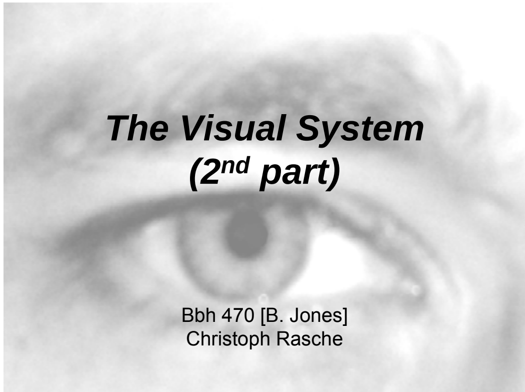
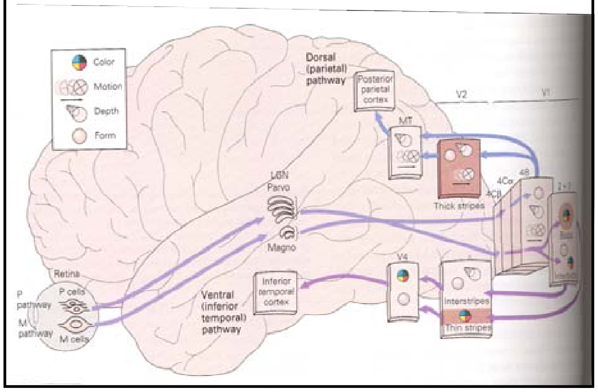


The Visual System (2nd part)

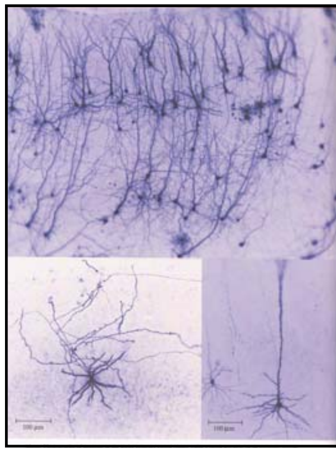
Bbh 470 [B. Jones]
Christoph Rasche

The Miraculous Machine

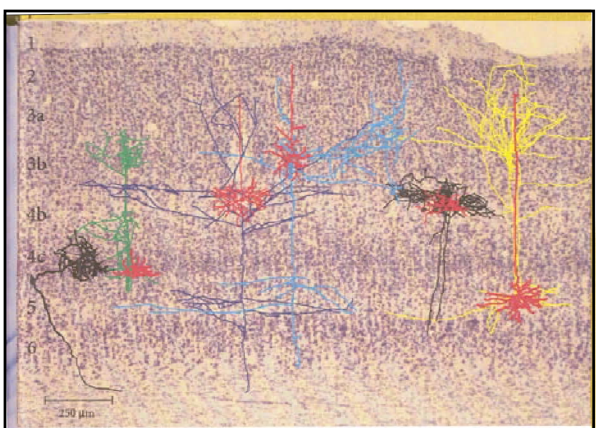


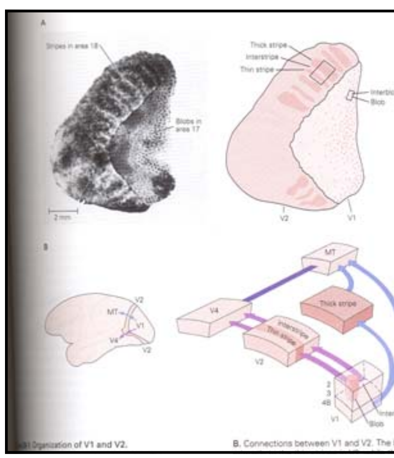
Correction

- LGN sits within the Thalamus
  (not the Hypothalamus)



(V1 'close')





One step up: V2

- = area 18
- = extra-striate

V2 cell responses

• responses similar to V1 but V2 cells also respond to illusory contours

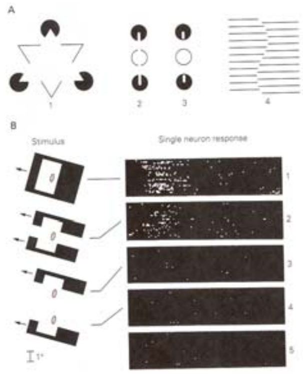


Figure 28-16 Illusions of edges used to study the higher level information processing in V2 cells of the monkey.

