Winter 2013

CSE 190: 3D User Interaction

Lecture #3: Stereo

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Announcements

- Homework Assignment #1 on-line
  - Due date: January 25 at 1pm
  - To be presented in Sequoiah lab
- Reminder: paper presentations
- Final Exam: alternate date?

Introduction To Displays

- *Display*: device which presents perceptual information
- Often ‘display’ used to mean ‘visual display’
- Goal: display devices which accurately represent perceptions in simulated world

Lecture Outline

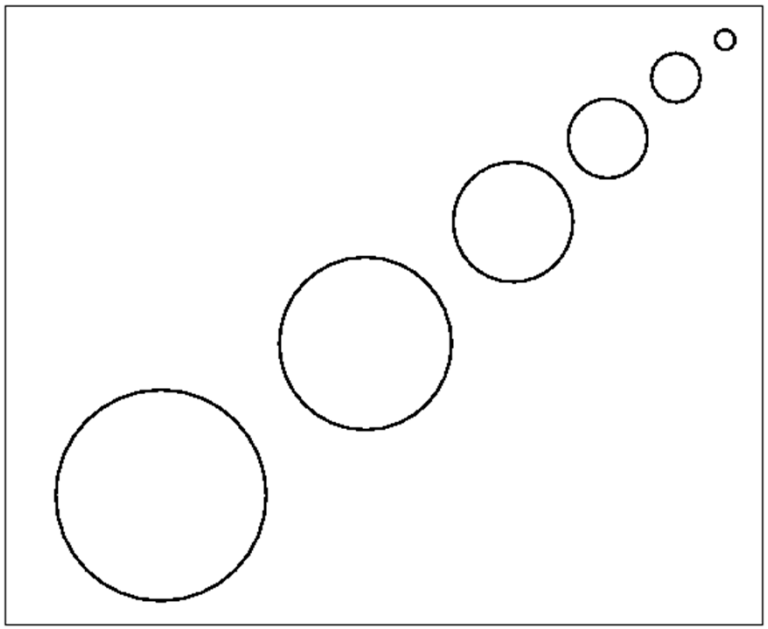
- Visual System
- Depth Cues
- Visual Display Characteristics
- Visual Display Examples
  - monitors
  - surround screen displays
  - workbenches
  - head mounted displays
  - arm-mounted displays
  - virtual retinal displays
  - autostereoscopic displays

Depth Cues – How Do We See 3D?

- Monocular/static cues
- Occulomotor cues (Accommodation/Convergence)
- Motion Parallax
- Binocular Disparity and Stereopsis

