Week 11-3
Interface and Interaction Types

SFWRENG 4HC3/6HC3 Human Computer Interfaces

** Slides adapted from previous and current instructors of COMPSCI/SFWRENG 4HC3/6HC3 (Danny Papagiannis, Geneva Smith)*

McMaster University

Week 11 Overview

- **Monday**
  - ~~Interface Implementations~~
- **Wednesday**
  - ~~Interface Design Patterns~~
  - ~~Interface Types~~
- **Friday**
  - **Interface Types**
  - **Interaction Types**

Interface Types: Overview

- ~~Command Line Interface~~
- ~~Graphical User Interface (GUI)~~
- Mobile Interface
- Touch/Multitouch Interface
- Gesture-based Interface
- Tangible Interface
- Voice User Interface
- Conversational Interface

NATURAL INTERFACE

- Wearable Interface
- Augmented Reality Interface (AR)
- Virtual Reality Interface (VR)
- Robots/Drones

Interface Type: Mobile

- Useful for users that need:
  - Real-time data or information while **moving around**
  - Contextual information (e.g., from QR codes in the physical space)
- Often have some sensors (e.g., accelerometer, gyroscope, LiDAR)

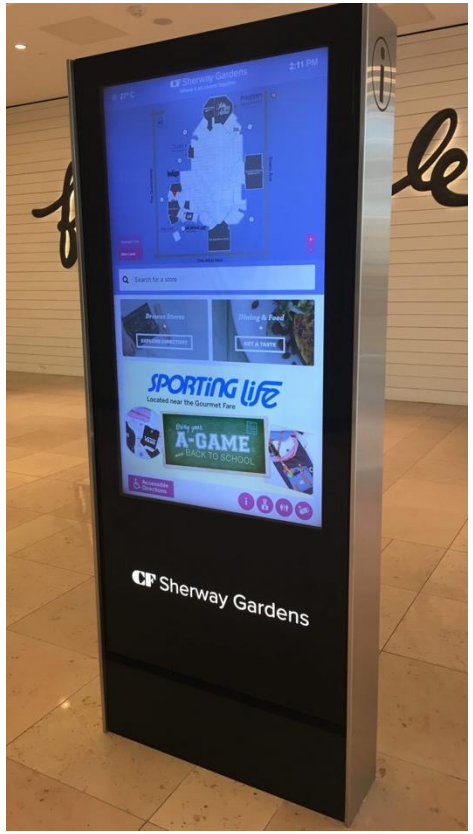
Interface Type: Mobile

Design Considerations

- **Small** screen, **limited** control and navigation space
- Size of “soft” controls (e.g., simulated buttons)
  - The average fingertip is 1–2 cm
  - 44px

Interface Type: Touch/Multitouch

- Detect presence and location of a person's touch on the display
- **Single-touch** is common in public spaces (e.g. walk-up kiosks)
- **Multitouch** is more flexible, common in smartphones and tablets



Map Kiosk

Interface Type: Touch/Multitouch

Design Considerations

- Strategies to best support different activities (e.g., using patterns like cards and carousels or menus for presenting options?)
- More feedback to compensate for **loss of tactile feedback** from physical input devices

Microsoft Surface Tabletop

Interface Type: Gesture

- Movement of **hands and arms** to communicate or provide information
- Current research into **tracking and analyzing** movement
- Gestures most understandable when done in sequences, like structuring sentences