A. Examples of illusory contours. 1. A white triangle is clearly seen, although it is not defined in the picture by a continuous

Inferior Temporal (IT) Cortex

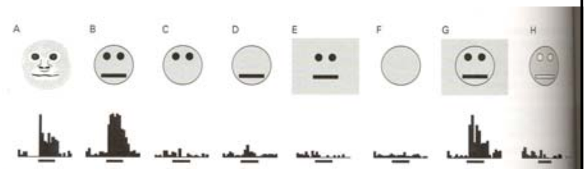


Figure 28-18 Response of a neuron in the inferior temporal cortex to complex stimuli. The cell responds strongly to the face of a toy monkey (A). The critical features producing the response are revealed in a configuration of two black spots and one horizontal black bar arranged on a gray disk (B). The bar, spots, and circular outline together were essential, as can be seen by the cell's responses to images missing one of these features (C, D, E, F). The contrast between the inside and outside of the circular contour was not critical (G). However, the spots and bar had to be darker than the background within the outline (H). (i = spikes.) (Modified from Kobatake and Tanaka 1994.)

- IT cells respond to orientations, faces, objects but also to color

(On the side: Measurements on Epileptic Patients)

Category-specific visual responses of single neurons in the human medial temporal lobe

Gabriel Kreiman[1], Christof Koch[1] and Itzhak Fried[2]

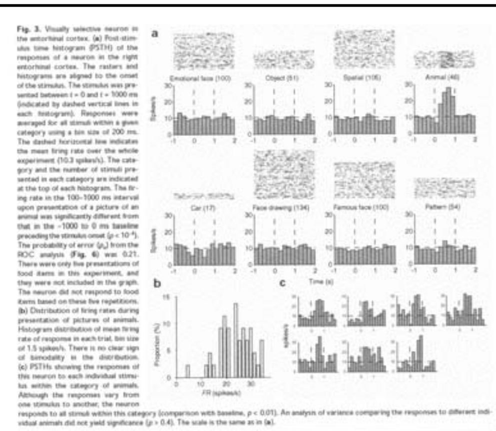
[1] Computation and Neural Systems Program, California Institute of Technology, 139-74, Pasadena, California 91125, USA

[2] Division of Neurosurgery and Department of Psychiatry and Biobehavioral Sciences, Box 957039, UCLA School of Medicine, 740 Westwood Plaza, Los Angeles, California 90095-7039, USA

Correspondence should be addressed to I.F. (ifried@mednet.ucla.edu)

The hippocampus, amygdala and entorhinal cortex receive convergent input from temporal neocortical regions specialized for processing complex visual stimuli and are important in the representation and recognition of visual images. Recording from 427 single neurons in the human hippocampus, entorhinal cortex and amygdala, we found a remarkable degree of category-specific firing of individual neurons on a trial-by-trial basis. Of the recorded neurons, 14% responded selectively to visual stimuli from different categories, including faces, natural scenes and houses, famous people and animals. Based on the firing rate of individual neurons, stimulus category could be predicted with a

Fig. 2. Sample of stimuli presented in each category. Figures (mostly color) were drawn from a group of nine categories that included faces denoting emotional expressions by unknown actors[21], household objects, spatial layouts (including house exteriors, interiors and natural scenes), animals, cars, drawings of famous people or cartoon characters, photographs of famous people, food items and abstract patterns. Stimuli were presented for 1000 ms. Subjects had to indicate by pressing a button whether the image was a human face or not.



