

# CSE 165: 3D User Interaction

Lecture #10: System Control

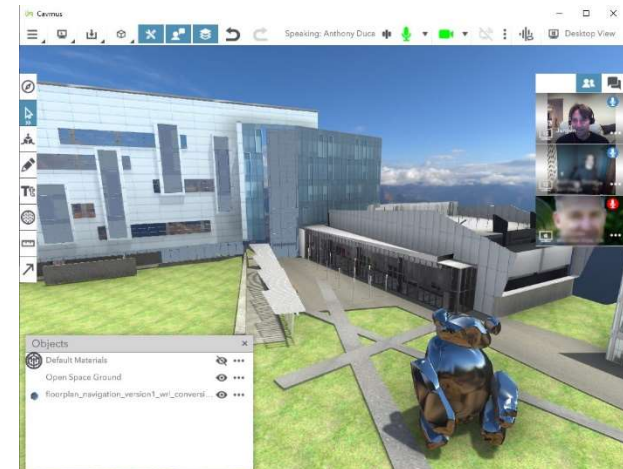
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# Announcements

- Sunday, February 7<sup>th</sup> at 11:59pm:
  - Homework project 2 due
- Monday, February 8<sup>th</sup> at 4pm:
  - Discussion Project 3
- Sunday, February 14<sup>th</sup> at 11:59pm:
  - Homework project 2 late deadline

# CAVRNUS Test

- Today at 3pm
- Click the link below and then "Join via app"
  - <https://cavrnus.cavrn.us/join/758-209-505>
- Download and install the app
- Enter the guest code in the box on the main screen to join
  - Guest Code: 758-209-505



# 3D UI Presentations

- Juan Carlos Amistoso
- Vincent Li:
  - Haptx Gloves DK2
- Winston Durand:
  - MEgATrack: Monochrome Egocentric Articulated Hand-Tracking for Virtual Reality

