Week 8

Designing User Interface
(Part 3)

A smartboard and an interactive tabletop interface

(a)

(b)

Benefits

- Provide a large interactional space that can support flexible group working
- Can be used by multiple users
  - Can point to and touch information being displayed
  - Simultaneously view the interactions and have the same shared point of reference as others
- Can support more equitable participation compared with groups using single PC

Research and design considerations

- Core design concerns include whether size, orientation, and shape of the display have an effect on collaboration
- Horizontal surfaces compared with vertical ones support more turn-taking and collaborative working in co-located groups
- Providing larger-sized tabletops does not improve group working but encourages more division of labor
- Having both personal and shared spaces enables groups to work on their own and in a group
  - Cross-device systems have been developed to support seamless switching between these, for example, SurfaceConstellations

Tangible Interfaces

- Type of sensor-based interaction, where physical objects, for example, bricks, are coupled with digital representations
- When a person manipulates the physical object/s, it causes a digital effect to occur, for example, an animation
- Digital effects can take place in a number of media and places, or they can be embedded in the physical object

Examples

- Flow Blocks
  - Depict changing numbers and lights embedded in the blocks
  - Vary depending on how they are connected together
- Urp
  - Physical models of buildings moved around on tabletop
  - Used in combination with tokens for wind and shadows

    ⇒ Digital shadows surrounding them to change over time
- MagicCubes
  - Connect physical electronic components and sensors to make digital events occur (for example, change color depending on how much shaken)

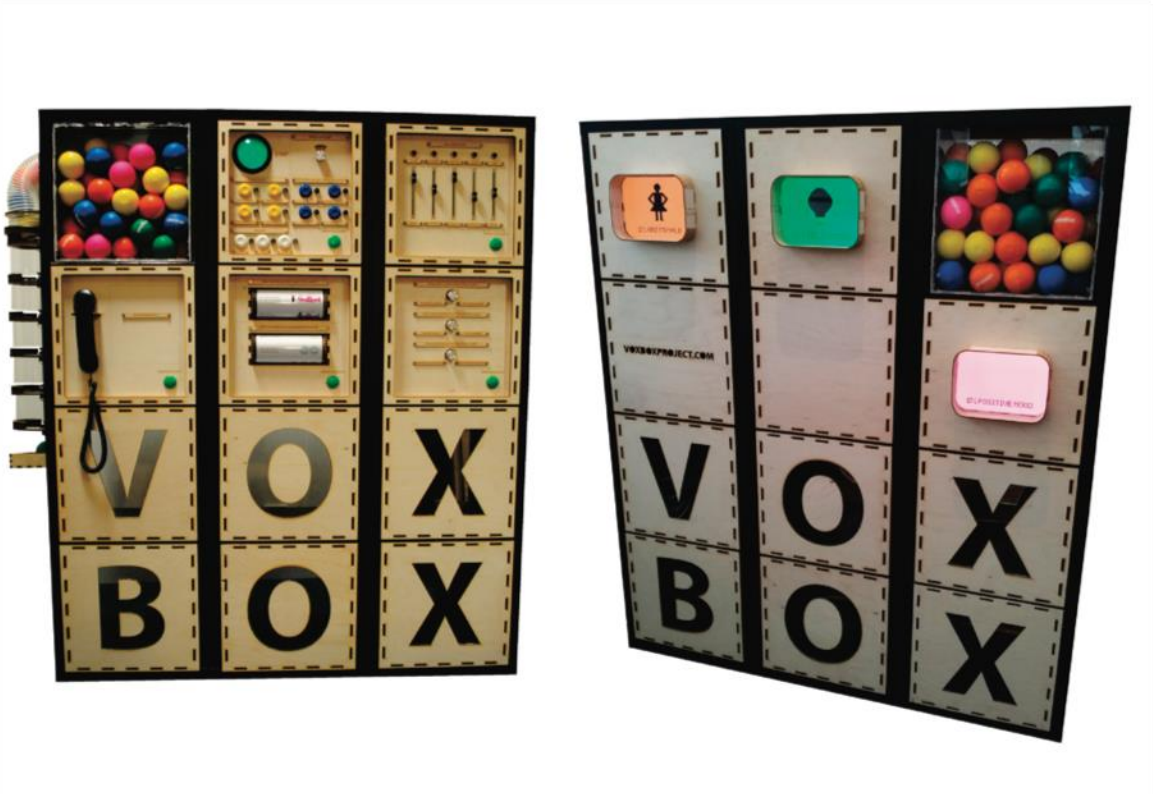
Learning to code and create with the tangible MagicCubes