10.1 | Mechanistic Accounts of Attention 175

RF sizes

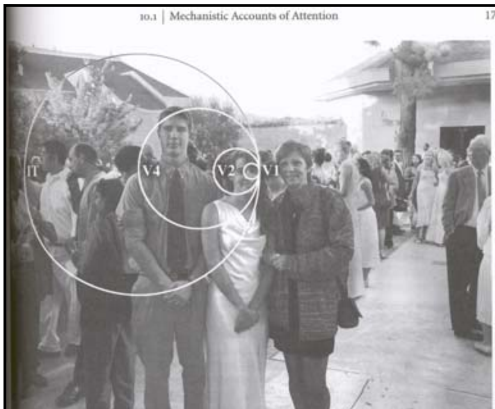
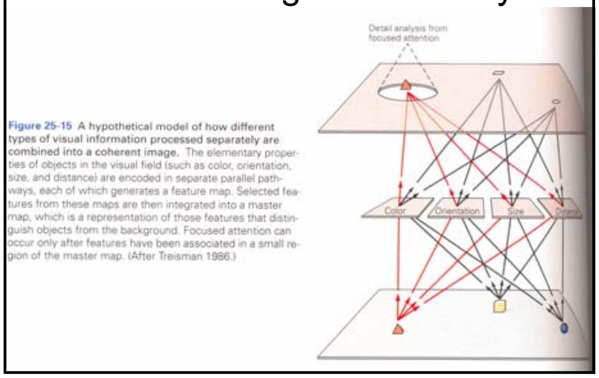
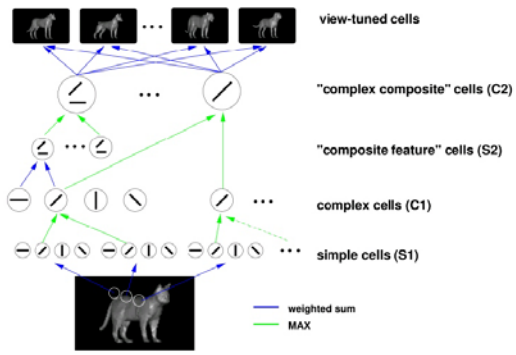


FIGURE 10.1 The Need for Attention Suppose you are looking at my family in this high

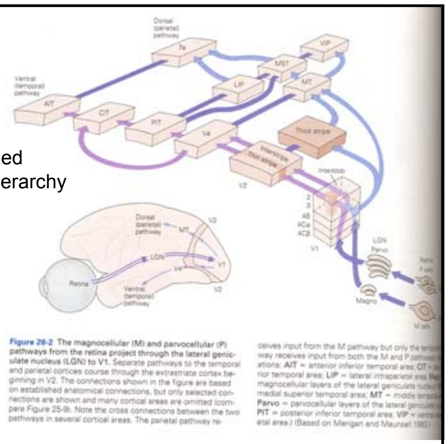
Feature-Integration Theory



(On the side: Prototypical Network)



- sometimes called cortical hierarchy

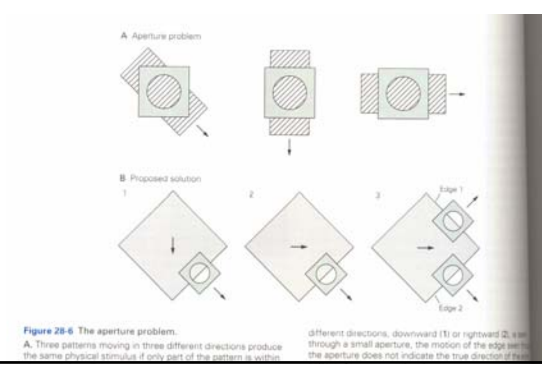


Motion Pathway

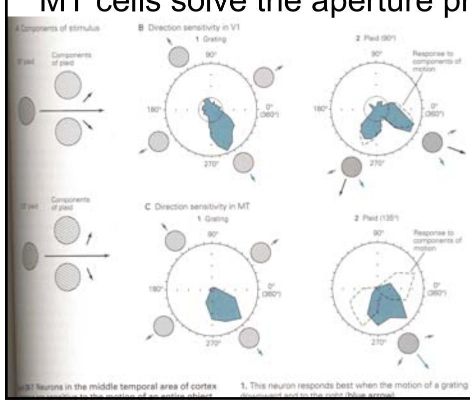
- V1 cells project to MT, some of them over V2
- V1 cells motion sensitive, but only for small (local) RFs