# System Control

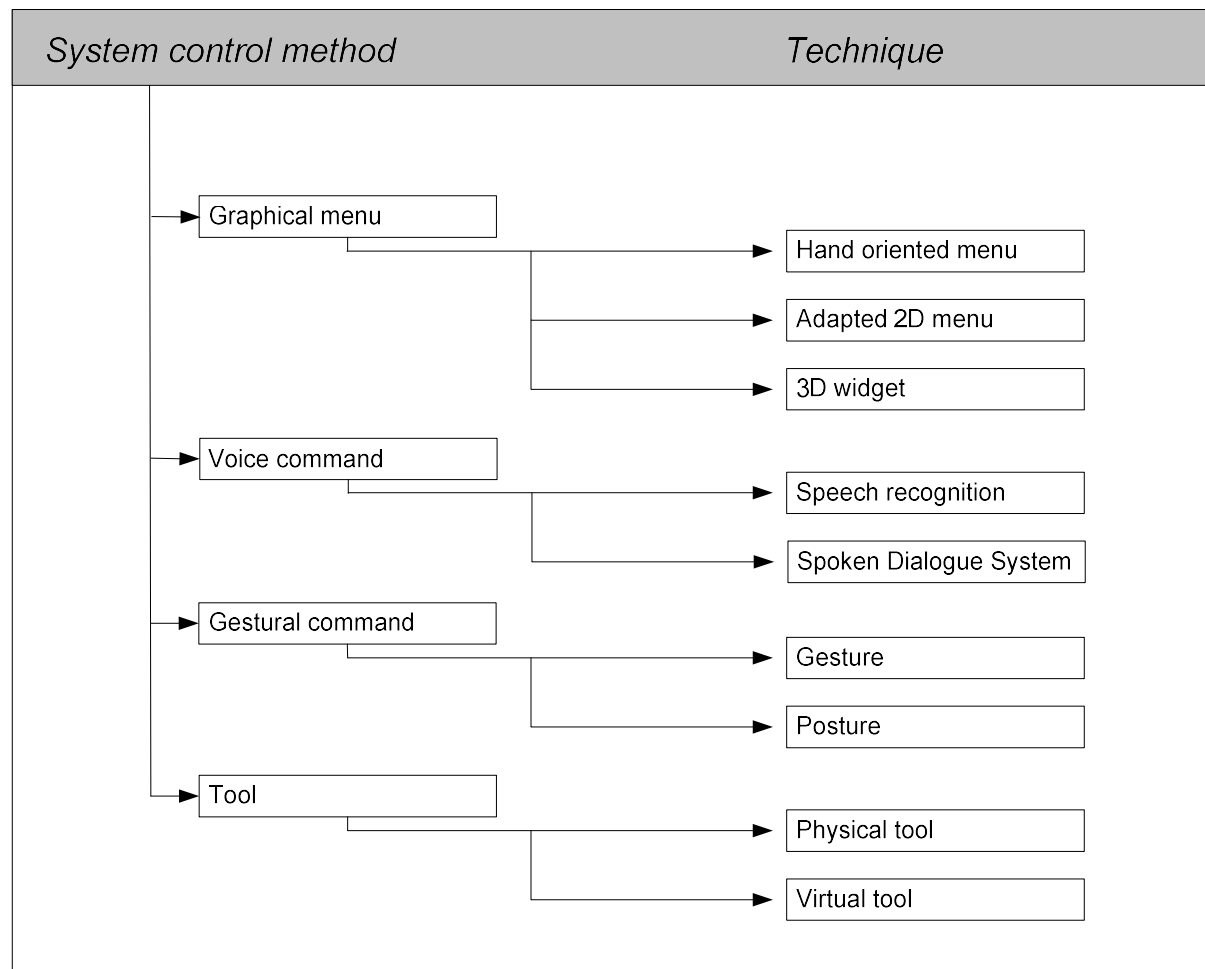
# Universal 3D Interaction Tasks

- Selection
- Manipulation
- Navigation
- **System control**
- Symbolic input

# System Control

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

# Classification

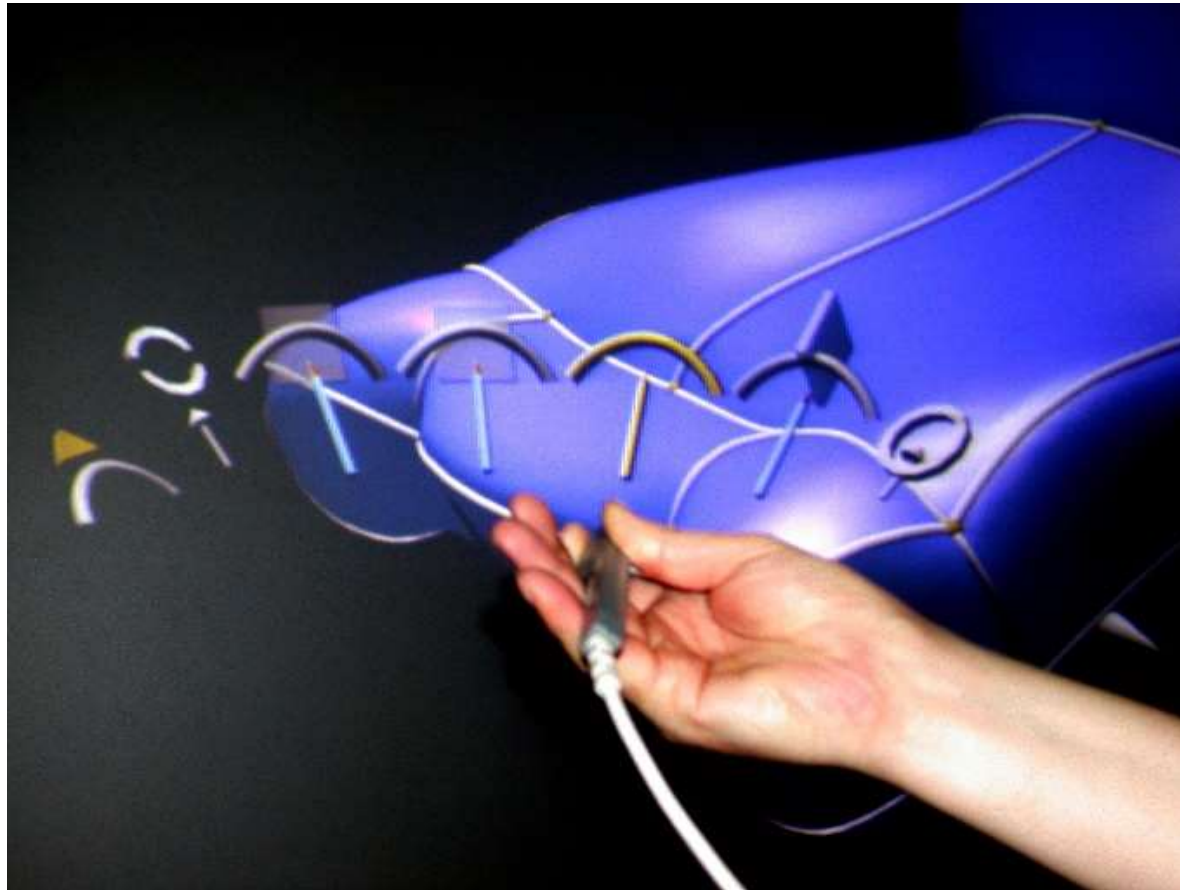




