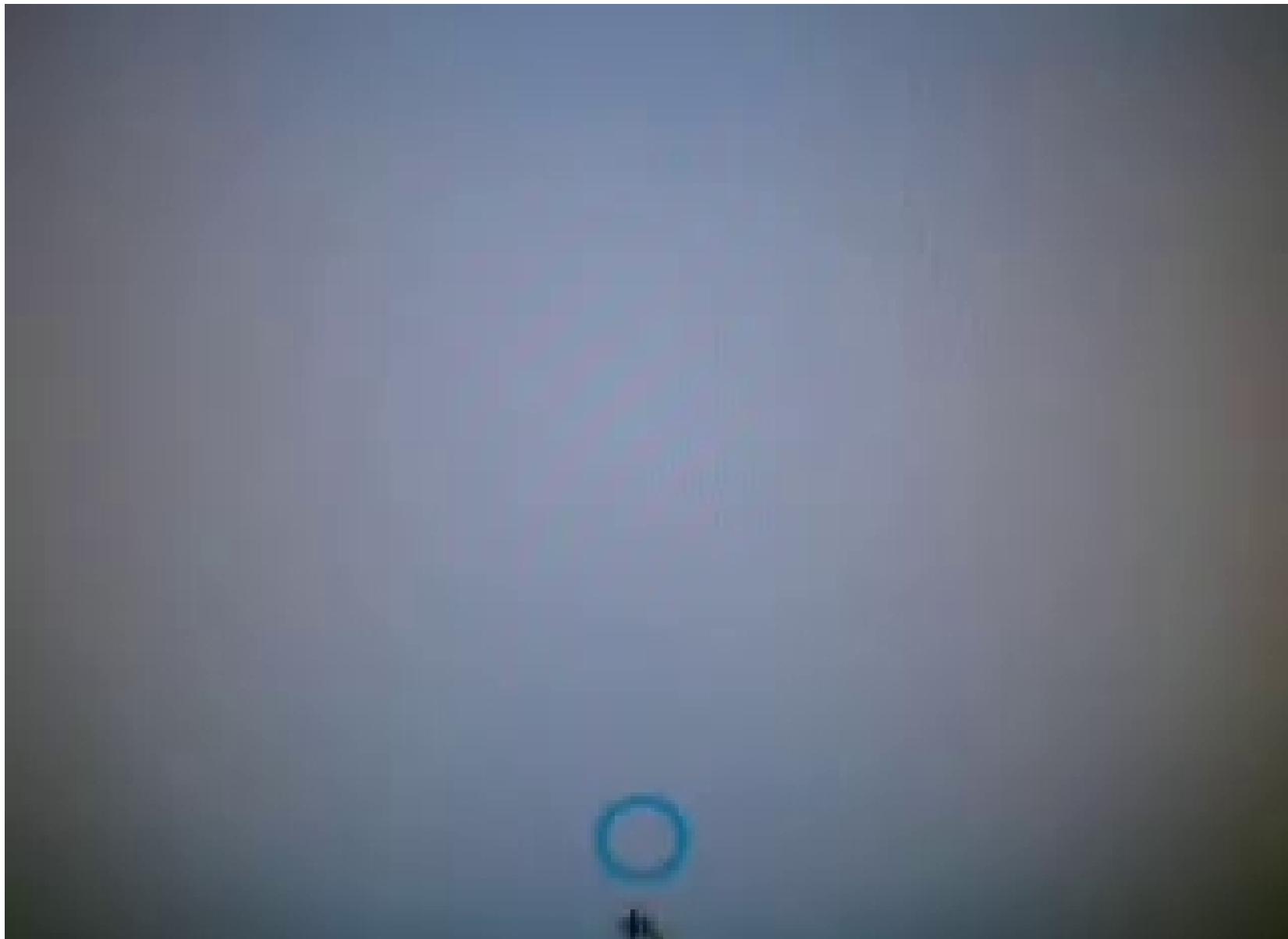


Direction and disparity



Local vs. global motion

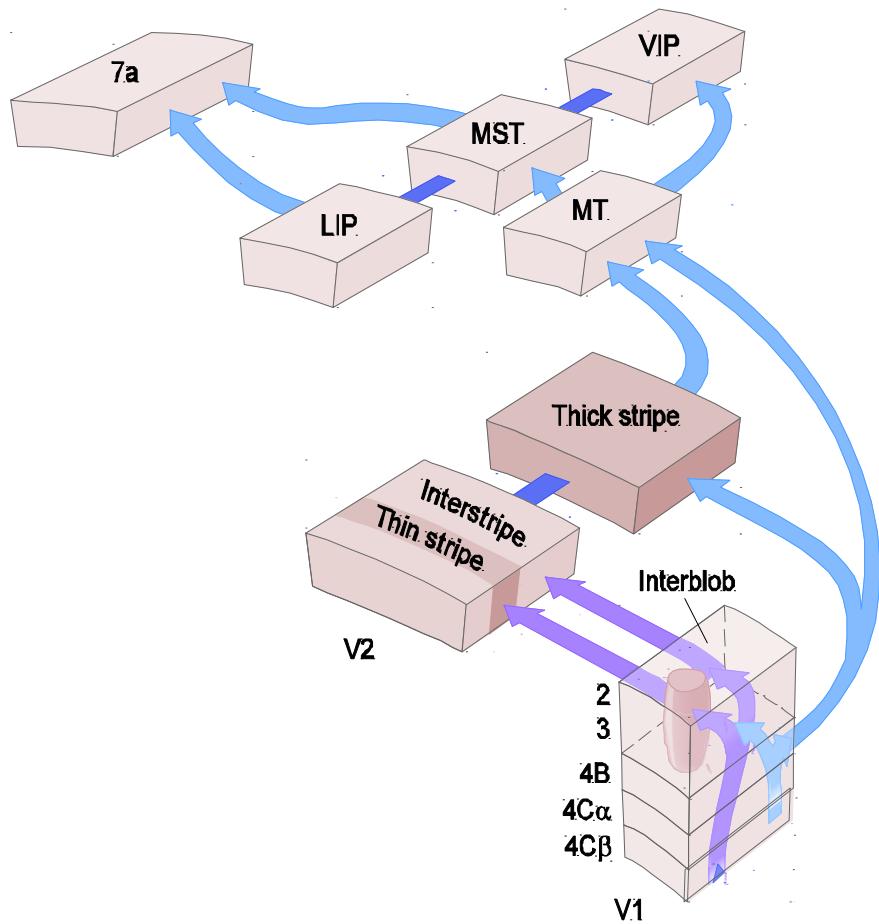




MT: Summary

- 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