→ aperture problem

The Aperture Problem



MT cells solve the aperture problem

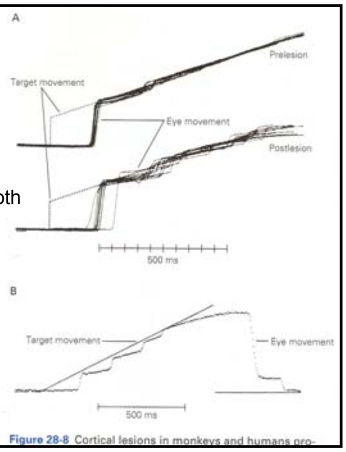


Component direction-selective neurons

Pattern direction-selective neurons

One effect of MT/MST Lesions

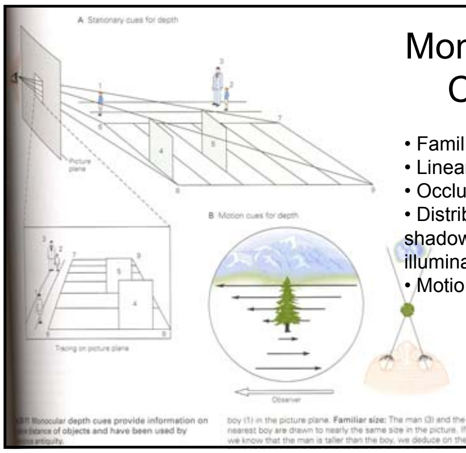
- Diffculties perceiving smooth movement



Depth - Understanding of 3D

- Comes from monocular and stereoscopic cues
- Monocular cues: > 100 feet (ca. 30m)
- Stereoscopic cues: < 100 feet

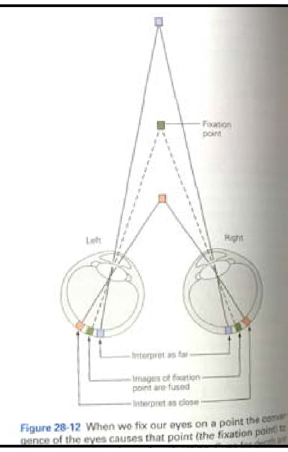
Monocular Cues



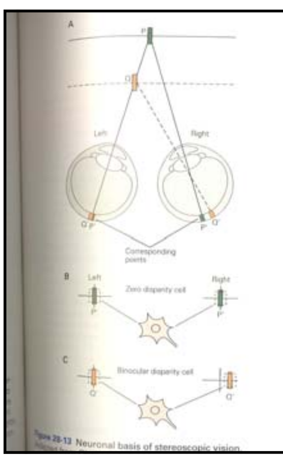
- Familiar Size
- Linear perspective
- Occlusion
- Distribution of shadows and illumination
- Motion parallax

Stereoscopic Cues

- spatial (3D) vision
- possible by the two separate eyes
- binocular disparity



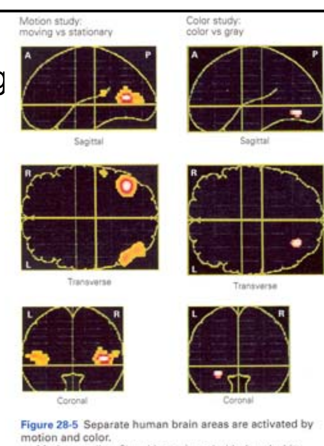
Cortical Cells code for Binocular Disparity



- taking place in V1 and other areas
- …in addition to orientation/ocular dom./blobs…V1 is analyzing many different aspects of the visual image

Is 'motion' and 'color' processing taking place separately?

- fMRI study
- …apparently it is.



Visual Agnosias - Deficits

Table 25-1 The Visual Agnosias

Type	Deficit	Most probable site of the lesion
Agnosia for form and pattern		
Object agnosia	Naming, using, recognition of real objects	Areas 18, 20, 21 on left and corpus cal[illegible]
Agnosia for drawings	Recognition of drawn objects	Areas 18, 20, 21 on right
Prosopagnosia	Recognition of faces	Areas 20, 21 bilaterally
Agnosia for color		
Color agnosia	Association of colors with objects	Area 18 on right
Color anomia	Naming colors	Speech zones or connections from [illegible]
Achromtopsia	Distinguishing hues	Areas 18, 37
Agnosia for depth and movement		
Visuospatial agnosia	Stereoscopic vision	Areas 18, 37 on right
Movement agnosia	Discerning movement of object	Medial-temporal area bilaterally [illegible] occipital and temporal cortex)

Modified from Kolb and Whishaw 1980.

