

CMSC 435

Introductory Computer Graphics

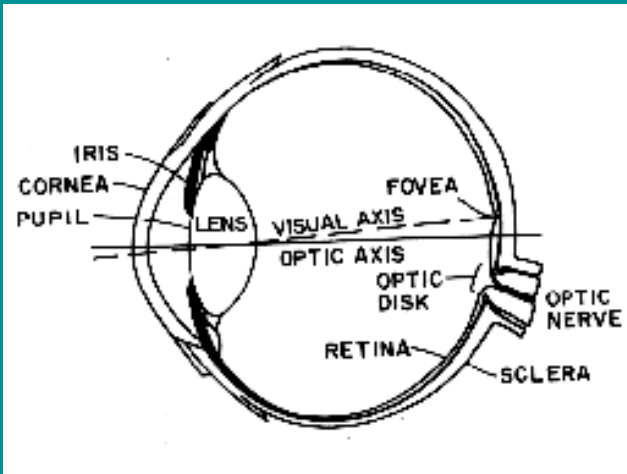
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UMBC

Light

- Visible range: 390-700nm
- Luminance has a large dynamic range:
 - 0.00003 -- Moonless overcast night sky
 - 30 -- Sky on overcast day
 - 3000 -- Sky on clear day
 - 16,000 -- Snowy ground in full sunlight
- Actual colors result from spectral curves
 - dominant wavelength, hue
 - brightness, lightness
 - purity, saturation

Physiology: Eye

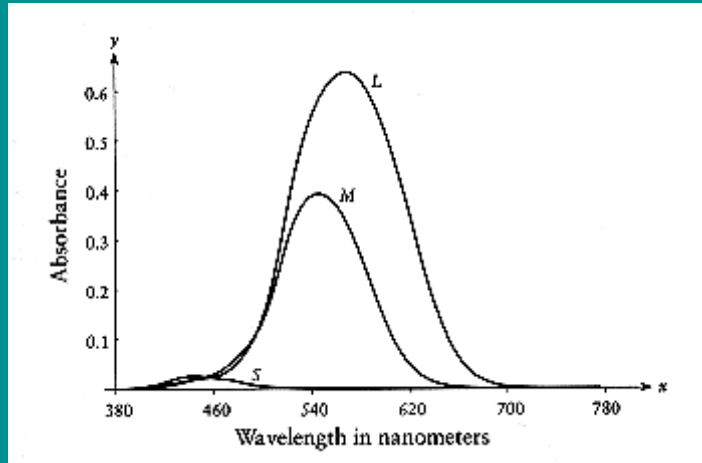
- Cornea
- Iris
- Lens
- Retina
- Optic nerve