# Graphical Menus – Adapted 2D Menus

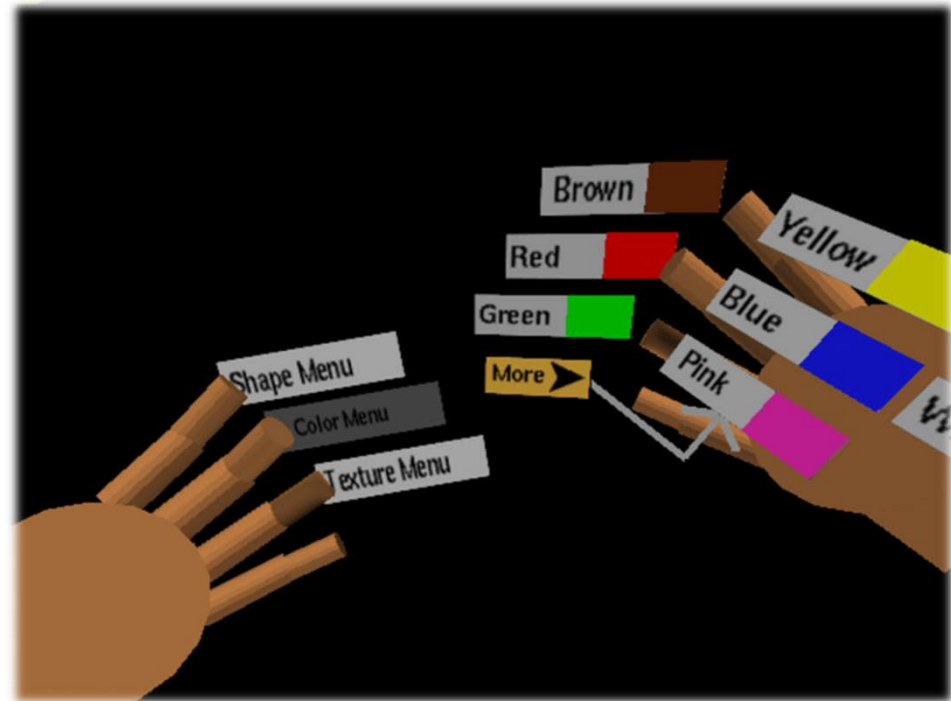


# Graphical Menus – 1-DOF Menus



# Graphical Menus – TULIP

- Uses pinch gloves
- Limited to 16 menu items
  - 8 per hand
- More than 16 menu items possible with “more” option on pinky finger