Agnosia for Drawings

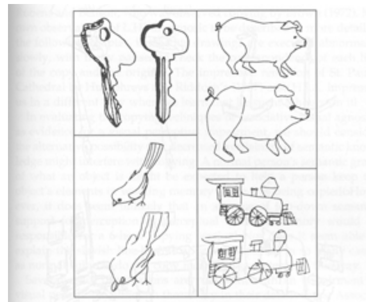
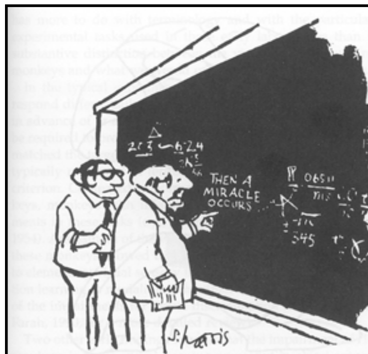


Figure 4.7 Copies of pictures made by an associative visual agnosic who could not recognize the pictures, either before or after copying them.
From A. B. Rubens and D. F. Benson, "Associative visual agnosia," Archives of Neurology, *24, 1971, with permission of the American Medical Association.*

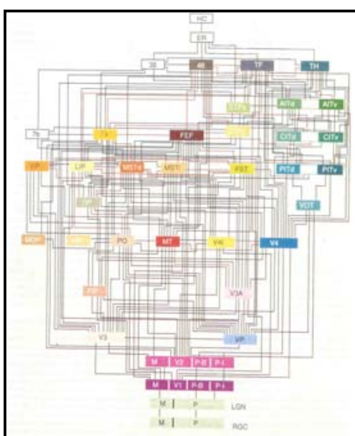
Prosopagnosia



"I think you should be more explicit here in step two."

Figure 4.1 Sidney Harris's classic cartoon, which about sums up our understanding of the neural information processing performed between V4 and IT.
From Harris, "I think you should be more . . ." in Chalk Up Another One: The Best of Sidney Harris, *New Brunswick, NJ, Rutgers University Press, 1992; copyright Sidney Harris.*

(The Miracle. Out of a text book on the cognitive neuroscience of vision, by Farah)



(On the side: The more realistic picture of connections)

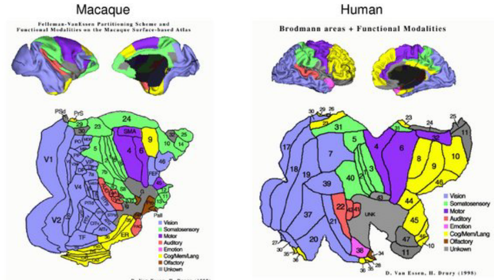
- sometimes called a hierarchy

(On the side: Monkey-Human comparison)

Cortical Areas

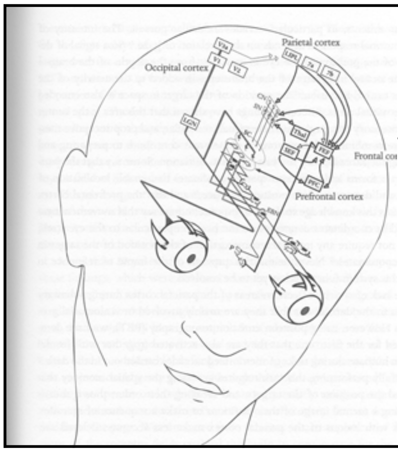
Macaque

Human



– Number of visual areas (macaque): 30 or more

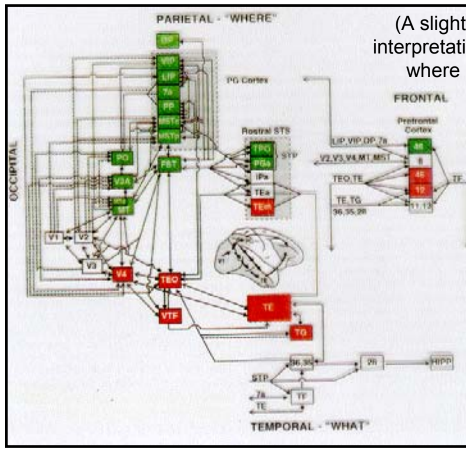
– 30–50% of cortex involved in visual processing



(Planning, Initiating Saccades)

- an elaborate and fine-structured network

(A slightly different interpretation: what and where pathway)



Now it should make sense…