Leap Motion

Interface Type: Gesture

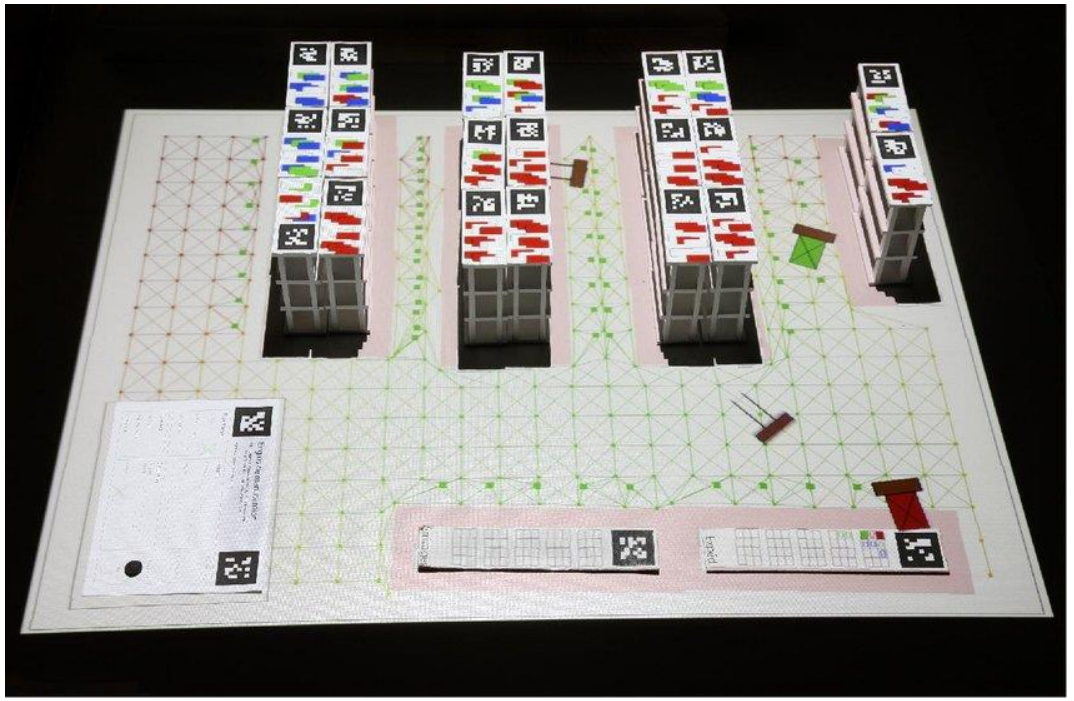
Design Considerations

- Recognizing and distinguishing gestures (e.g., when a gesture starts and ends)
- Realism of user representation for real-time avatar/their own body movements

Hand Gestures in Quest 3

Interface Type: Tangible (TUI)

- Sensor-based systems coupling **physical objects** with **digital representations**
- Interacting with the **physical object** causes something to happen to its **digital** counterpart
- Exploits physical object affordances to help users understand how to interact with it, also helpful for users with **visual impairments**

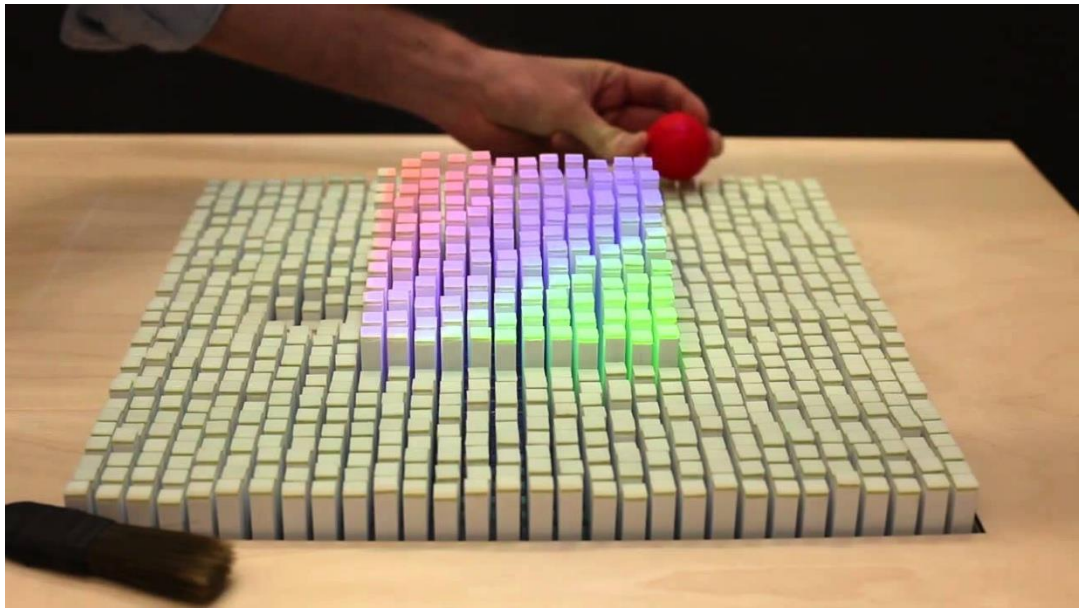


Tinkersheets

Interface Type: Tangible (TUI)

