

Lecture 20 -- Vision III – M. Goldberg

- I. The nature of human vision: the brain does not precisely measure the visual world: it makes guesses about object's nature, size and location. Optical illusions illustrate flaws in the guessing
 - a. Visual processing in striate cortex: striate cortex transforms the information from the lateral geniculate, where cells are organized with symmetric centers and surrounds, into neurons selective for specific features of visual stimuli.
- II. V1 has a hierarchy of neurons. Simple cells have oriented on and off areas. Complex cells respond to oriented contours over a larger area.
- III. V1 (and most cerebral cortex) is organized in a columnar manner.
 - a. The cerebral cortex has 6 layers. Thalamic input comes into layer 4.
 - b. Within a column, information is processed and transformed from monocular, center-surround, non-directionally selective input to orientation-selective, motion-direction-selective, Direction-Binocular disparity-selective output
 - c. Processed information is distributed to other cortical areas from layers 2 and 3; to the superior colliculus from layer 5, and to the lateral geniculate nucleus from layer 6.
 - d. Within a column, all oriented cells have the same orientation. All thalamic input is monocular and comes from the same eye. Columns of all orientations are found within a single ocular dominance column.
- IV. Extrastriate visual cortex – two cortical visual streams.
 - a. The dorsal stream “what and how” goes from V1 and V2 through MT, a motion selective area, to the parietal lobe. Dorsal stream functions include spatial localization, attention, the description of visual objects for action, the analysis of shape from motion, and the construction of perceived motion. Motion analysis is done in MT. Lesions in MT make it difficult to perceive motion. Electrical stimulation of MT biases motion decisions.
 - b. The ventral stream is concerned with the identification of objects (“what”).
 - c. The dorsal and ventral functions are separable clinically. Patients can identify objects without knowing where they are, or they can locate them and move them without knowing what they are.

Relevant reading: chapter 28 in “Principles”