Benefits

- Can be held in one or both hands and combined and manipulated in ways not possible using other interfaces
  - Allows for more than one person to explore the interface together
  - Objects can be placed on top of each other, beside each other, and inside each other
  - Encourages different ways of representing and exploring a problem space
- People are able to see and understand situations differently
  - Can lead to greater insight, learning, and problem-solving than with other kinds of interfaces
  - Can facilitate creativity and reflection

VoxBox

A tangible system that gathers opinions at events through playful and engaging interaction (Goldsteijn et al., 2015)



Research and design considerations

- What kinds of conceptual frameworks to use to help identify novel and specific features
- What kind of coupling to use between the physical action and digital effect
  - If it is to support learning, then an explicit mapping between action and effect is critical
  - If it is for entertainment, then it can be better to design it to be more implicit and unexpected
- What kind of physical artifact to use
  - Bricks, cubes, and other component sets are most commonly used because of flexibility and simplicity
  - Stickies and cardboard tokens can also be used for placing material onto a surface
- With what kinds of digital outputs should tangible interfaces be combined?

Augmented Reality

- Augmented reality: Virtual representations are superimposed on physical devices and objects
- Pokémon Go made it a household game
  - Used smartphone camera and GPS to place virtual characters onto objects in the environment as if they really are there
- Many other applications including medicine, navigation, air traffic control, games, and everyday exploring

Other examples

In medicine

- Virtual objects, for example, x-rays and scans, are overlaid on part of a patient's body
- Aid the physician's understanding of what is being examined or operated

In air traffic control

- Dynamic information about aircraft overlaid on a video screen showing the real planes, and so on landing, taking off, and taxiing
- Helps identify planes difficult to make out

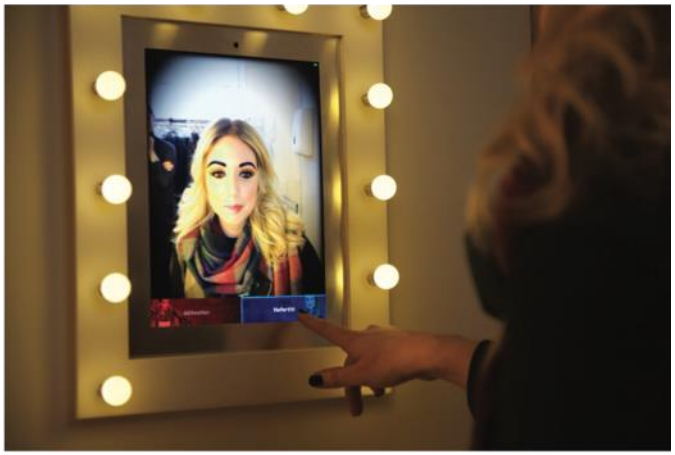
Augmented reality overlay on a car windshield

AR that uses forward facing camera

- Enables virtual try-ons (for example, Snapchat filters)
- AT mirrors set up in retail stores for trying on make-up, sunglasses, jewelry
  - Convenient, engaging, and easy to compare more choices
  - But cannot feel the weight, texture, or smell of what is being tried on
- Can be used to enable users to step into a character (for example, David Bowie, Queen Victoria)

Singers trying on the virtual look of two characters from the opera Akhnaten

(a)



(b)

