Week 7

Designing User Interface
(Part 2)

Appliances

- Everyday devices in home, public places, or car
  - For example, washing machines, remotes, toasters, printers, and navigation systems)
- And personal devices
  - For instance, digital clock and digital camera
- Used for short periods
  - For example, starting the washing machine, watching a program, buying a ticket, changing the time, or taking a snapshot
- Need to be usable with minimal, if any, learning

Simple toaster control

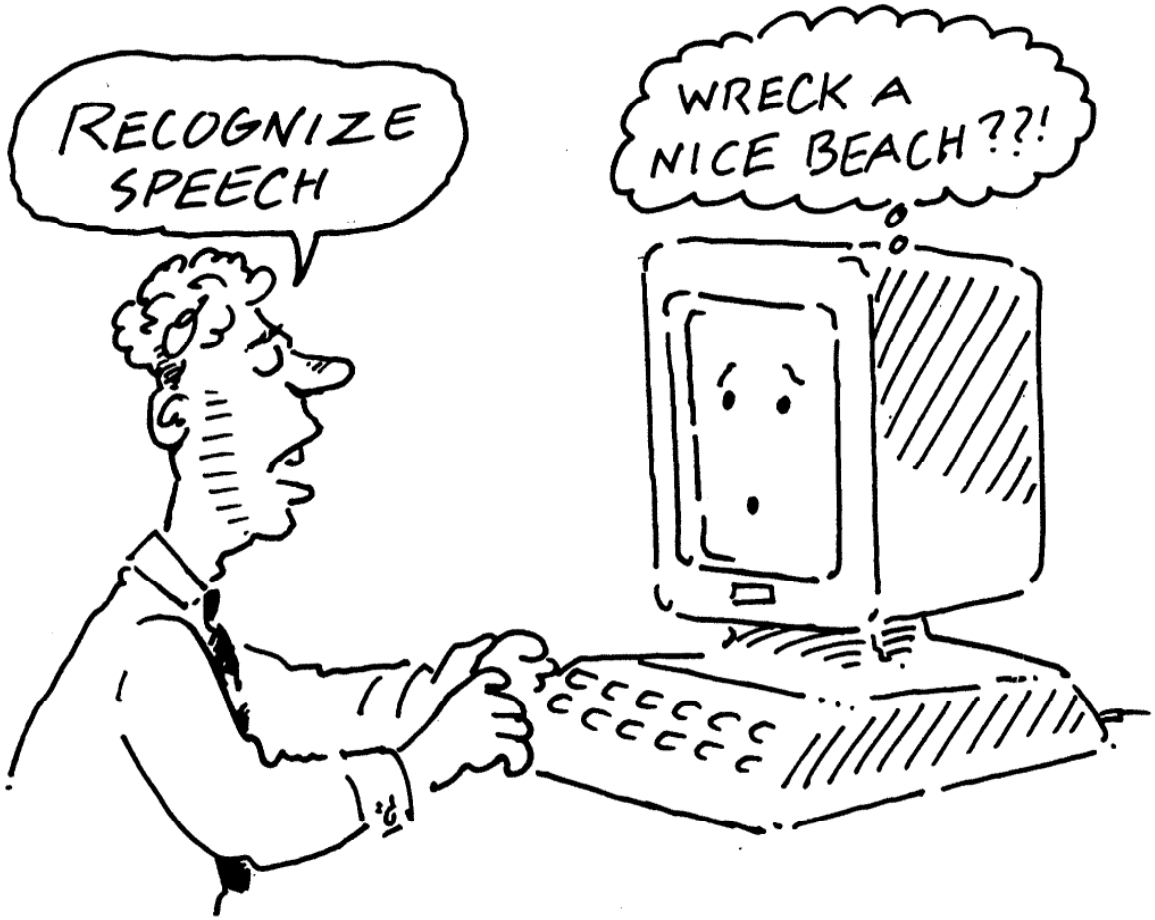
Research and design considerations

- Need to design as transient interfaces with short interactions
- Simple interfaces
- Consider trade-off between soft and hard controls
  - For example, use of buttons or keys, dials, or scrolling

Voice User Interfaces

- Involves a person talking with a spoken language app, for example, timetable, travel planner, or phone service
- Used most for inquiring about specific information, for example, flight times or to perform a transaction, such as buying a ticket
- Also used by people with visual impairments
  - For example, speech recognition word processors, page scanners, web readers, and home control systems

Have speech interfaces come of age?



