Vision: Distance & Size Perception

Useful terms:

•Egocentric distance: distance from you to an object.

•Relative distance: distance between two objects in the environment.



•3-d structure: Objects appear three-dimensional, even though projected on to a 2-d surface.



Depth/distance Cues

•As you operate in the real world, you have a sense that you know how far away things are – but how do you know?

Monocular distance cues

Accommodation: Cilliary muscles working implies viewing something up close; otherwise, far away. Not a particularly reliable distance cue. Occlusion: When something's in front of something else, the closer object will cover (or occlude) the farther object



 Depth/distance Cues (cont.)
 Monocular distance cues (cont.) Relative size: when similar objects are presented, bigger ones look closer



Depth/distance Cues (cont.)
Monocular distance cues (cont.) Familiar size: We know how big some objects are, giving us distance info.



Depth/distance Cues (cont.)
 Monocular distance cues (cont.)
 Linear perspective: Parallel lines in the world tend to appear as though they converge and meet at a vanishing point.



Monocular distance cues (cont.) Texture gradient: textures on a surface become closer as distance increases. (Gradient: anything that changes as you change something else. For example, it gets colder as you go north, so that's a temperature gradient.)



 Monocular distance cues (cont.) Atmospheric perspective: Air itself occludes very distant objects, making them look blurry, indistinct, and slightly blue.



 Monocular distance cues (cont.) Height/Vertical location: stuff far away tends to be closer to the horizon than stuff up close:



 Monocular distance cues (cont.) Shading: shading gives useful information about relative distance and object shape:

Attached shadows Cast shadows

Depth/distance Cues (cont.) Monocular distance cues (cont.) (We tend to assume stuff is lit from above:)



Depth/distance Cues (cont.) Monocular distance cues (cont.) (We tend to assume stuff is lit from above:)



Some monocular cues involve motion (the previous ones were all static).
 Motion Parallax: stuff far away looks like it's moving slowly; stuff up close looks like it's moving fast



•Some monocular cues involve motion (the previous ones were all static).

Motion Perspective/Optic flow: forward motion produces "outflow" (expansion); backward motion produces "inflow." Helps determine heading, rate of motion, time to contact, etc.



•Some monocular cues involve motion (the previous ones were all static).

Kinetic Depth effect (structure from motion): no information other than silhouette (or even just a few points on the surface) is necessary to get object shape, if it's in motion.





•Binocular disparity:

Each eye gets a slightly different view of the world – providing you with depth information. (Much like closing one eye and moving side-toside slightly provides you with depth information)





 Binocular disparity: Doesn't even require recognizable objects to work!

•Binocular disparity:

Correspondence problem: How do we find the stuff (dots, swirls, etc.) in a magic eye image in the left eye that corresponds with the stuff in the right eye?

(Computer programs have been developed to solve the C. problem)

•Size Perception

- Size Constancy: Things don't seem to grow and shrink as you move toward or away from them; they seem to stay the same size.
- If two objects are the same distance from you, visual angle is enough to tell which is bigger. (compare retinal size)
- But what about when we don't know how far an object is from us?
- Emmert's law (size-distance invariance hypothesis): Perceived size = k*Reinal image size *perceived distance.

- •Size Perception
 - Size Constancy
 - Holway & Boring, 1941



•Shown just one of the standard stimuli (under different conditions), then adjust comparison stimulus size to match.

Depth/distance Cues (cont.) Size Perception Size Constancy Holway & Boring, 1941



•Size Perception

- Illusions can help inform us about size perception
- Muller-Lyer illusion:



 Perspective constancy theory: the picture is perceived as if it were an impoverished version of a greater whole.

- Size Perception
 - Muler-Lyer illusion (cont.)
 - By making the distance cues more obvious,
 - we can exaggerate the effect:



Depth/distance Cues (cont.) Size Perception Ponzo illusion



 Note that the line closer to the top looks much further away than the other line. Holway & Boring!

Depth/distance Cues (cont.) Size Perception Moon illusion



List of terms, section 8

- Egocentric distance
- Relative distance
- 3-d structure
- Monocular distance cues
- Accommodation
- Occlusion
- Relative size
- Familiar size
- Linear perspective
- Gradient
- Texture gradient
- Atmospheric perspective
- Height/vertical location
- Shading
- Motion parallax
- Optic flow

- Kinetic depth effect
- Binocular disparity
- Correspondence problem
- Size constancy
- Emmert's law
- Holway & Boring (1941) experiment
- Muler-Lyer illusion
- Perspective constancy theory
- Ponzo illusion
- Moon illusion