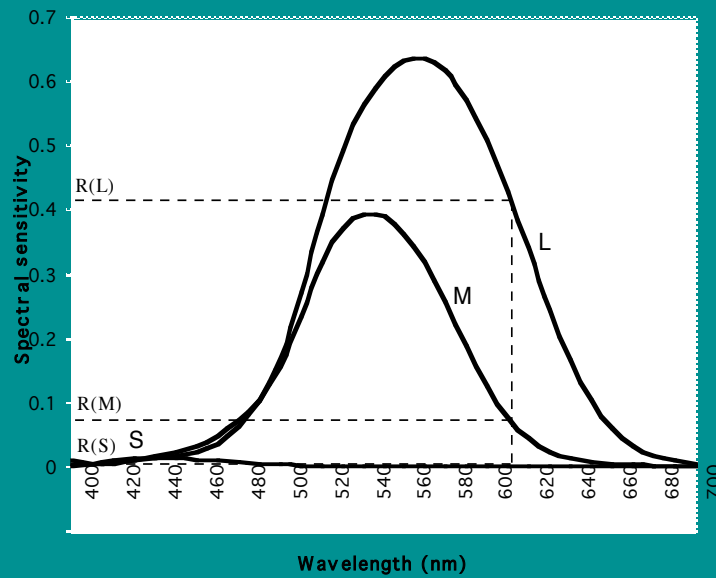
Physiology: Receptors

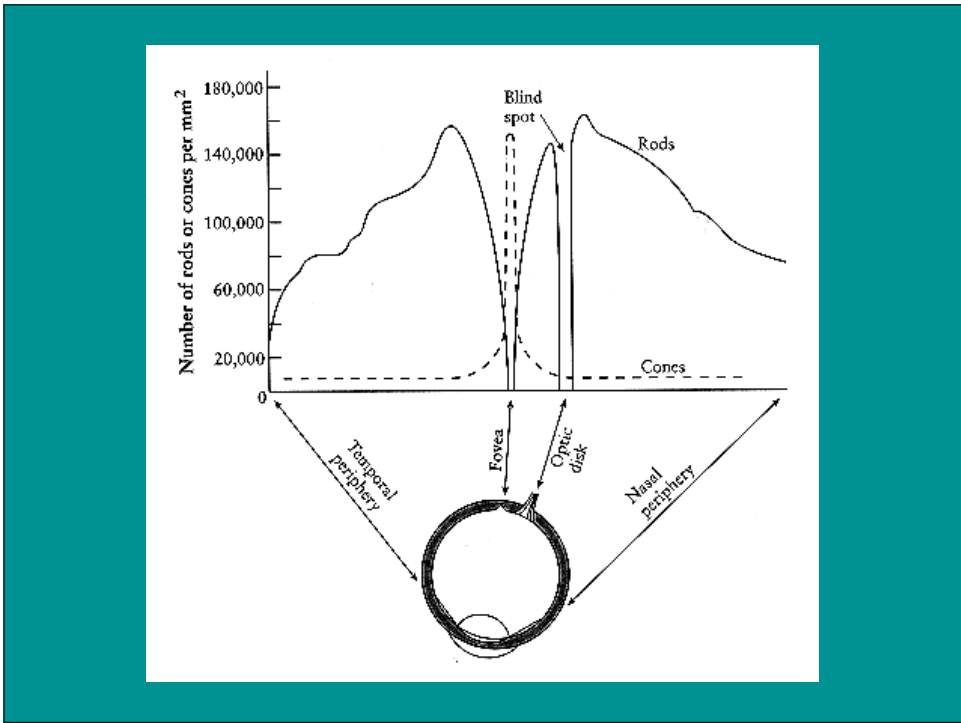
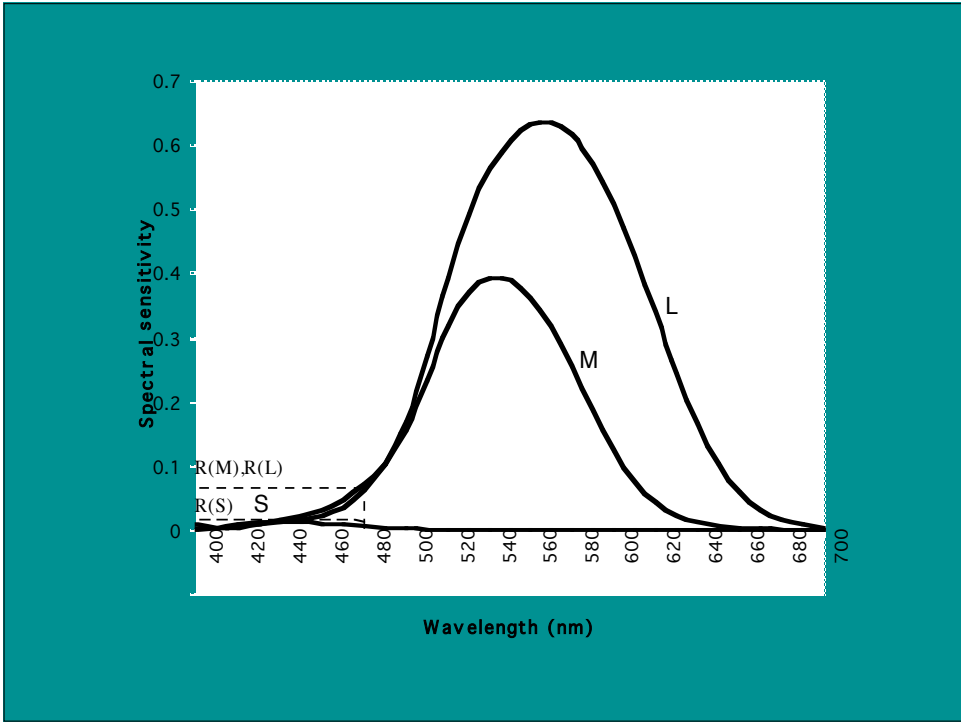
- Rods
 - active at low light levels (scotopic vision)
 - only one wavelength sensitivity function
- Cones
 - active at normal light levels
 - three types: sensitivity functions with different peaks