Modeling human conversations

- People often interrupt each other in a conversation
  - Especially when ordering in a restaurant, rather than let the waiter go through all of the options
- Speech technology has a similar feature called ‘barge-in’
  - Users can choose an option before the system has finished listing all of the options available

Structuring VUI dialogs

- Directed dialogs are where the system is in control of the conversation
  - Where it asks specific questions and requires specific responses
- More flexible systems allow the user to take the initiative:
  - For example, “I’d like to go to Paris next Monday for two weeks.”
- But more chance of error, since caller might assume that the system is like a human
- Guided prompts can help callers back on track
  - For example, “Sorry I did not get all that. Did you say you wanted to fly next Monday?”

Voice assistants (for example, Alexa)

- Have become popular in many homes
- Allow all to use rather than being single use
- Support families playing games, interactive storytelling, jokes, and so forth
- Can encourage social and emotional bonding
- Young children (under 4), however, find it difficult to be understood by the voice assistants
  - Frustrating for them

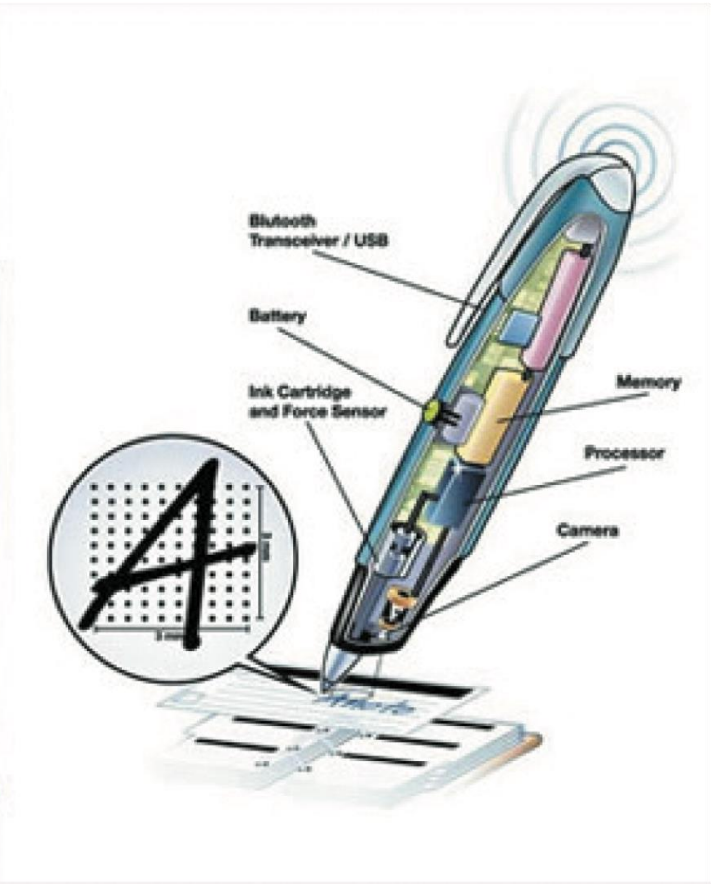
Research and design considerations

- How to design systems that can keep conversation on track
  - Help people navigate efficiently through a menu system
  - Enable them to recover easily from errors
  - Guide those who are vague or ambiguous in their requests for information or services
- Type of voice actor (for example, male, female, neutral, or dialect)
  - Do people prefer to listen to and are more patient with a female or male voice, a northern or southern accent?

