CSE 165: 3D User Interaction

Lecture #2: Overview

Announcements

- Sign up for video presentation
  - by Sunday 1/17
- Get VR device access

Projects from prior years

- Air Race: https://www.youtube.com/watch?v=9XJk4TPwPeY
- Trapped by a wall: https://www.youtube.com/watch?v=EYsgV6d1AU8
- Jedi Training: https://www.youtube.com/watch?v=-kqrTI3Bsmo

What are 3D UIs?

- 3D interaction: human-computer interaction in which the user's tasks are carried out in a 3D spatial context
  - 3D input devices
  - 2D input devices with direct mappings to 3D
- 3D user interface (3D UI): A UI that involves 3D interaction
- 3D interaction technique: A method (hardware and software) allowing a user to accomplish a task in a 3D UI

Why 3D UIs?

- 3D applications should be useful
  - Immersion
  - Natural skills
  - Immediacy/directness of visualization in general
- But, many real world applications have low complexity of interaction
  - Don't need 3D UI

Goals of 3D UIs

- Performance
  - efficiency
  - accuracy
  - productivity
- Usability
  - ease of use
  - ease of learning
  - user comfort
- Usefulness
  - interaction helps meet system goals
  - interface transparent so users can focus on tasks

What makes 3D interaction difficult?

- Spatial input
- Lack of constraints
- Lack of standards
- Lack of tools
- Lack of precision
- Fatigue
- Spatial scene layout

Universal 3D Interaction Tasks

- Navigation
  - travel: motor component
  - wayfinding: cognitive component
- Selection/Picking
- Manipulation
  - specification of object position & orientation
  - specification of scale, shape, other attributes
- System Control
  - changing the system state or interaction mode (e.g., menus)
  - may be composed of other tasks
- Symbolic Input (text, numbers)