Cone Sensitivity Functions



- Glasner '95, p. 16.





Physiology: Ganglia

- Transform incoming SML into opponent color responses

- G - R

- Y - B (Y = R+G)

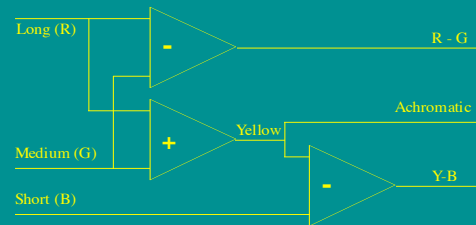
- W (W ≅ R+G)

- Characteristics

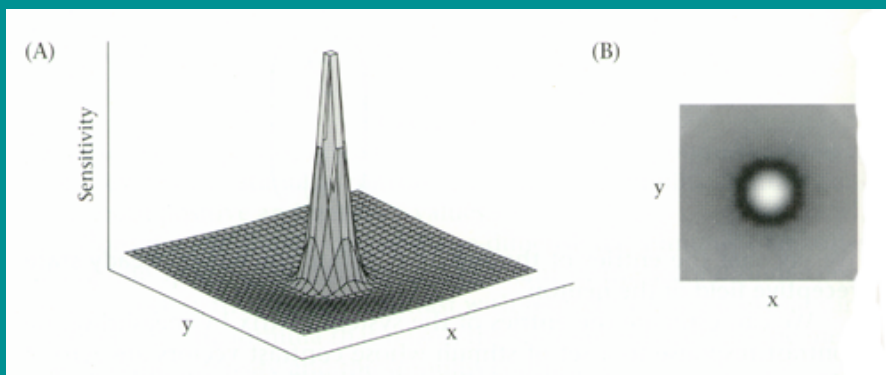
- concentric receptive fields

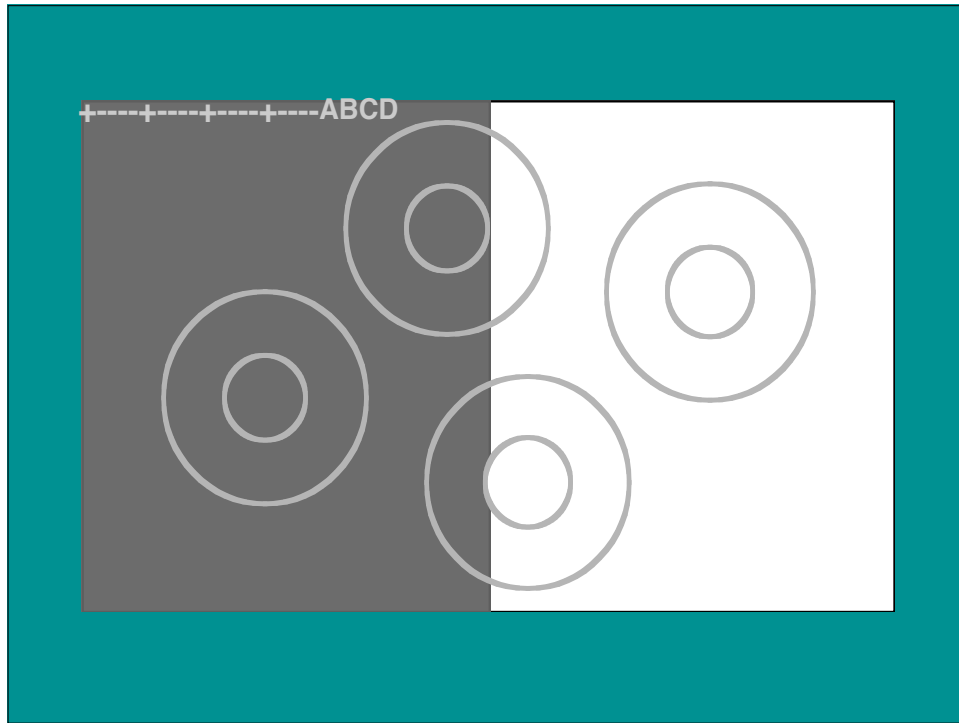
- logarithmic response of receptors

- adaption



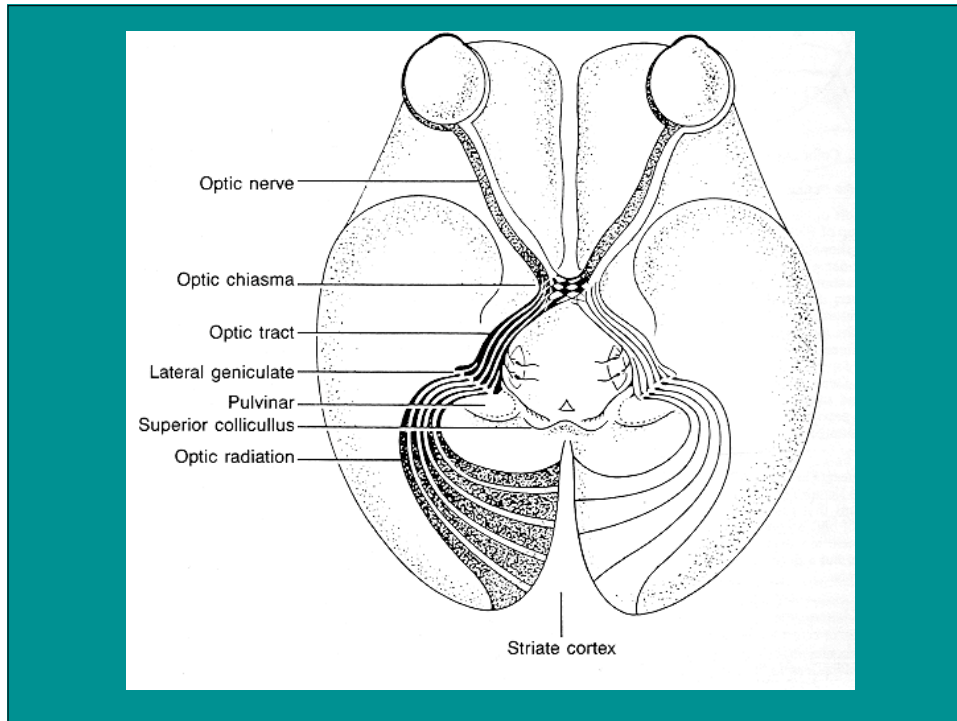
Center-surround Receptive Fields





Physiology: Brain

- Lateral geniculate nuclei
 - assemble data for single side of visual field
 - 2 monochromatic layers => magnocellular path
 - 4 chromatic layers => parvocellular path
- Visual cortex
 - orientation
 - end-stopped
 - ocular dominance
 - spatial frequency
- Feedback from cognitive levels to earlier stages



Magnocellular Division

- Role in vision
 - identify objects and boundaries
 - depth perception
 - motion perception
- Characteristics
 - color: achromatic
 - acuity: large RF centers
 - speed: fast, transient response