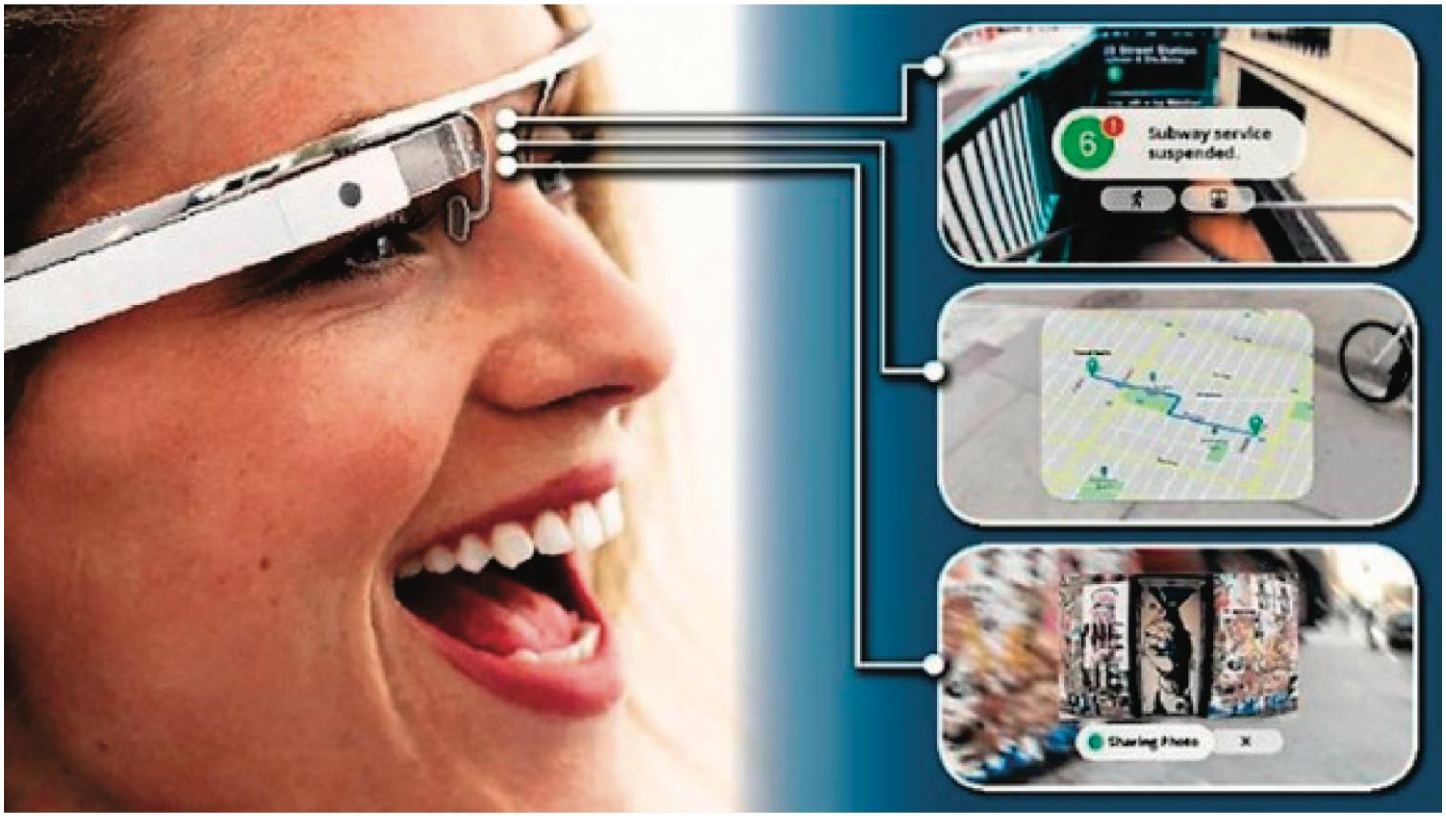
Research and design considerations

- What kind of digital augmentation?
  - When and where in physical environment?
  - Needs to stand out but not distract from ongoing task
  - Needs to be able to align with real world objects
  - What happens if the AR is slightly off?
- What kind of device?
  - Smartphone, tablet, head up display or other?

