Vision: change, lightness, acuity

Role of visual edges

•Ganzfeld/whole field: light falling on retina with no visual structure; eventually, perception is of a uniform dark gray field

- Involuntary eye movements: spontaneous, unconscious, unavoidable movements
- •Stabilized retinal image: Image presented through computer goggles such that image moves in such a way as to cancel out involuntary eye movements
- •When a stabilized retinal image is produced, a ganzfeld-like experience results light is still there and visual edges are present, but temporary blindness still results!

Role of visual edges

- •Version movements: looking back and forth.
 - Saccades: rapid movement from one fixation point to the next (about 100,000/day, no fatigue)
 - Smooth pursuit: tracking a moving object, smooth, slow
- •Vergence movements: crossing your eyes; very slow, double vision can result if there's a problem, can be a distance cue.

Role of visual edges: lateral inhibition



Role of visual edges: lateral inhibition

•Lateral inhibition has the ultimate role of enhancing perception of edges:



Role of visual edges: lateral inhibition



Role of visual edges: illusion caused by lateral inhibition

Role of visual edges: practical effect of lateral inhibition

•Mach bands: When illumination changes rapidly, a faint dark band can be seen on the dark side of the edge, and a faint light band can be seen on the light side of the edge.



Filling in

•Visual system is pretty sophisticated about how it fills in blind spots:

- Lashley's scotoma (Scotoma = blind spot due to damage to the visual system) – experienced continuous patterns in blind region
- Krauskopf's Color circle experiment: Green ring, red circle inside. Red ring stabilized (like stabilized retinal image, above), green ring not stable on the retina. Red circle disappeared, people saw a solid green disc.

•Albedo: proportion of light reflected back from a surface.

- Generally, surfaces aren't really white or black, they just have a high albedo (reflect back a lot of the light shining on them) or a low albedo (reflect back little of the light shining on them).
- Increasing the light shining on an object increases the light reflected back.
- Lightness constancy means that, generally, you're pretty good at ignoring the fact that the lightness reflected by an object is constantly changing (based on ambient light).



Gelb's experiment took advantage of this: •By secretly shining a lot of light on a black disk (on a dark background), he made the black disk appear white. •Turning off the hidden light source resulted in people saying: "no, I was wrong, it's black" and eventually "what's going on?"

Ratio principle: Lightness perceived depends not on amount of light reaching your eye, but rather on the ratio of light from different areas.
Wallach's disk experiment: Shown two rings with a circle in the center. Alter one circle to match the other.



•Wallach's disk experiment (cont.): in matching, the correct thing to do is change the middle circle to reflect 100 units of light; then, the two circles would match. Instead, people change the middle to reflect 250 units of light, preserving the ratio of light, rather than the absolute amount.



An aside: different kinds of visual acuity:

Emmetropic vision: cornea and lens work well, eyeball is the right shape

myopia: cornea and lens bend light too much, or eyeball is too long; hence retinal image blurred

hyperopia: cornea and lens bend light not enough, or eyeball is too short; hence retinal image blurred



List of terms, section 7

Ganzfeld	Ratio principle
Involuntary eye movement	Wallach's experiment
Stabilized retinal image	Emmetroptic vision
Version	Myopia
Saccade	Hyperopia
Smoothe pursuit	
Vergence	
Lateral inhibition	
Mach bands	
Scotoma	
Krauskopf's color circle experiment	
Albedo	
Lightness constancy	
Gelb's experiment	