Parvocellular Division

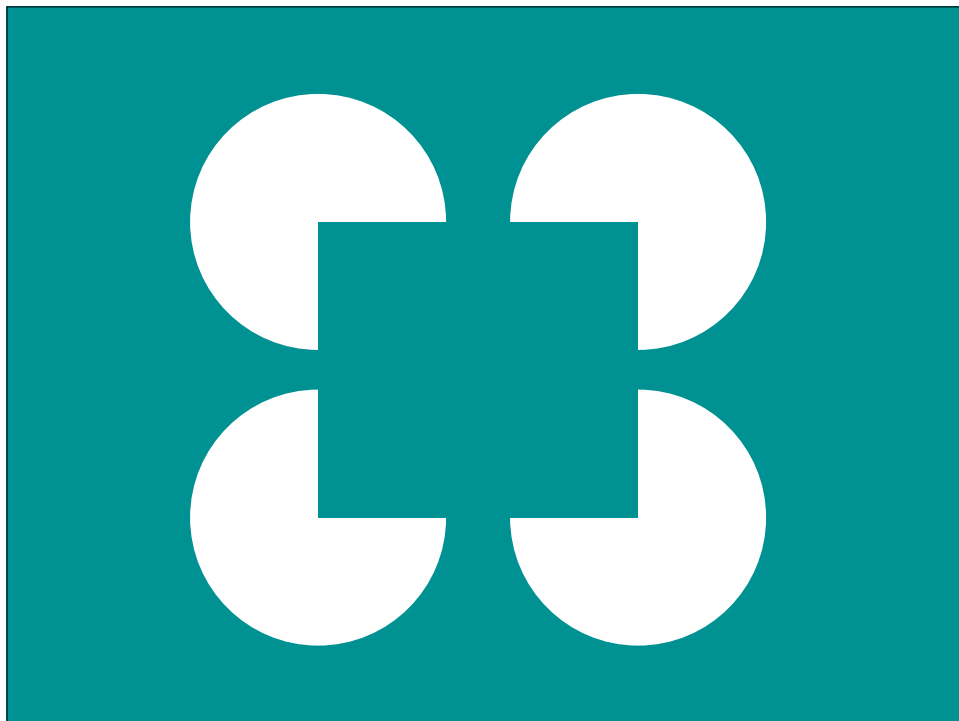
- Role in vision
 - discrimination of fine detail
 - color
- Characteristics
 - color: sensitive to wavelength variations
 - acuity: small RF centers
 - speed: relatively slow response