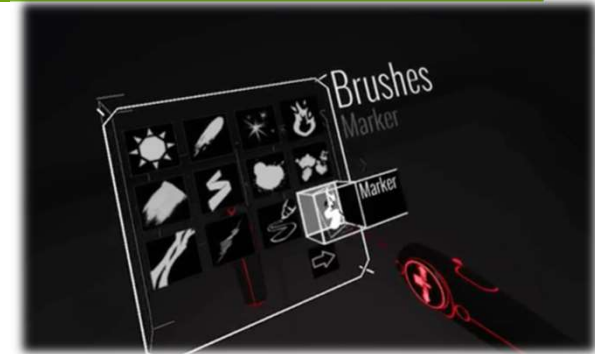


*Bowman, Wingrave 2001*

# Arm Widget for Leap Motion



# Controller-Space Widgets in Tilt Brush



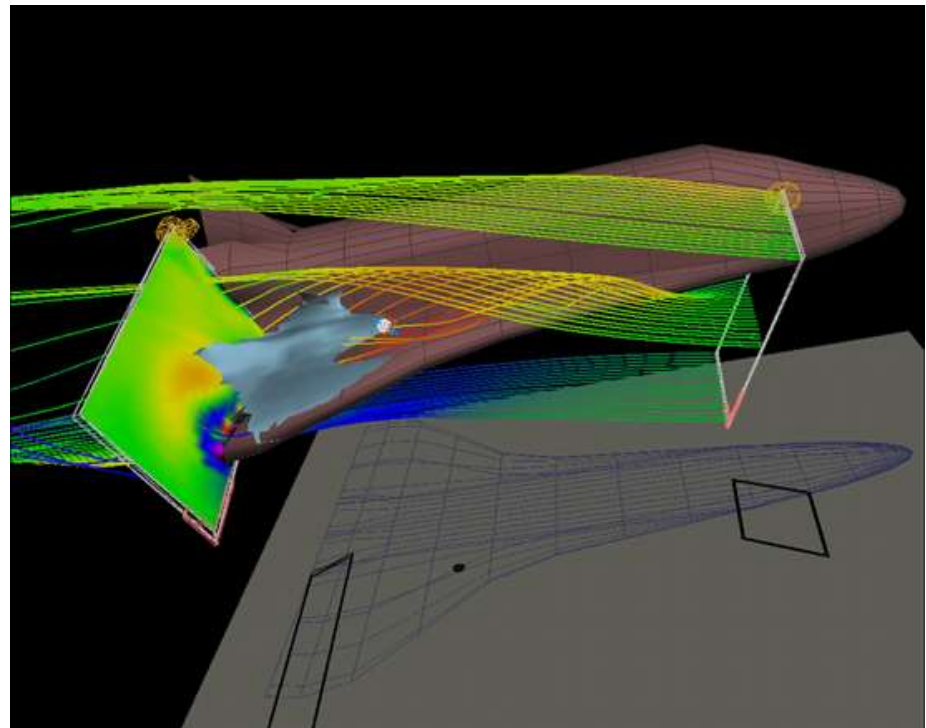
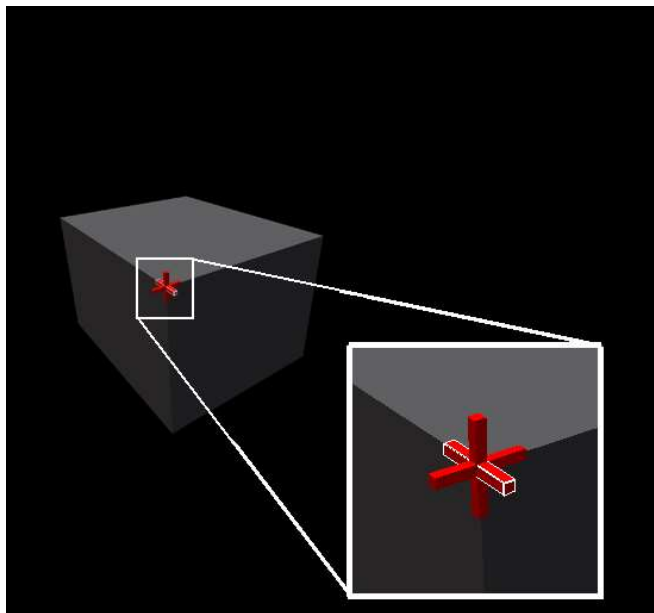
# Hovercast VR Menu (2015)