Design Considerations

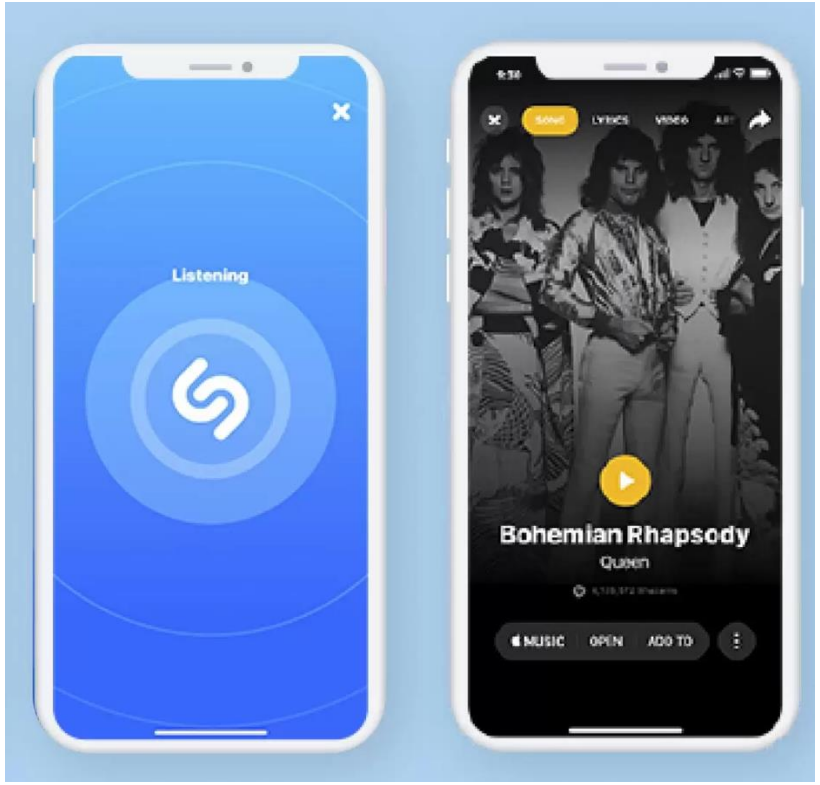
- Coupling between physical object and digital effect (e.g., feedback)
- Picking **physical objects** to best support the user's activity/task
- Output channel combinations



Shape-changing Tangible Display

Interface Type: Voice (VUI)

- Users talk to the system using **natural language**
- Common for asking about specific information and issuing commands
- Can be more efficient than typing for some users (e.g., children), helpful for visually impaired users

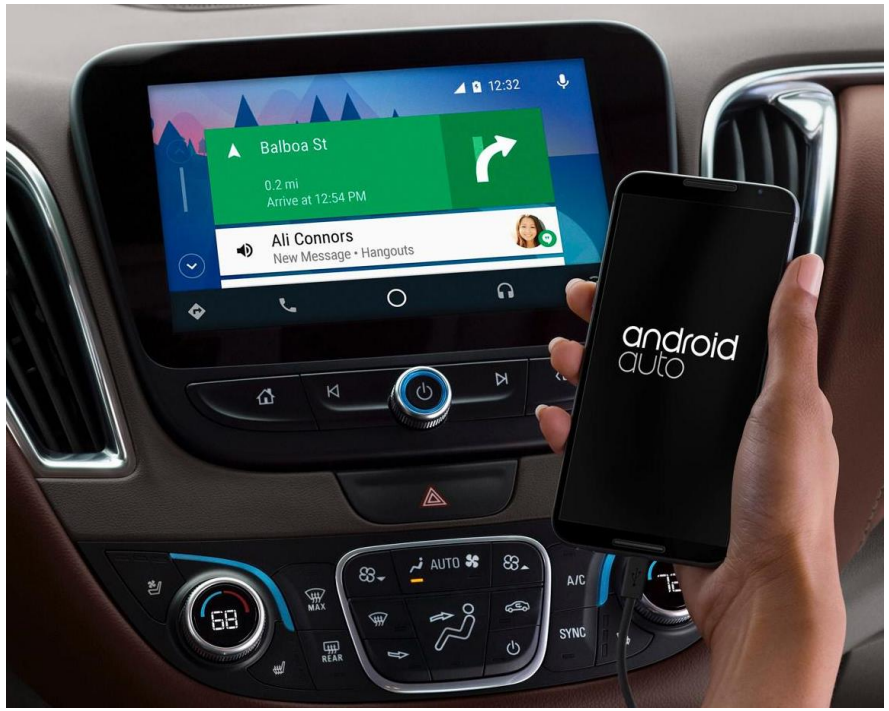


Shazam

Interface Type: Voice (VUI)