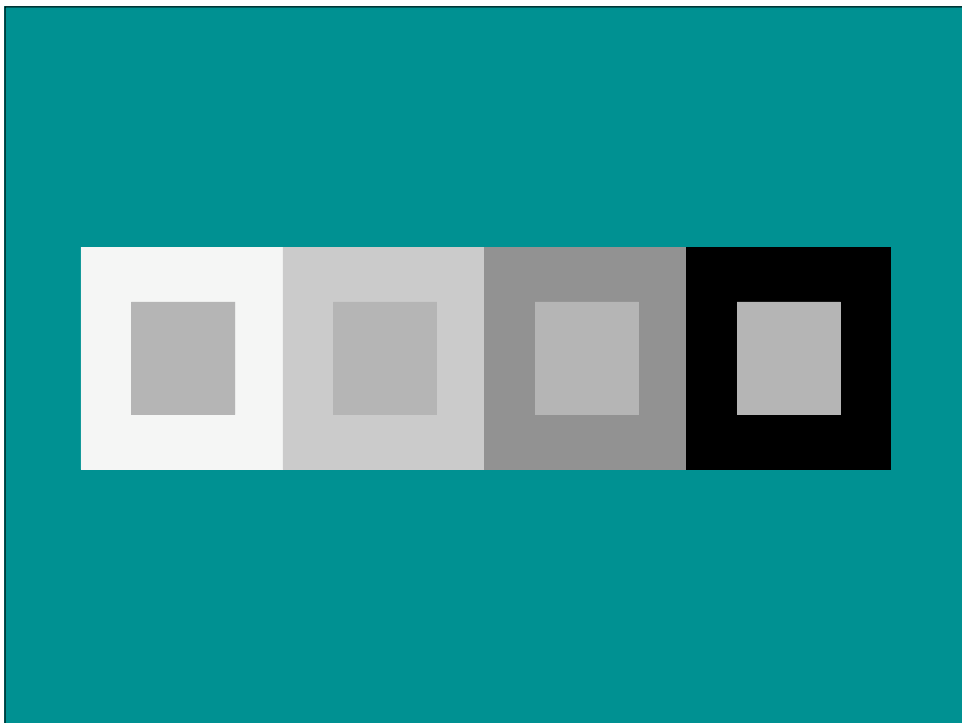
Human Visual Characteristics

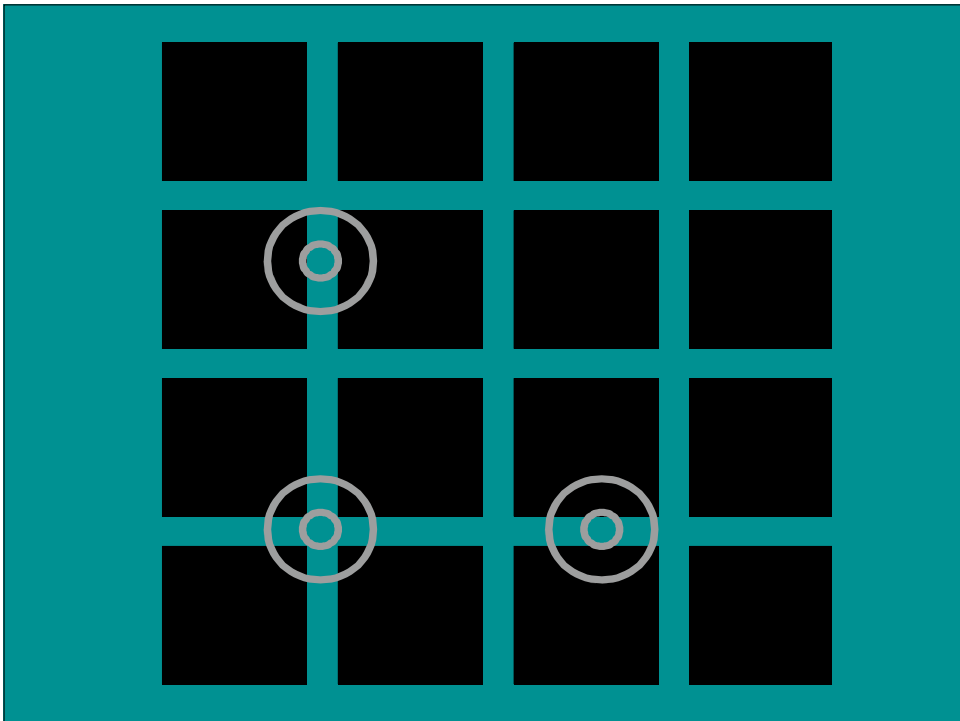
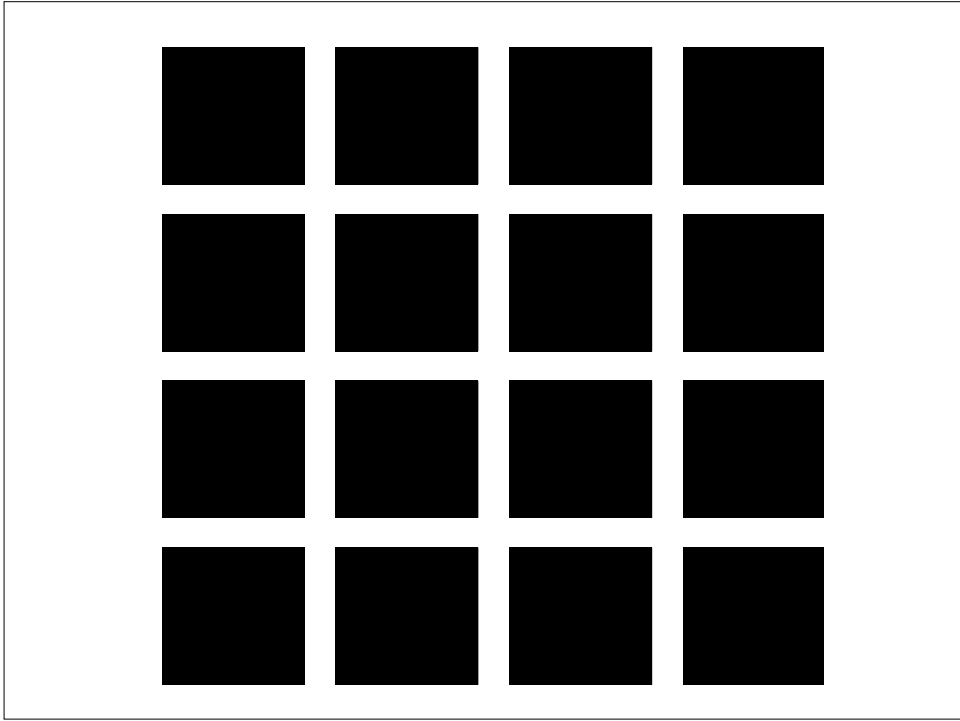
- Contrast sensitivity influenced by spatial frequency
- Adaption
- Communication between neighboring receptors
- Illusions