# Oculus Dash



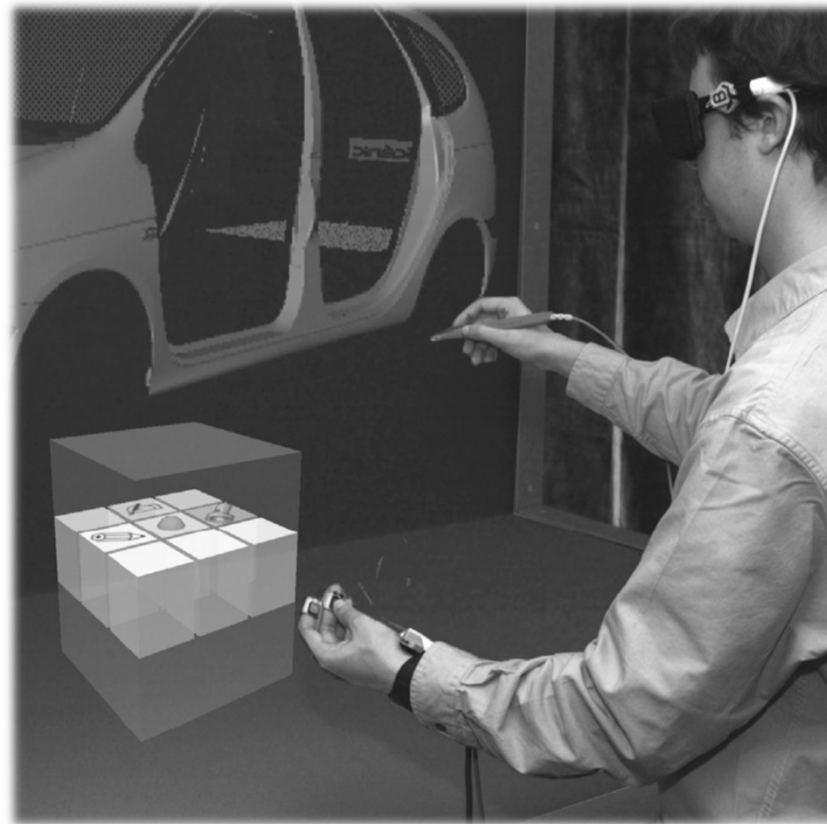
# Graphical Menus – 3D Widgets (1)