Wearables

- First developments were head- and eyewear-mounted cameras that enabled user to record what was seen and to access digital information
- Since then, jewelry, head-mounted caps, smart fabrics, glasses, shoes, and jackets have all been used
  - Provides the user with a means of interacting with digital information while on the move
- Applications include automatic diaries, tour guides, cycle indicators, and fashion clothing

Google Glass (2014)



Why was there so much excitement and concern about people filming what they could see right in front of them?

Research and design considerations

- Comfort
  - Needs to be light, small, not get in the way, fashionable, and preferably hidden in the clothing
- Hygiene
  - Is it possible to wash or clean the clothing once worn?
- Ease of wear
  - How easy is it to remove the electronic gadgetry and replace it?
- Usability
  - How does the user control the devices that are embedded in the clothing?

Robots

Main types

- Remote robots used in hazardous settings
  - Can be controlled to investigate bombs and other dangerous materials
- Domestic robots helping around the house
  - Can pick up objects and do daily chores like vacuuming
- Pet robots as human companions
  - Have therapeutic qualities, helping to reduce stress and loneliness
- Sociable robots that work collaboratively with humans
  - Encourage social behaviors

Social robots: Mel and Paro

- Cute and cuddly
- Can open and close eyes and make sounds and movements

Source: Images courtesy of Mitsubishi Electric Research Labs.

Drones

- Unmanned aircraft that are controlled remotely and used in a number of contexts
  - For example, entertainment, such as carrying drinks and food to people at festivals and parties
  - Agricultural applications, such as flying them over vineyards and fields to collect data about crops, which is useful to farmers
  - Helping to track poachers in wildlife parks in Africa
- Can fly low and and stream photos to a ground station where images can be stitched together into maps
- Can be used to determine the health of a crop, or when it is the best time to harvest the crop