Monocular/Static Cues

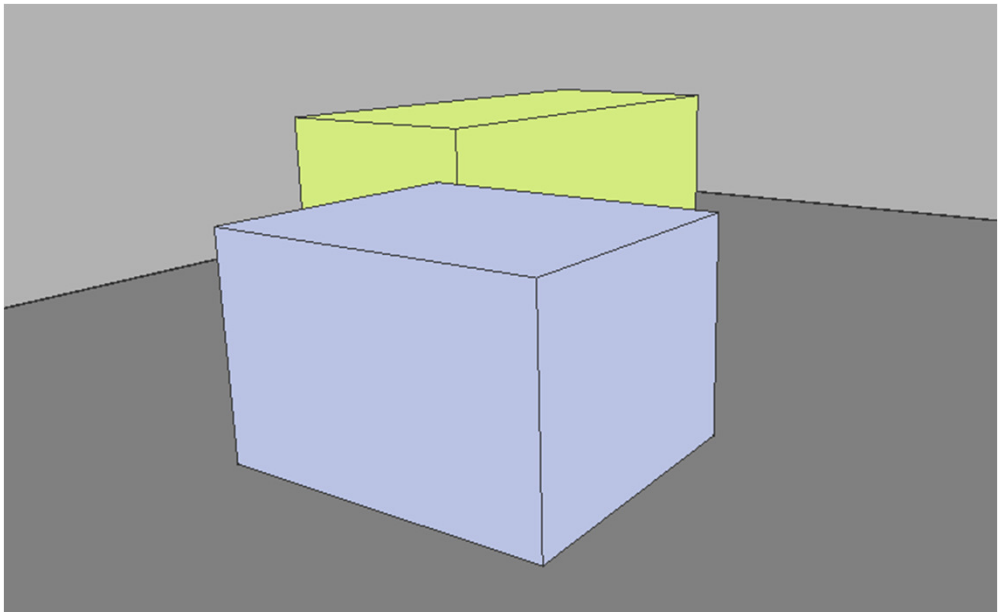
- Relative Size



- Height relative to horizon

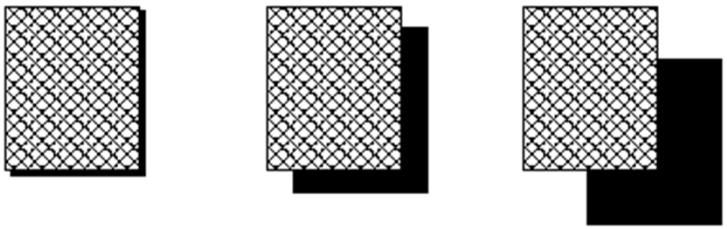
Monocular/Static Cues

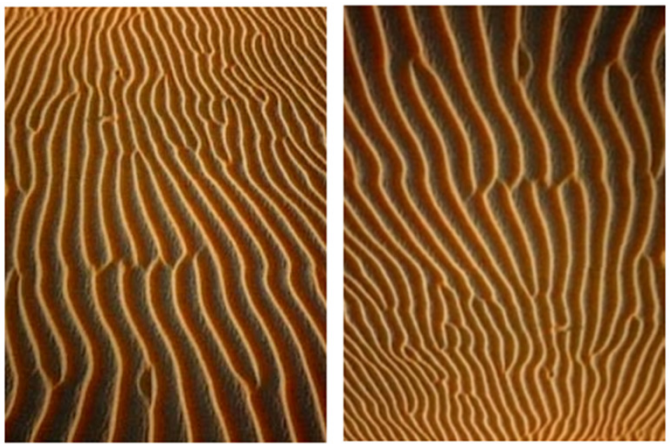
- Occlusion and Linear Perspective



Monocular/Static Cues