# Graphical Menus – 3D Widgets (2)

## Command and Control Cube



*Grosjean, Coquillart 2001*

# 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
  - 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



# Speech Recognition

- Natural language processing
- For example: Microsoft Cortana API

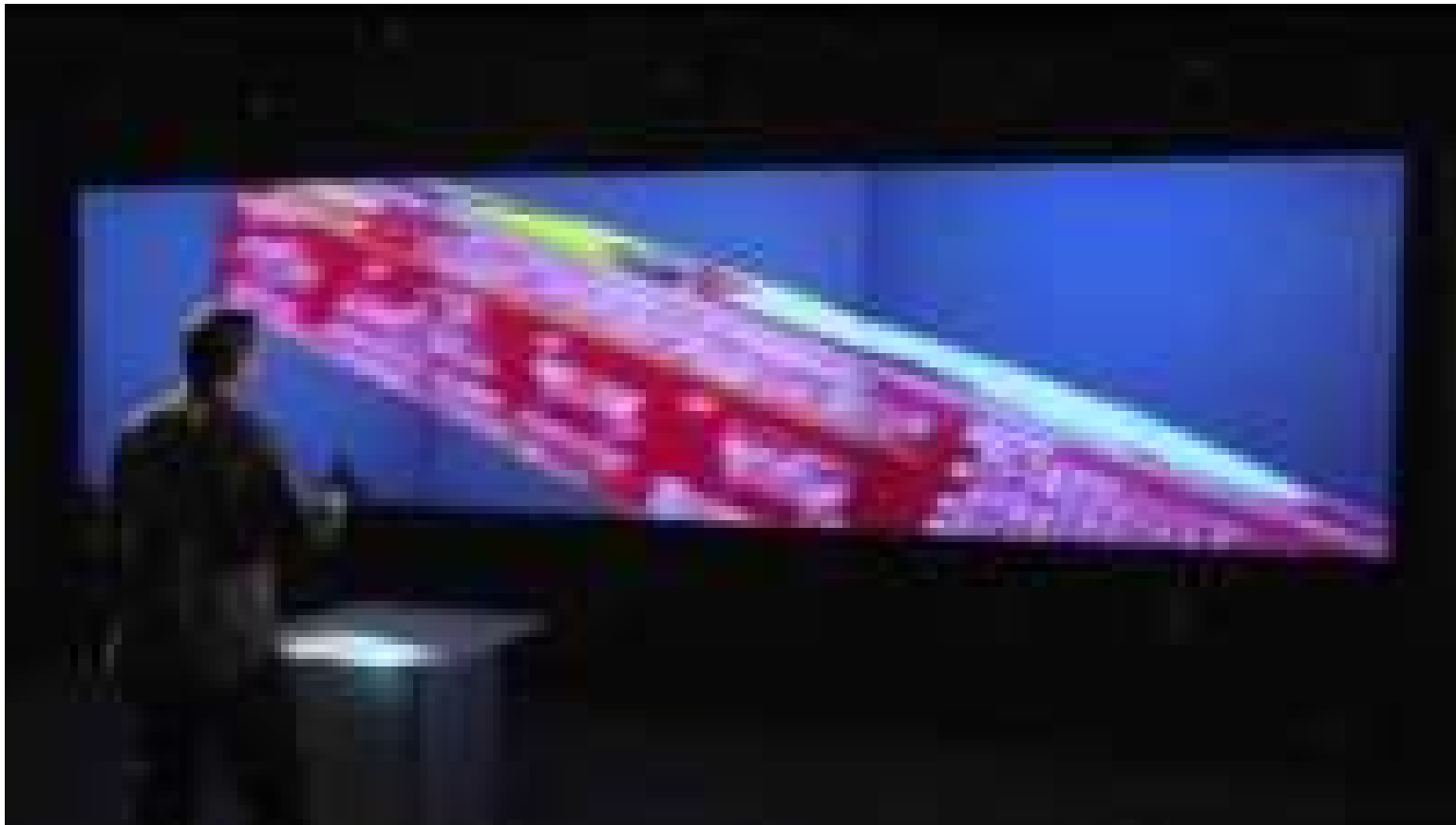


# Gesture Command Types

- Speech connected gestures: spontaneous gesticulation while talking
- Mimic gestures: directly describe a concept
- Symbolic: e.g., thumbs up
- Sign language: artificial vocabulary



# Oblong Industries: G-Speak



# Holotouch File Browser





# Tools

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



*CavePainting  
(Keefe 2001)*

# Virtual Tool belt

- Rendered in user space around waist
- Doesn't block the view
- User looks down to see items
- Supports proprioception: with practice user will find menu items without looking down



# Tangible User Interfaces



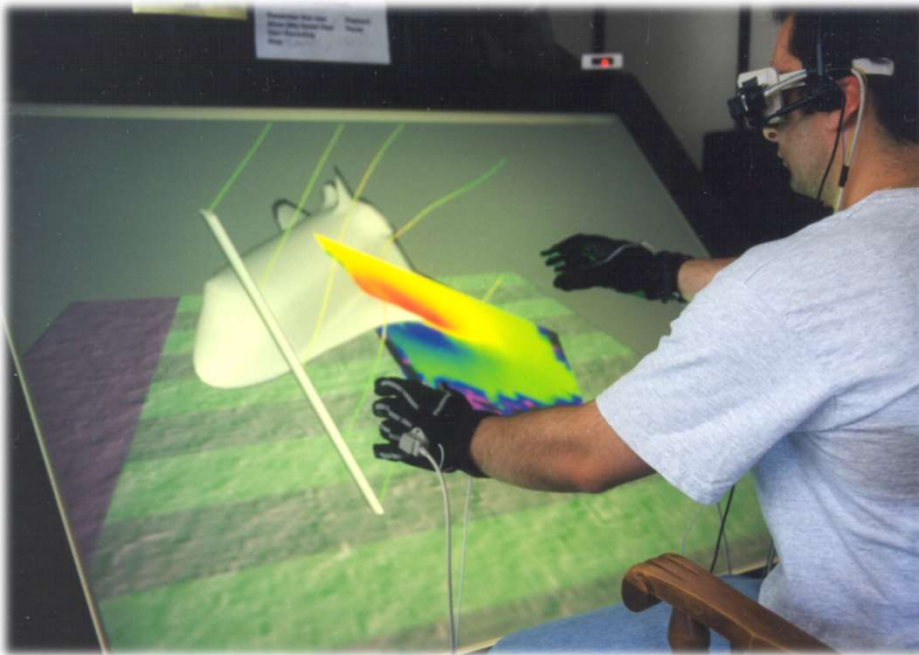
*Retractable*



# Multimodal System Control

- More than one input modality (speech, gesture, facial expression, etc...)
- Allows decoupling of interaction modes
  - Avoids switching between, e.g., navigation and other interaction mode
- Reduces errors through redundant input
- Flexibility through complementary behavior

# Multimodal Interaction



*Hand gestures and speech [Van Dam et al. 2000]*