Drone being used to survey the state of a vineyard

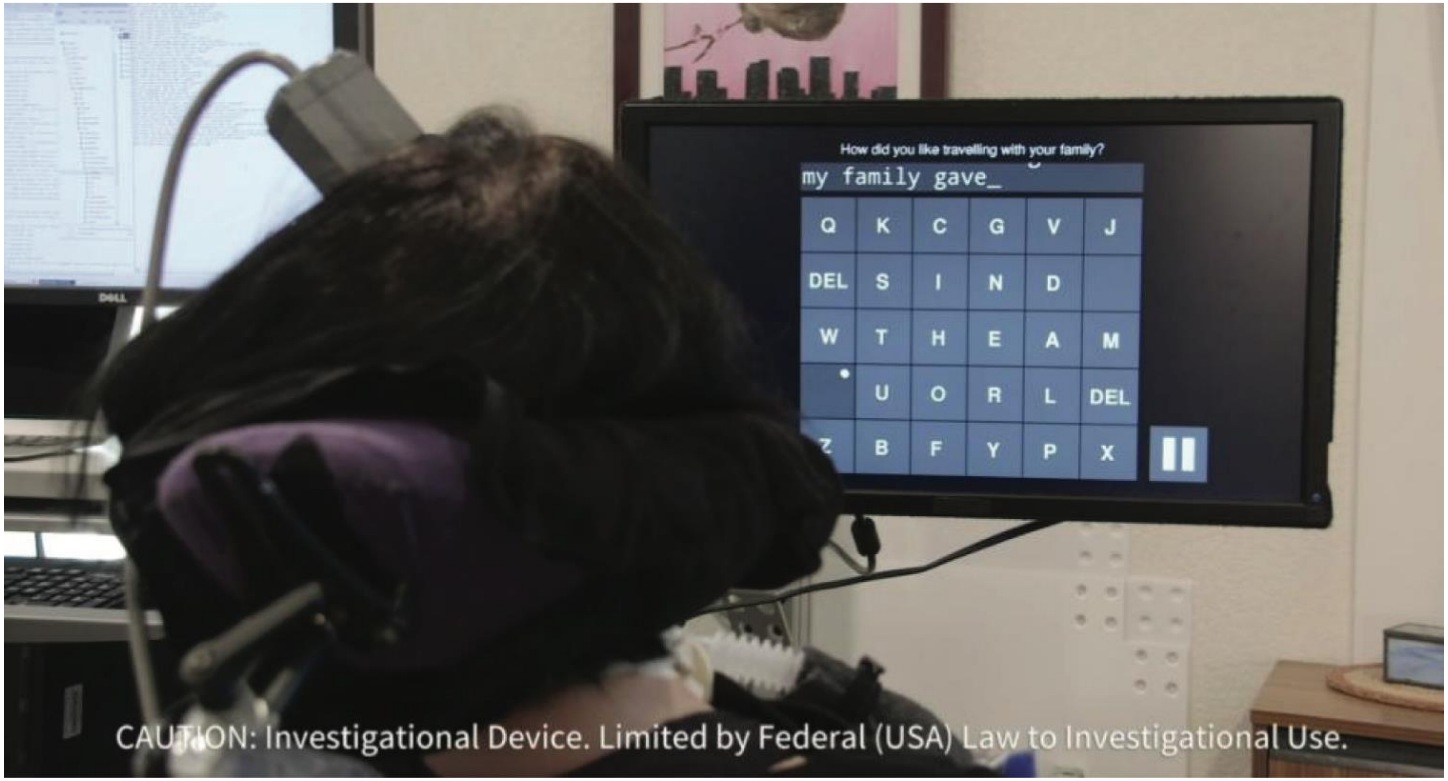
Research and design considerations

- How do humans react to physical robots designed to exhibit behaviors (for example, making facial expressions) compared with virtual ones?
- Should robots be designed to be human-like or look like and behave like robots that serve a clearly-defined purpose?
- Should the interaction be designed to enable people to interact with the robot as if it was another human being or more human-computer-like (for example, pressing buttons to issue commands)?
- Is it acceptable to use unmanned drones to take a series of images or videos of fields, towns, and private property without permission or people knowing what is happening?

Brain-computer interfaces

- Brain-computer interfaces (BCI) provide a communication pathway between a person's brain waves and an external device, such as a cursor on a screen
- Person is trained to concentrate on the task, for example, moving the cursor
- BCIs work through detecting changes in the neural functioning in the brain
- BCIs apps:
  - Games (for example, Brain Ball)
  - Enable people who are paralyzed to control robots

A brain-computer interface being used by a woman who is paralyzed to select letters on the screen



Smart interfaces

- Smart: phones, speakers, watches, cars, buildings, cites
- Smart refers to having some intelligence and connected to the internet and other devices
- Context-aware
  - Understand what is happening around them and execute appropriate actions, for example, a Nest thermostat
- Human-building interaction
  - Buildings are designed to sense and act on behalf of the inhabitants but also allow them to have some control and interaction with the automated systems

Which interface?

- Which interface to use will depend on task, users, context, cost, robustness, and so on
- Is multimedia better than tangible interfaces for learning?
- Is speech as effective as a command-based interface?
- Is a multimodal interface more effective than a mono-modal interface?
- Will wearable interfaces be better than mobile interfaces for helping people to find information in foreign cities?
- Are virtual environments the ultimate interface for playing games?
- Are shareable interfaces better at supporting communication and collaboration compared with using networked desktop PCs?

Summary

- Many innovative interfaces have emerged in last 30 years, including speech, wearable, mobile, brain, and tangible
- This raises many design and research questions as to decide which to use
  - For example, how best to represent information to the user so that they can carry out ongoing activity or task
- New smart interfaces that are context-aware and monitor people
  - Raising new ethical issues concerned with what data is being collected and what it is used for