3D UI Design Philosophies

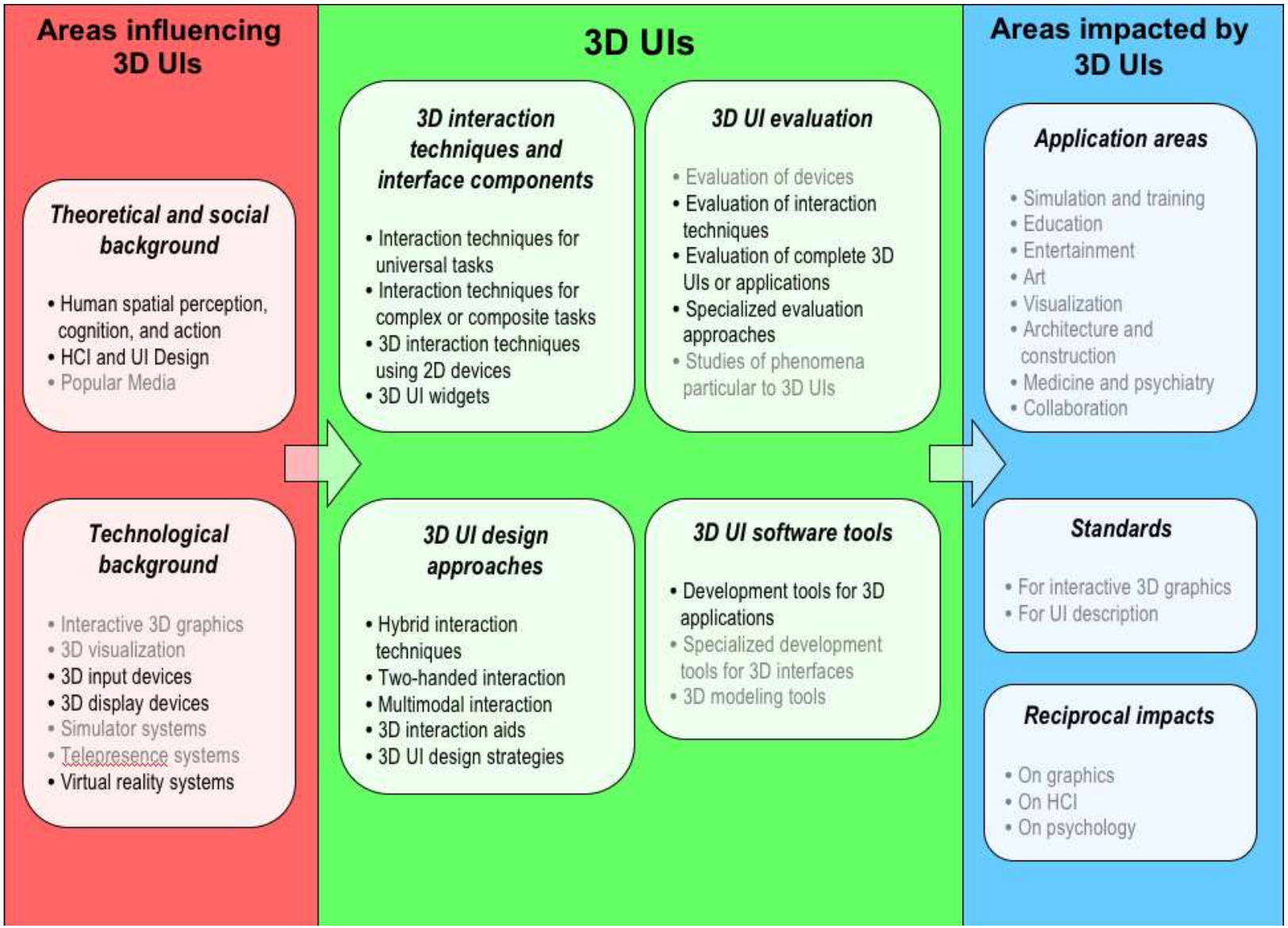
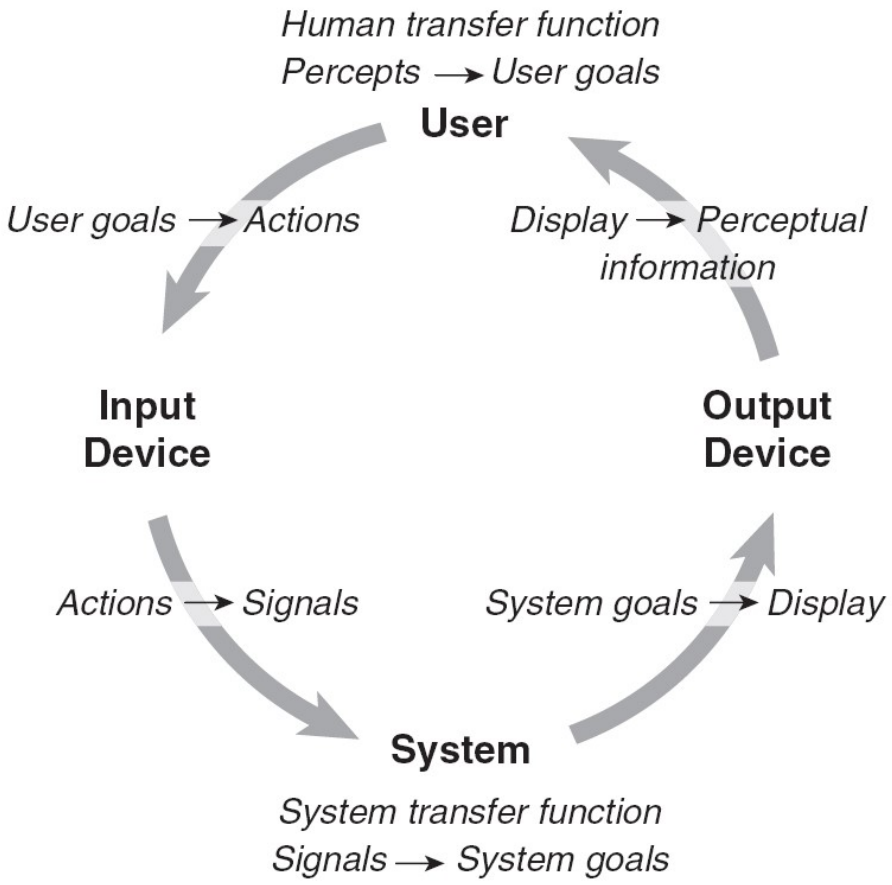
- Artistic approach: Base design decisions on
  - intuition about users, tasks, and environments
  - heuristics, metaphors, common Sense
  - aesthetics
  - adaptation/inversion of existing interfaces
- Scientific approach: Base design decisions on
  - formal characterization of users, tasks, and environments
  - quantitative evaluation results
  - performance requirements
  - examples: taxonomies, formal experimentation

Applications

- *Games*
- Architecture / CAD
- Education
- Medicine
- Manufacturing
- Simulation / Training
- Design / Prototyping
- Information / Scientific Visualization
- Collaboration / Communication

Examples

- Training: https://www.youtube.com/watch?v=cfdBgJdFC6Q
- Medical Imaging: https://www.youtube.com/watch?v=AttXbcLUyR0
- Gaming: Half-Life: Alyx https://www.youtube.com/watch?v=Nc5kTOup0AU


Areas influencing 3D UIs
Theoretical and social background
• Human spatial perception, cognition, and action
• HCI and UI Design
• Popular Media
Technological background
• Interactive 3D graphics
• 3D visualization
• 3D input devices
• 3D display devices
• Simulator systems
• Telepresence systems
• Virtual reality systems
3D UIs
3D interaction techniques and interface components
• Interaction techniques for universal tasks
• Interaction techniques for complex or composite tasks
• 3D interaction techniques using 2D devices
• 3D UI widgets
3D UI evaluation
• Evaluation of devices
• Evaluation of interaction techniques
• Evaluation of complete 3D UIs or applications
• Specialized evaluation approaches
• Studies of phenomena particular to 3D UIs
3D UI design approaches
• Hybrid interaction techniques
• Two-handed interaction
• Multimodal interaction
• 3D interaction aids
• 3D UI design strategies
3D UI software tools
• Development tools for 3D applications
• Specialized development tools for 3D interfaces
• 3D modeling tools
Areas impacted by 3D UIs
Application areas
• Simulation and training
• Education
• Entertainment
• Art
• Visualization
• Architecture and construction
• Medicine and psychiatry
• Collaboration
Standards
• For interactive 3D graphics
• For UI description
Reciprocal impacts
• On graphics
• On HCI
• On psychology

Interaction Workflow