Pen-based devices

- Enable people to write, draw, select, and move objects at an interface using light pens or styluses
  - Capitalize on the well-honed drawing skills developed from childhood
- Digital ink, for example, Anoto, use a combination of ordinary ink pen with digital camera that digitally records everything written with the pen on special paper

The Anoto pen being used and its internal components



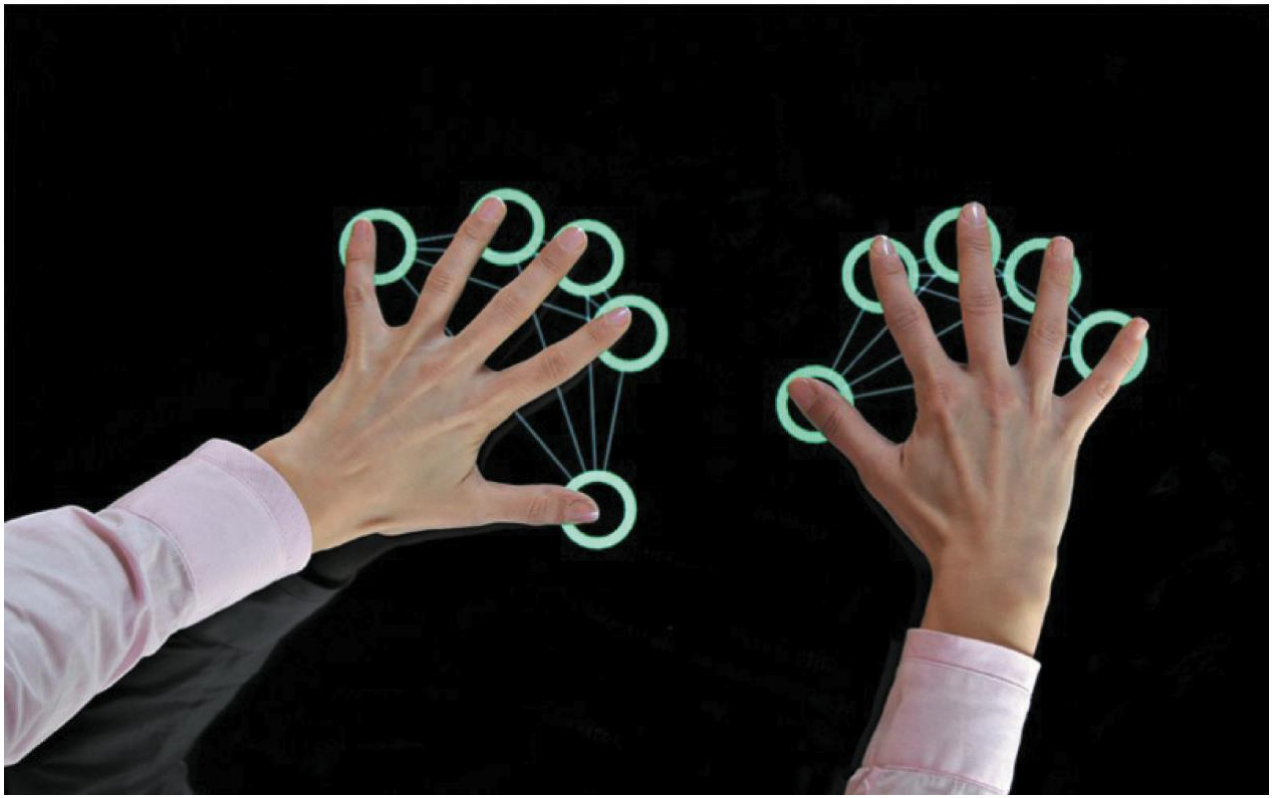
Advantages

- Allows users to annotate existing documents quickly and easily
- Can be used to fill in paper-based forms that can readily be converted to a digital record using standard typeface
- Can be used by remote teams to communicate and work on the same documents

Touchscreens

- Single touchscreens are used in walk-up kiosks (such as ticket machines and ATMs) to detect the presence and location of a person's touch on the display
- Multi-touch surfaces support a range of more dynamic finger tip actions, for example, swiping, flicking, pinching, pushing, and tapping
- They do so by registering touches at multiple locations using a grid
- Now used for many kinds of displays, such as smartphones, iPods, tablets, and tabletops
  - Supports one and two hand gestures, including tapping, zooming, stretching, flicking, dwelling, and dragging