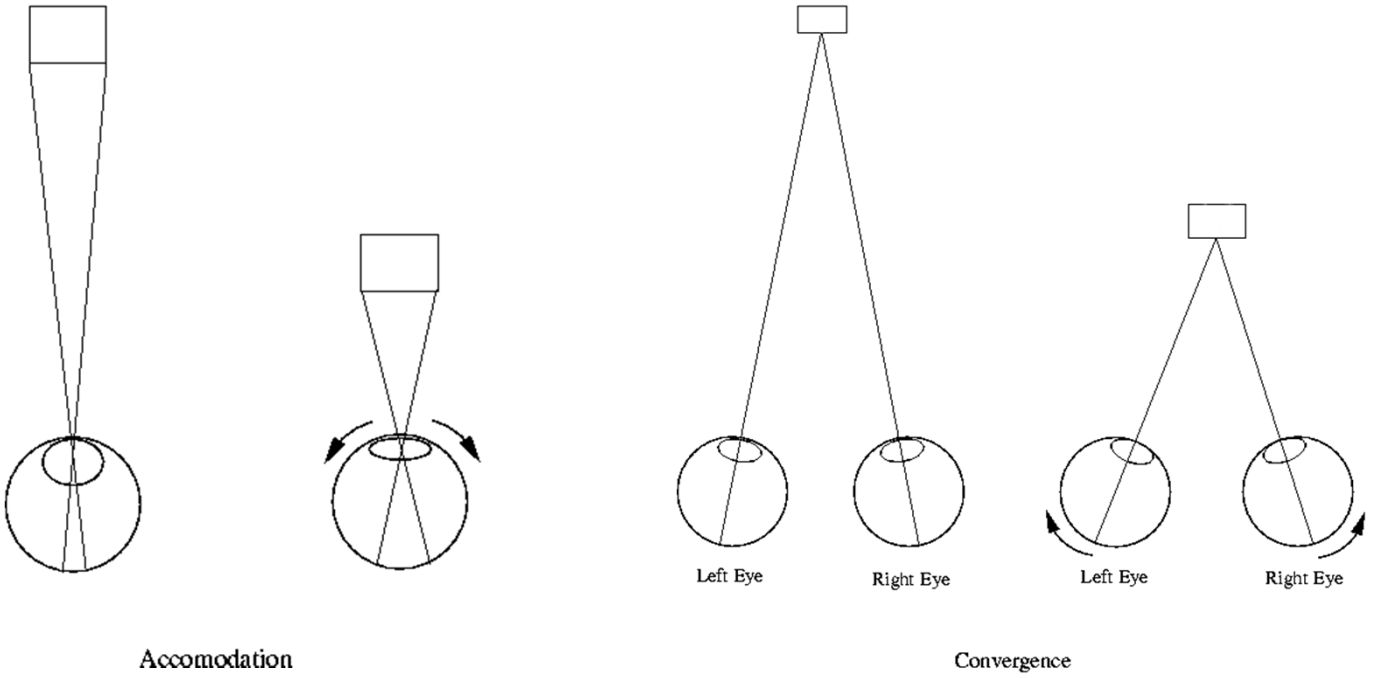
- Shading, Lighting, and Texture





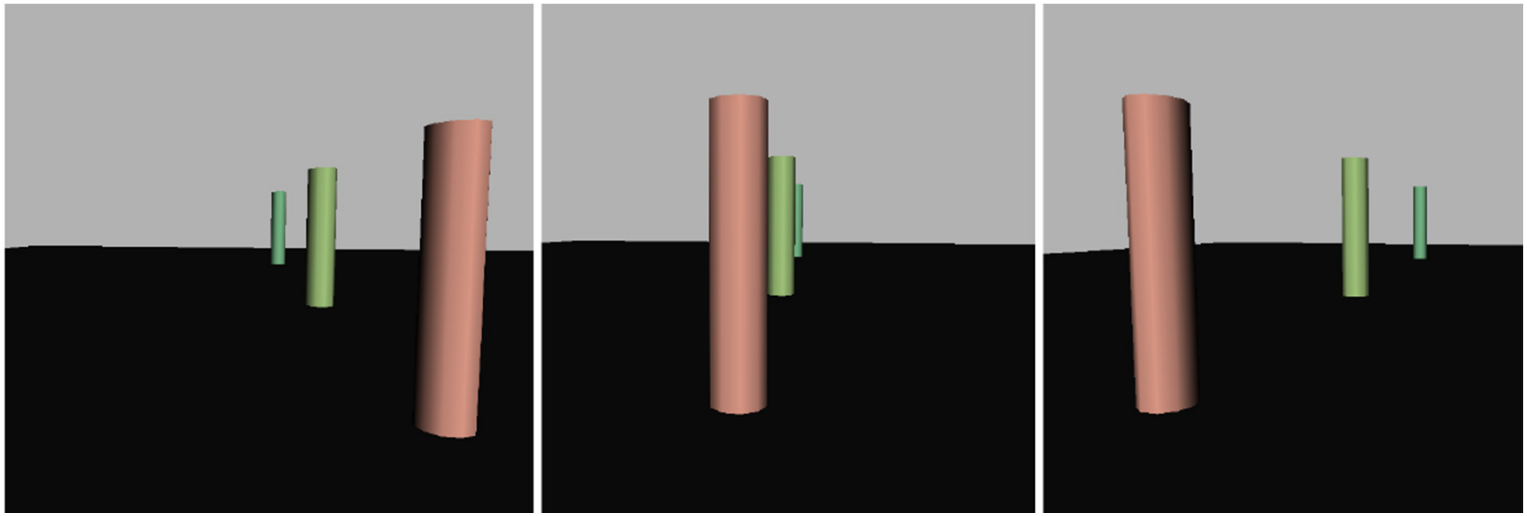
Oculomotor Cues

- Accommodation – physical stretching and relaxing of eye lens
- Convergence – rotation of viewer's eyes so images can be fused together at varying distances