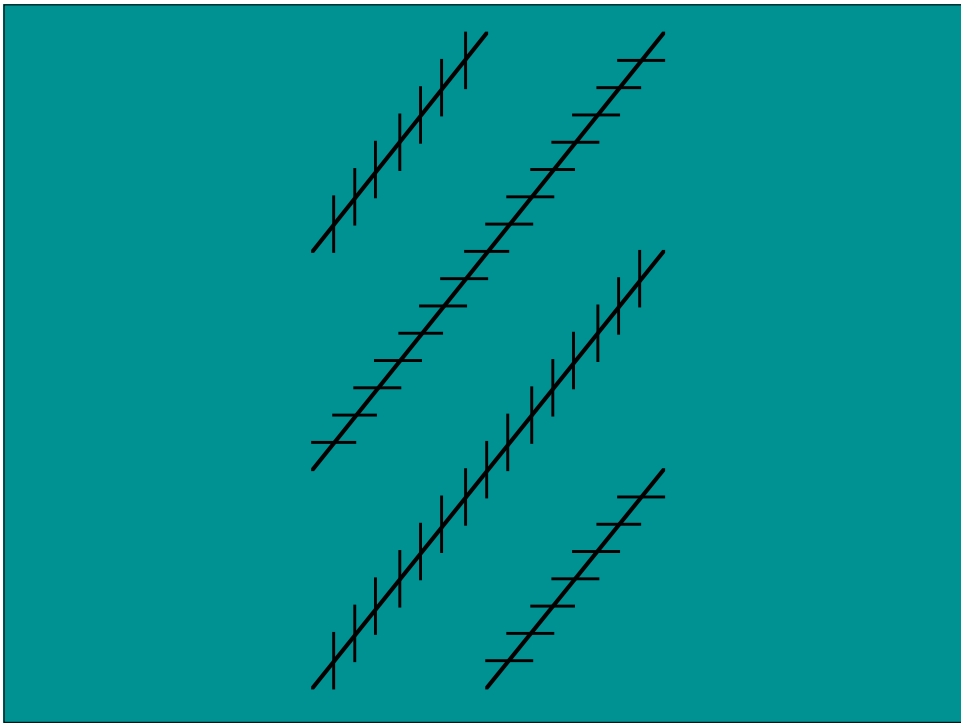
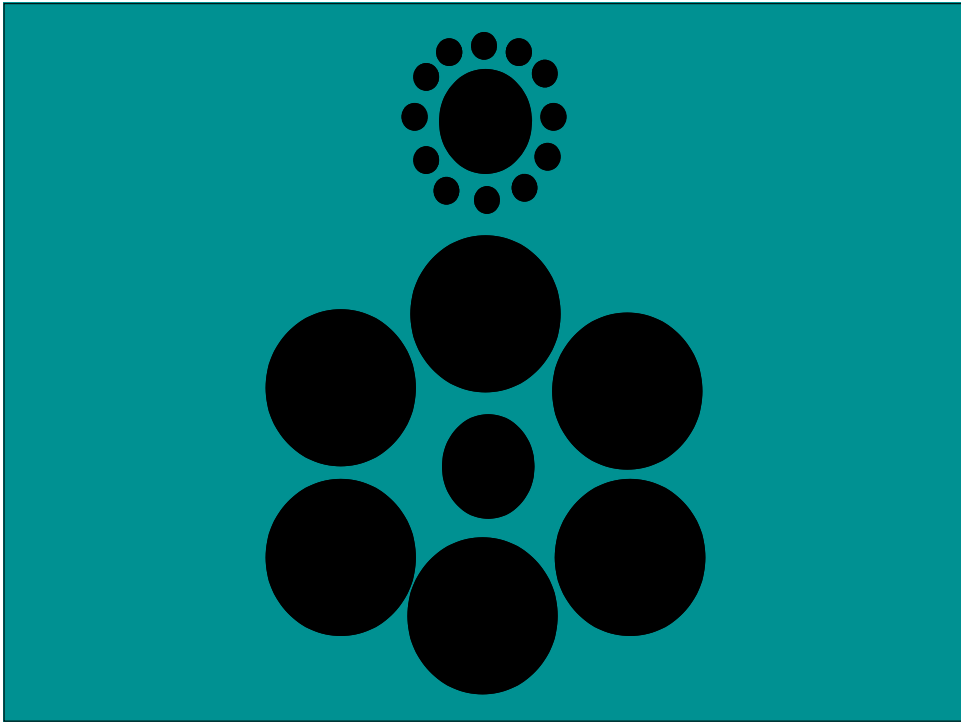
Communication between Receptors