Design Considerations

- Accuracy of speech recognition
- Friendliness of system responses/output
- Expected system environment
- User interruptions
- Flexibility in dialogue structure



Android Auto

Interface Type: Conversational (CUI)

- Enables communication between users and computing systems **through natural language**
- Engage in a conversation with the system using spoken or **written language**
- Consider dialog management for conversation coherency and consistency

Lark, Digital Health Coach

Interface Type: Wearable

- Broad category of devices **worn on the body** (from watch to cloths)
- Commonly appears with **haptics**, lots of room to experiment with other interface combinations

Interface Type: Wearable

Design Considerations

- Will your users want to wear it?
- Is it comfortable to wear?
- Washing/cleaning
- How do users control the devices embedded in the wearable?

My Heart on My Dress

Interface Type: Augmented Reality (AR)

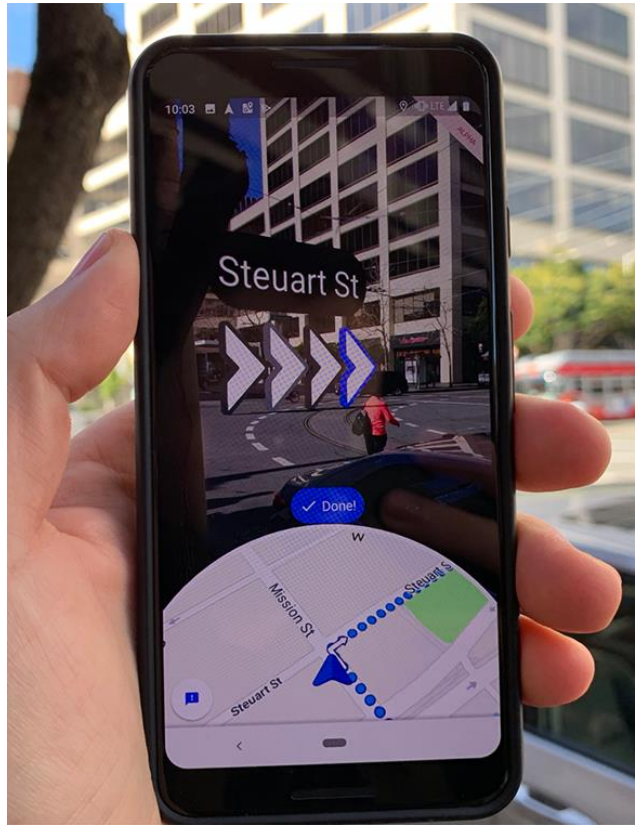
- Superimposing **digital elements onto physical devices and objects** (e.g., HUDs)
- Closely related to mixed reality (overlapping digital and real-world views)

Pokemon Go

Interface Type: Augmented Reality (AR)

Design Considerations

- Form and quantity of digital augmentation
- When and where it should appear in the physical environment
- Not distracting
- Tolerance for ambiguity and uncertainty



Google Map AR

Interface Type: Virtual Reality (VR)

- Focus on computer-generated graphical simulations that **“feel real”** when interacting with the environment
- Stereoscopic image displays, users interact via an input device
- Often combined with auditory and haptic feedback
- Can represent objects with a higher fidelity than other interfaces

Beat Saber

Interface Type: Virtual Reality (VR)

Design Considerations

- User discomfort (e.g., head-mounted displays, motion sickness, disorientation)
- Accuracy of head tracking
- Graphical realism (e.g., polygon style vs. others)

BBC Connect *We Wait*

Interface Type: Robots and Drones

Robots

- Help in manufacturing assembly lines, remote investigators, search and rescue, domestic chores, companionship
- Often controlled through console interfaces, focus on steering and moving

Bellabot

Interface Type: Robots and Drones

Drones

- Remotely controlled, unmanned aircraft
- Useful for exploration and data collection (e.g., emergency response)

DJI Mini 2 SE Camera Drone

Interface Type: Robots and Drones

Design Considerations

- Robots: Realism of human or animal-like behaviors
- Drones: Data collection and privacy, noise

