COMPSCI 705 - SOFTENG 702 Lecture 3

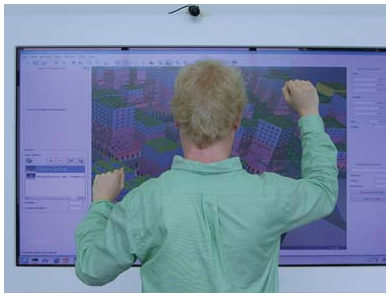
Gesture-based User Interfaces

Motivation?

- Mouse is fastest interaction device
- So why gestures?
  - Natural and intuitive communication
  - Expressive communication
  - 'Clean' communication
  - Overcoming physical handicaps
  - Human-robot interactions
  - Adjunct to speech
  - ???

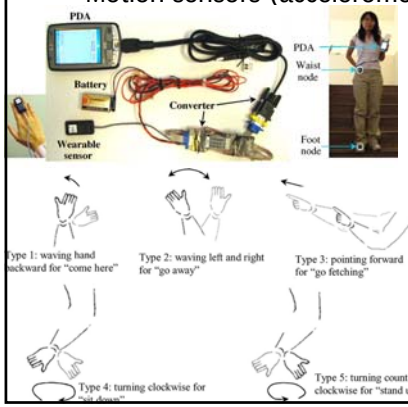
Examples

- Kinect hacks
- 3D modelling in space



Sensor-based gestures

- Motion sensors (accelerometers)



TimeTilt

Video/Vision-based gestures

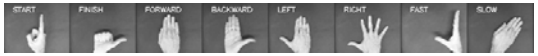
- Non-intrusive (?) gesture recognition
- Consider costs vs benefits

Costs/Benefits

- Price
  - Better cameras and shutter speed yield better performance
  - Stereo cameras required
  - Use of flashing IR LED illuminators
- Responsiveness
  - Real-time gesture recognition
  - Up to 45ms experienced as no delay
  - At 300ms the system feels sluggish

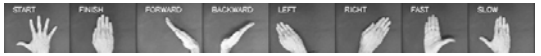
Costs/Benefits

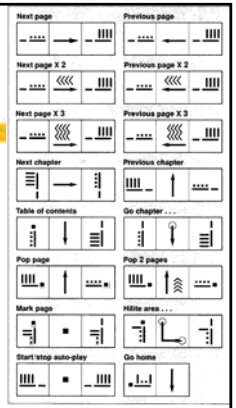
- User adaptability and feedback
  - Fixed palette of gestures, or adapt during use
- Learnability
  - Learning rate and memorability for users
  - Performance versus gesture set size
- Accuracy
  - Hand within the camera view, moving, occluded, shape, colour
  - Gestures designed for camera accuracy versus intuitive



Costs/Benefits

- Low mental load
  - Recalling gestures and trajectory adds to load
  - Short and natural gestures
- Intuitiveness
  - Clear cognitive association with task
  - No complex shapes and unnatural combinations
  - Tied to cultural background, no commonality





- Comfort
  - Avoid requiring intense muscle tension - “Gorilla Arm” syndrome
  - No awkward repetitive gestures

Concepts and Colors

8% of men and 1% of women are color blind

Green	%	Red	%	Yellow	%	Black	%	White	%
Safe	62.2	Hot	31.1	Caution	44.8	Off	53.5	Cold	71.5
Go	44.7	Danger	64.7						
On	22.3	Stop	48.5						

% of Hong Kong Chinese who associate particular concepts and colors (Courtney 86)

Green	%	Red	%	Yellow	%	Blue	%
Safe	61.4	Hot	94.5	Caution	81.1	Cold	96.1
Go	99.2	Danger	89.8			Off	31.5
		Stop	100				

% of Americans who associate particular concepts and colors (Bergum&Bergum 81)

Costs/Benefits

- Lexicon size and multi-hand systems
  - Single hand, dual hand, arm, body, ???
  - Recogniser for small # of gestures is best
- Come as you are
  - How encumbered can the user be, and in what environment
  - Impact on setup time
  - IR for near, far, ultrasonic, other imagers?
- Reconfigurability
  - Not providing a huge palette to start, but modifying the palette
  - Modify palette for different tasks

Multi-touch with Kinect

Costs/Benefits

- Interaction space
  - Where can gestures be recognised (virtual interaction envelope)
  - Stereo vision is best, but possible for mobile platforms?
- Gesture spotting and the immersion syndrome
  - Unintended movement recognition (Midas Touch problem)
  - Cue selection approaches (voice, buttons, gestures, ?)

Multimodal Pizza Ordering System

- Ubiquity and wearability
  - Small sensors and cameras placed where on the body?

Systems and Toolkits

- OpenNI (Open Natural Interaction)
  - http://www.openni.org/
- GART (Gesture and Activity Recognition Toolkit)
  - https://wiki.cc.gatech.edu/ccg/projects/gt2k/gt2k
- Kinect

- Wii

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