



# CSE 190: 3D User Interaction

Lecture #16: 3D UI Design 2  
Jürgen P. Schulze, Ph.D.

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# Announcements

- Final Exam
  - Tuesday, March 19<sup>th</sup>, 11:30am-2:30pm
  - Closed book
  - See new section on course web page.
- Sid's office hours in lab 260 this week
- CAPE
  - Web site closes March 18 at 8am
  - Responses to all surveys are completely anonymous.
  - Only a summary of results is provided to the academic department and the course instructor.
  - This summary is provided only after final grades are posted.
  - A minimum number of three evaluations must be submitted by students for summaries to be made available.
- Please return borrowed webcams, Hydras, Kinects

# Paper Presentations Next Lecture

- Joey: Predator-prey vision metaphor for multi-tasking virtual environments

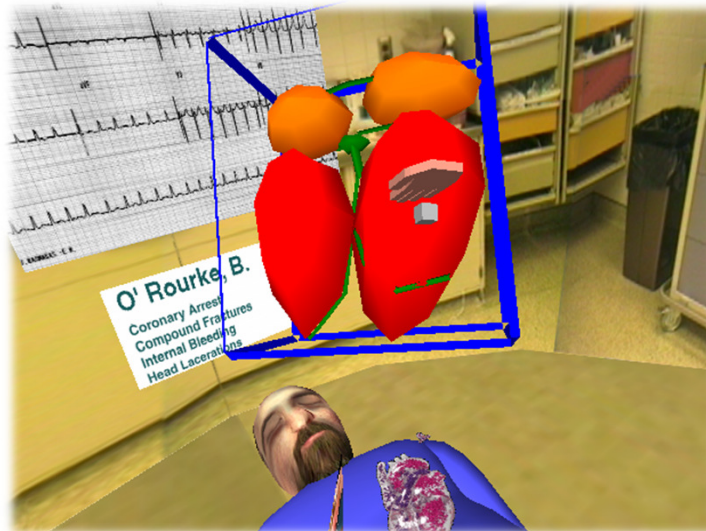
# Paper Presentations Today

- Bryan: Impossible Spaces: Maximizing Natural Walking in Virtual Environments with Self-Overlapping Architecture
- Arick: Augmented perception of satiety: controlling food consumption by changing apparent size of food with augmented reality

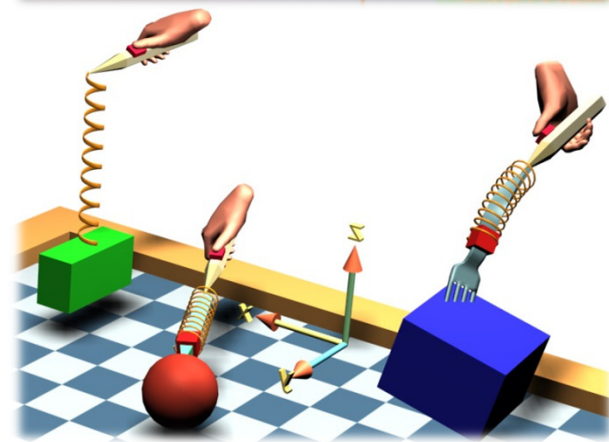
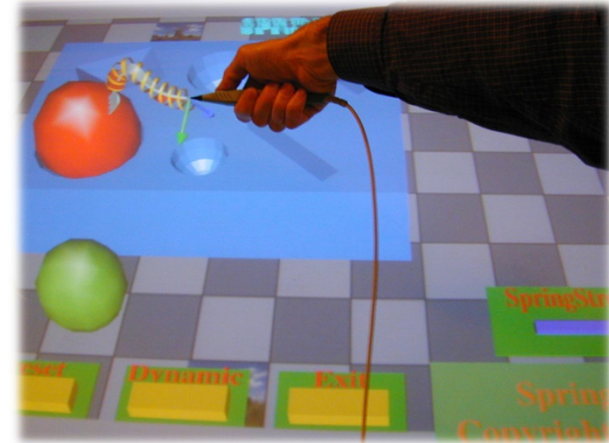
# More on 3D UI Design Strategies

# Designing for Humans – Feedback Substitution

- Cannot always support all sensory feedback dimensions
- Typical approach is to substitute



*Highlighting object about to be selected*



*Spring Manipulation Tools,  
Michal Koutek, TU Delft*

# Designing for Humans – Passive Haptics

- Match shape and appearance of virtual object with physical prop
  - User both sees and feels
- Advantages
  - Inexpensive haptic/tactile feedback
  - Establish perceptual frame of reference
- Disadvantages
  - Scalability
  - Performance improvements have not yet been measured



# Designing for Humans – Constraints

- Constraints:
  - Are a relation between variables that must be satisfied
    - Example: a line should stay horizontal
  - Define geometrical coherence of scene
  - Can make interaction simpler and improve accuracy



# Designing for Humans – Constraint Types

- Physically realistic constraints
  - Collision detection and avoidance
  - Gravity
  - Application dependent
- DOF reduction
  - Simplify interaction (example: constrain travel to ground)
- Dynamic alignment tools
  - Grids and snapping, guiding surfaces
- Intelligent constraints
  - Deal with semantics
    - Example: lamp can only stand on horizontal surfaces

# Designing for Humans – Two Handed Control

- Also known as bimanual input
- Transfer everyday manipulation experiences to 3DUI
- Can increase user performance on certain tasks
- Active topic of research

# Designing for Humans – Guiard's Framework

- Tasks are
  - Unimanual: throwing darts
  - Bimanual symmetric
    - Synchronous: pulling a rope
    - Asynchronous: typing on keyboard
  - Bimanual asymmetric (cooperative): holding a cell phone with one hand, operating it with the other
- Division of labor (hand roles) for asymmetric scenario:
  - Nondominant hand dynamically adjusts spatial frame of reference for dominant hand
  - Dominant hand produces precision movements, nondominant hand performs gross manipulation
  - Manipulation is initiated by nondominant hand

# Designing for Different User Groups

- Age
- Prior 3DUI experience
- Physical characteristics: arm length, etc.
- Perceptual, cognitive, motor capabilities
  - Color recognition
  - Stereo vision
  - Spatial abilities

# Designing for User Comfort

- Weight of equipment
- Keep users in proper physical space
- Hygiene and public installations
- Keep sessions short (30-45min max) to prevent sickness, fatigue