3D User Interface System Control Techniques

Lecture #11: System Control
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Universal 3D Interaction Tasks

- Navigation
  - Travel – motor component
  - Wayfinding – cognitive component
- Selection
- Manipulation
- System control
- Symbolic input

System Control

- Often considered glue of 3D UI
- Specify the "what"
- Commands are issued to
  - request system to perform a particular function
  - change interaction mode
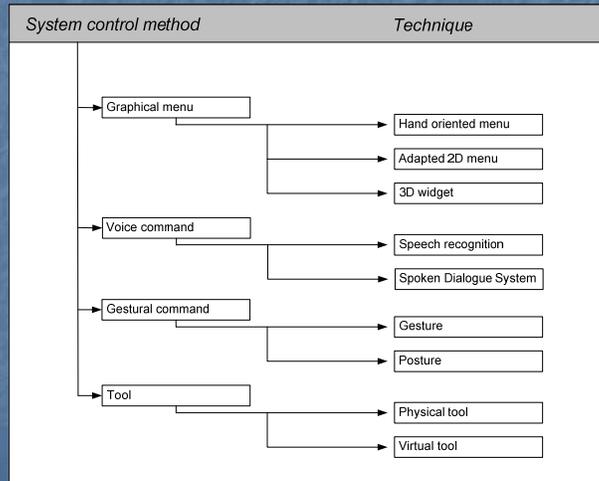 - change system state

Human Factors and System Control

- Learn from mechanical systems
  - transfer of mechanical energy/information to system
  - control-body linkage
    - interaction between control device and human body
- Effectiveness of control-body linkage
  - human experience, training
  - shape and size of control
  - visual representation and labeling
  - methods of selection

Classification

System control method	Technique

- Graphical menu
  - Hand oriented menu
  - Adapted 2D menu
  - 3D widget
- Voice command
  - Speech recognition
  - Spoken Dialogue System
- Gestural command
  - Gesture
  - Posture
- Tool
  - Physical tool
  - Virtual tool

Graphical Menus – Adapted 2D Menus

Graphical Menus – 1-DOF Menus
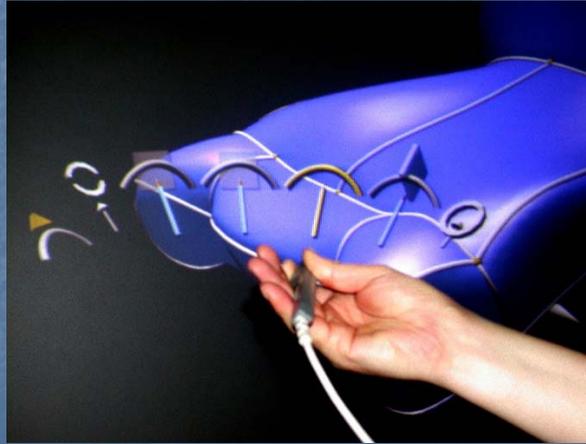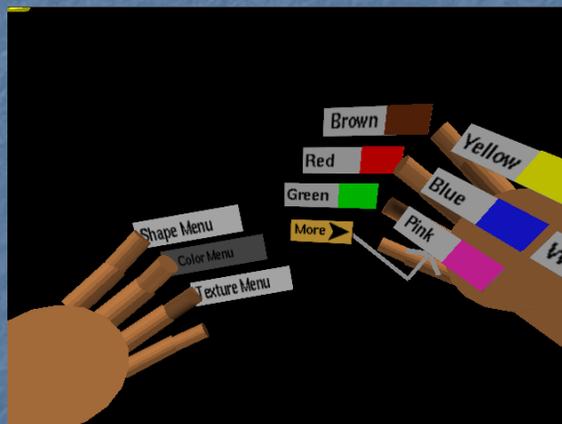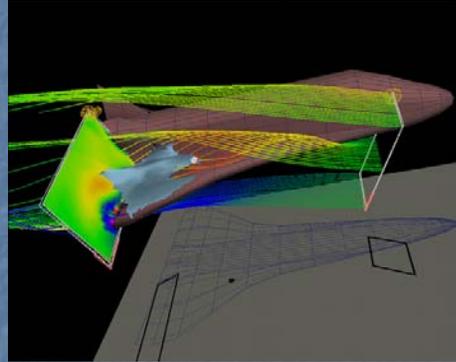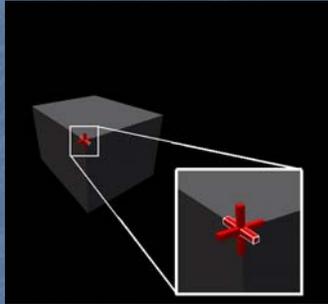
Graphical Menus – TULIP

Graphical Menus – 3D Widgets (1)

Graphical Menus – 3D Widgets (2)

Command and Control Cube
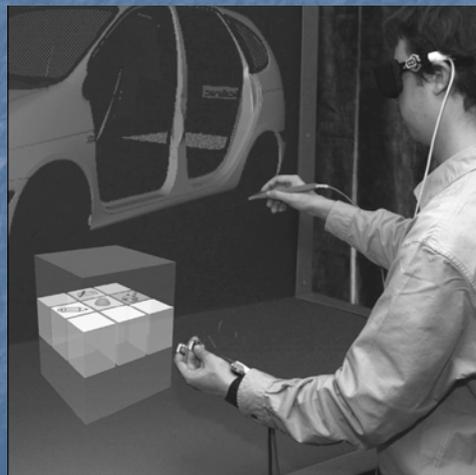
Graphical Menus – Design

- Placement
  - world-referenced (freely in world)
  - object-referenced (centered to object in world)
  - head-referenced (view centered)
  - body-referenced
  - device-centered
- Selection
  - Degrees of freedom, constraints
- Representation and structure
  - form, size, space, affordance
  - hierarchy: functional and semantic grouping, context sensitivity, control coding

Voice Commands

- Speech recognition
- Spoken dialogue techniques
- Requires
  - speech recognition engine
    - speaker dependent vs. independent
    - varying vocabulary size
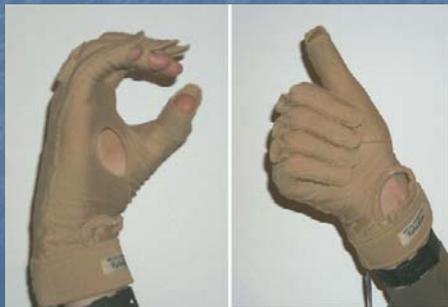 - good microphone
- Invisible to the user
- Push to talk

Gestural Commands

- One of the first system control techniques
- Posture – static hand configuration
- Gesture – dynamic movement

Gesture Command Types

- Speech connected
- Mimic gestures
- Symbolic
- Sign language

Tools

- Provide directness of interaction
- Familiar (real-world devices)
- Physical tools
  - real physical objects (props)
  - may have graphical representation
- Virtual tools

Tools – Virtual Tool belt

Tools – Tricorder

Tools – TUI

Multimodal System Control

- More than one input modality (speech, gesture, facial expression, etc...)
- Advantages
  - decoupling
  - flexibility and complementary behavior
  - control of mental resources

Multimodal Interaction – Examples

Next Class

- Symbolic Input
- Readings
  - 3DUI Book – Chapter 8