3D User Interface System Control Techniques

Lecture #11: System Control
Spring 2015
Joseph J. LaViola Jr.

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
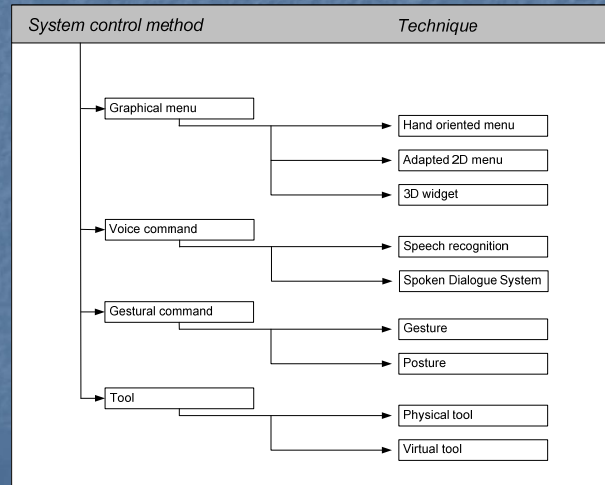
Human Factors and System Control

- 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

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Graphical Menus – 1-DOF Menus
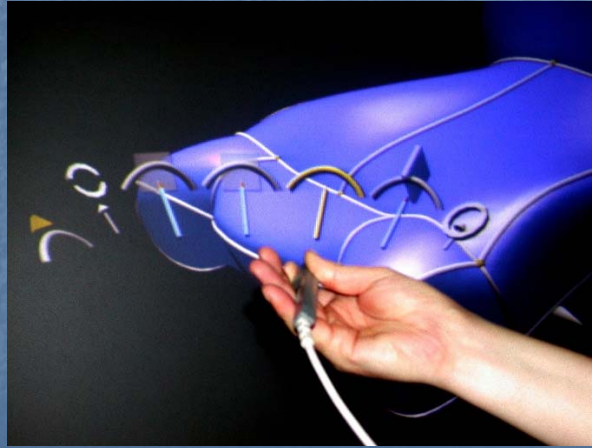
Graphical Menus – TULIP

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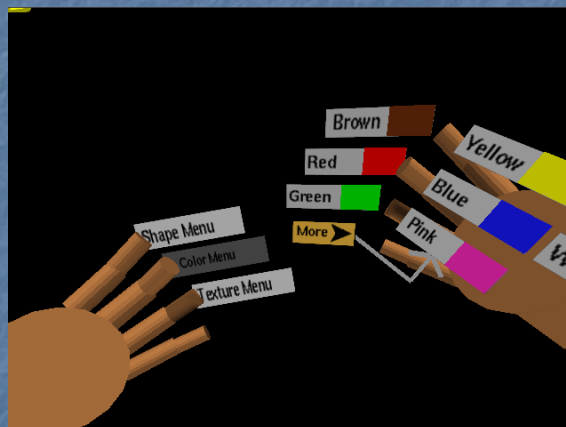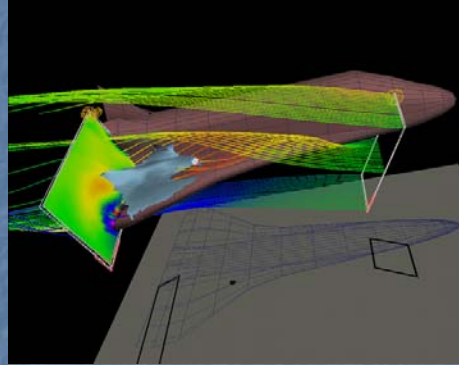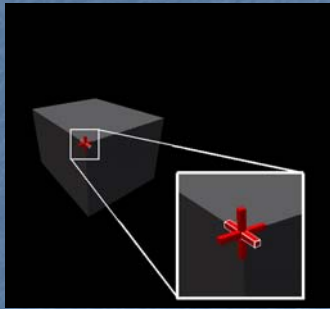
Graphical Menus – 3D Widgets (1)

Graphical Menus – 3D Widgets (2)

Command and Control Cube
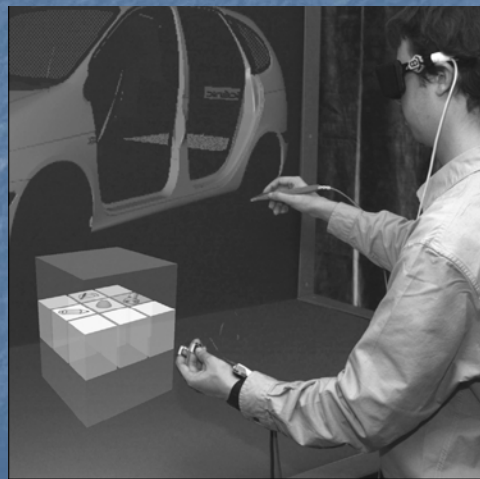
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Graphical Menus – Design

- 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
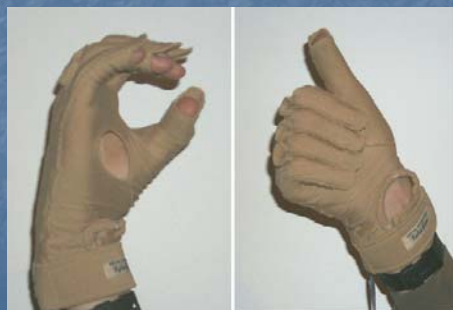 - good microphone
- Invisible to the user
- Push to talk

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

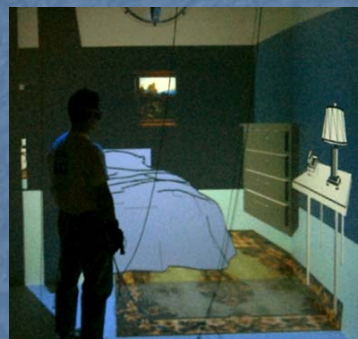# Tools – TUI

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