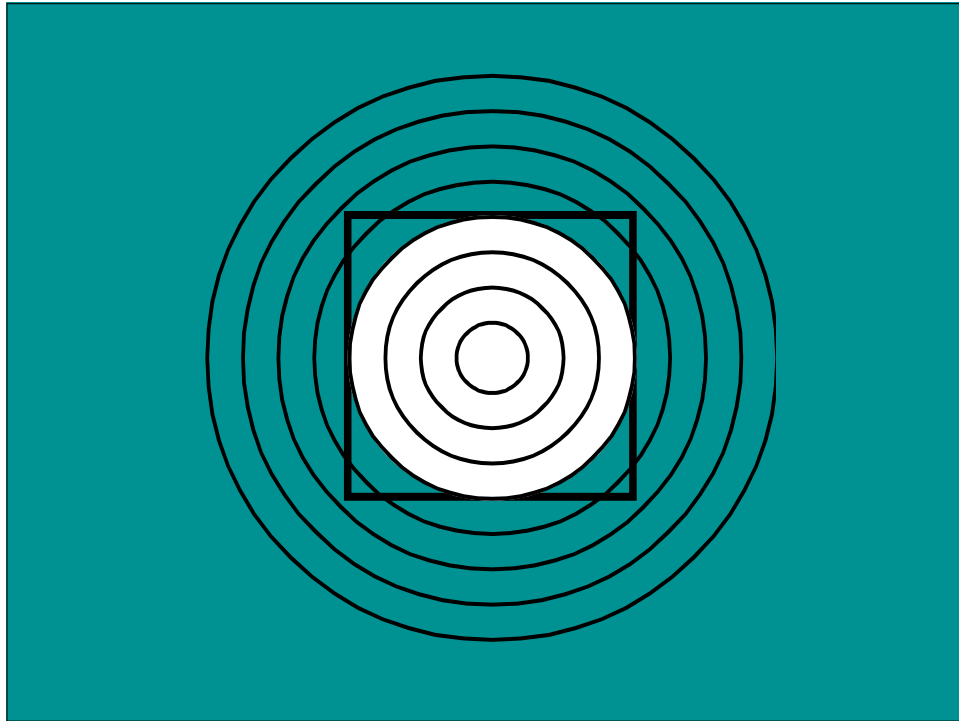
- Edge completion: subjective contours
- Relative judgements
 - intensity
 - size
 - slope
- Constancy
 - lightness
 - simultaneous contrast
- Tolerance of noise











Illusions

- Feedback from higher visual processes
- 3D interpretation of 2D drawings
- Expectations from experience