Aibo

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Interaction Types: Overview

- Instructing
- Conversing
- Manipulating
- Exploring
- Responding

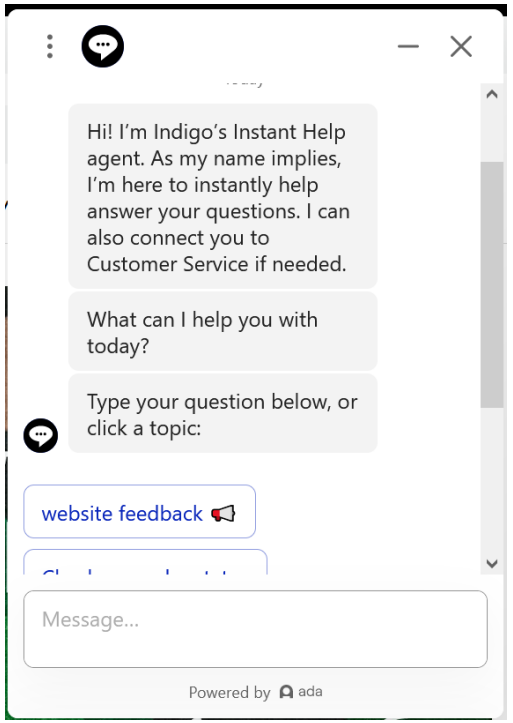
Focus on users‘ actions and help you think about how a user interact with the system or product

Interaction Type: Instructing

- Users **issue instructions** to the system via typed commands, selecting menu options, vocal commands, gestures, button combinations, etc. How we traditionally view interactions with machines
- System usually **completes and responds** to instructions in sequence
- Some benefits include **quick and efficient interactions**, particularly if users often need to repeat actions on multiple objects (e.g., saving, deleting, and organizing files)

Interaction Type: Conversing

- Users have a **dialogue/conversation** with the system (leverage's their experience of conversations with others)
- System designed **to respond like another person in the conversation**; behaves like a partner in a two-way communication process
- Users can ask questions via menu selections or typed/spoken commands and the system replies via speech and/or text
- Common for systems where users needs to find out specific information, wants to discuss issues



Customer Help

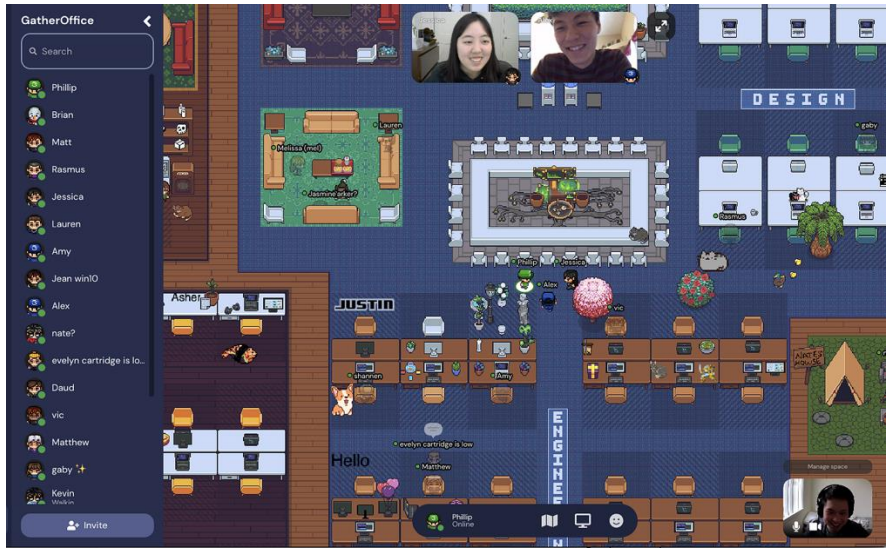
Interaction Type: Manipulating

- Users **interact with objects** in a virtual or physical space by manipulating them (e.g., holding, opening, closing, placing, selecting, zooming, stretching/shrinking)
  - Leverages their knowledge of how they interact with real-world objects
- Imitate human actions via physical controllers, gesture-based input

Minecraft

Interaction Type: Exploring

- Users **move through a virtual environment or physical space**
  - leverage's their knowledge of how they physically move through and navigate space
- Also proven useful for representing architectural designs for planned buildings and public spaces, visualizing complex data sets



Gather.town

Interaction Type: Responding

- **The system initiates requests** for interaction and the user chooses whether to respond
- Useful for proactive systems that **alert, describe, or show users something** it thinks is of interest