A multi-touch surface



Research and design considerations

- Provides fluid and direct styles of interaction involving freehand and pen-based gestures for certain tasks
- Core design concerns include whether size, orientation, and shape of touch displays effect collaboration
- Much faster to scroll through wheels, carousels, and bars of thumbnail images or lists of options by finger flicking
- Gestures need to be learned for multi-touch, so a small set of gestures for common commands is preferable
- More cumbersome, error-prone, and slower to type using a virtual keyboard on a touch display than using a physical keyboard

Gesture-based systems

- Gestures involve moving arms and hands to communicate
- Uses camera recognition, sensor, and computer vision techniques
  - Recognize people's arm and hand gestures in a room
  - Gestures need to be presented sequentially to be understood (compare with the way sentences are constructed)

Gestures used in the operating theater

Recognizes core gestures for manipulating MRI or CT images using Microsoft Kinect

Research and design considerations

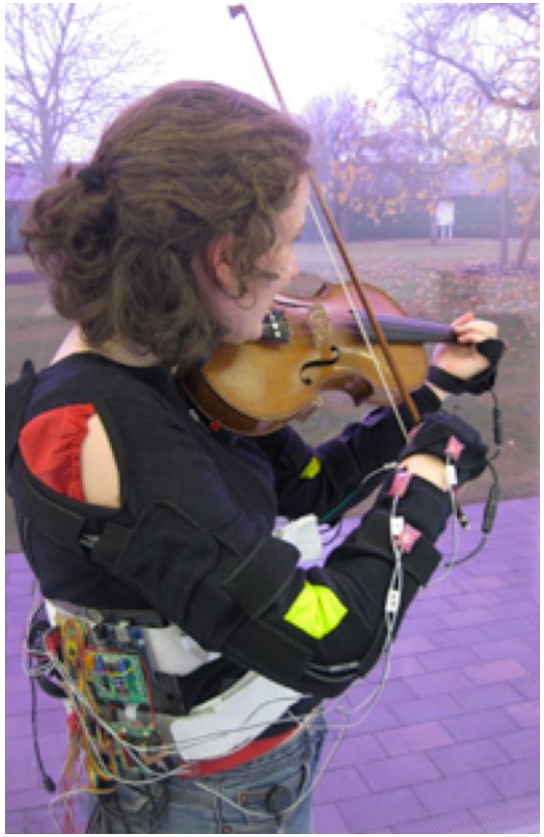
- How does computer recognize and delineate user's gestures?
  - Start and end points?
  - Difference between deictic and hand waving
- How realistic must the mirrored graphical representation of the user be in order for them to be believable?

Haptic interfaces

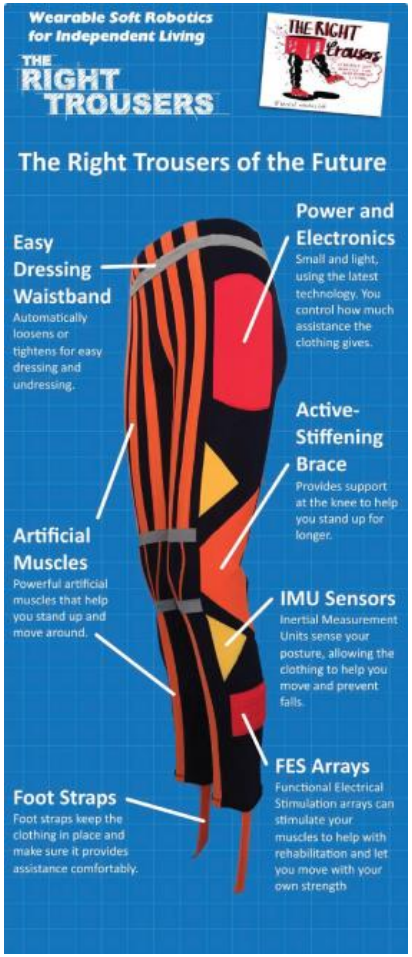
- Provide tactile feedback
  - By applying vibration and forces to a person's body, using actuators that are embedded in their clothing or a device they are carrying, such as a smartphone
- Vibrotactile feedback can be used to simulate the sense of touch between remote people who want to communicate
- Ultrahaptics creates the illusion of touch in midair using ultrasound to make the illusion of 3D shapes