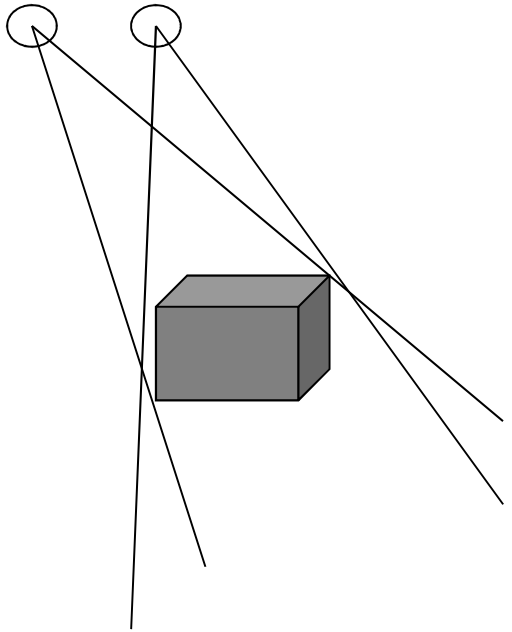
Motion Parallax

- Stationary viewer vs. moving viewer



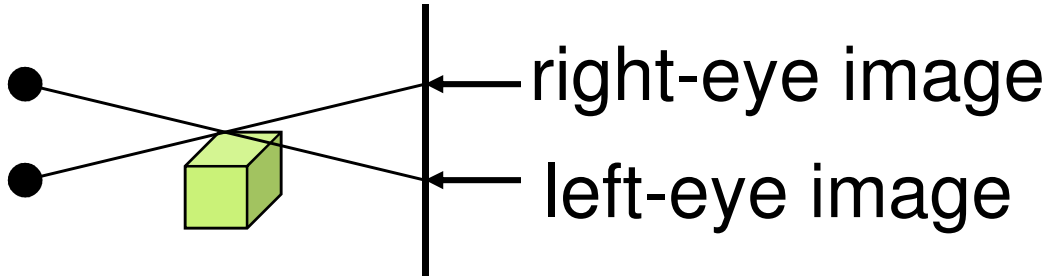
Binocular Disparity and Stereopsis

- Each eye gets a slightly different image
- Only effective within a few feet of viewer
- Many implementation schemes



Accommodation-Convergence Mismatch

- Standard stereo displays confuse the brain based on oculomotor cues



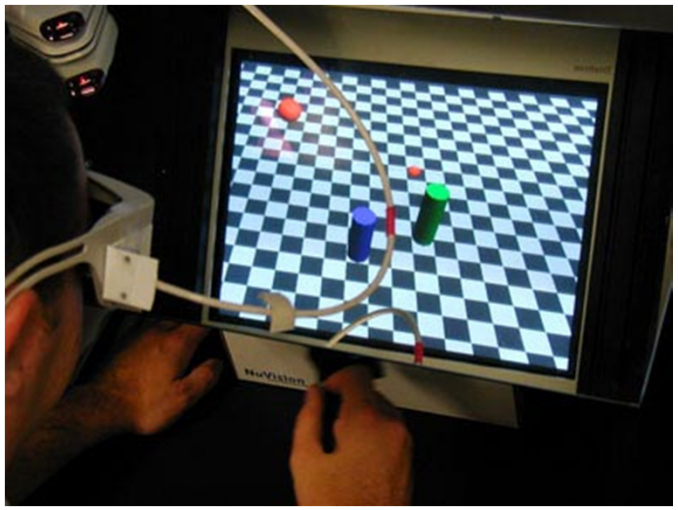
- Only “true 3D” displays can provide these correctly

Visual Display Characteristics

- Field of View (FOV) and Field of Regard (FOR)
  - FOR – amount of physical space surrounding viewer in which visual images appear
  - FOV – maximum visual angle seen instantaneously
- Spatial Resolution
  - number of pixels and screen size
- Screen Geometry
  - rectangular, hemispherical, etc…
- Light Transfer Mechanism
  - front projection, rear projection, laser light, etc…
- Refresh Rate
  - not the same as frame rate
- Ergonomics

Stereo Monitor

- Ordinary workstation equipped with emitter and shutter glasses



Stereo Monitor – Advantages

- Least expensive in terms of additional hardware over other output devices
- Allows usage of virtually any input device
- Good resolution
- User can take advantage of keyboard and mouse

Stereo Monitor – Disadvantages

- Not very immersive
- User really cannot move around
- Does not take advantage of peripheral vision
- Stereo can be problematic
- Occlusion from physical objects can be problematic