Realtime vibrotactile feedback

- Provides nudges when playing violin incorrectly
- Uses motion capture to sense arm movements that deviate from model
- Nudges are short vibrations on arms and hands



Exoskeleton with artificial muscles that uses bubble haptic feedback



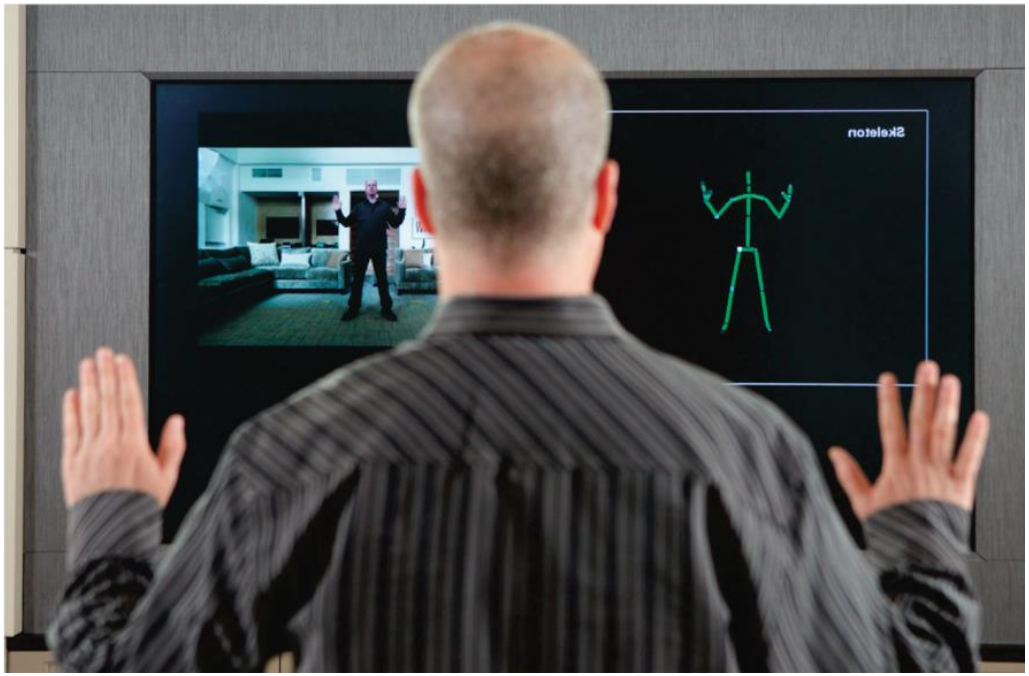
Research and design considerations

- Where best to place actuators on body
- Whether to use single or sequence of ‘touches’
- When to buzz and how intense
- How does the wearer feel it in different contexts?
- What kind of new smartphone/smartwatch apps can use vibrotactile creatively?
  - For example, slow tapping to feel like water drops meant to indicate that it is about to rain, and heavy tapping to indicate a thunderstorm is looming

Multimodal Interfaces

- Provide enriched user experiences
  - By multiplying how information is experienced and detected using different modalities, such as touch, sight, sound, and speech
  - Support more flexible, efficient, and expressive means of human-computer interaction
  - Most common is speech and vision
- Can be combined with multi-sensor input to enable other aspects of the human body to be tracked
  - For example, eye gaze, facial expression, and lip movements
  - Provides input for customizing user interfaces

Tracking a person's movements



- Kinect camera can detect multimodal input in real time using RGA camera for facial recognition and gestures, depth camera for movement tracking, and microphones for voice recognition
- Used to build model of person and represented as avatar on display programmed to move just like them

Research and design considerations

- Need to recognize and analyze user behavior, for example, speech, gesture, handwriting, or eye gaze
- Much harder to calibrate these than single modality systems
- What is gained from combining different input and outputs
- Is talking and gesturing, as humans do with other humans, a natural way of interacting with a computer?

Shareable interfaces

Designed for more than one person to use:

- Provide multiple inputs and sometimes allow simultaneous input by co-located groups
- Large wall displays where people use their own pens or gestures
- Interactive tabletops where small groups interact with information using their fingertips
  - For example, DiamondTouch, Smart Table, and Surface