User interface design

Week6: Interfaces: interface types

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Outline

- Intended learning outcomes.
- Introduction to interface types
- Different interface types

Intended learning outcomes

- Understanding the different types of interfaces and their strengths and weaknesses.
- Being able to choose the right type of interface for a given task or user group.

Introduction

- When considering how to solve a user problem, the default solution that many developers choose to design is an app that can run on a smartphone.
- Making this easier still are many easy-to-use app developer tools that can be freely downloaded.
- It is hardly surprising, therefore, to see just how many apps there are in the world.
- In 2022, Apple had more than 2 million apps in its store while Google had more than 3 million!

- Despite the enormity of the smartphone app industry, the web continues to multiply in offering services, content, resources, and information.
- A central concern is how to design websites that deliver services, content, resources, and information across different devices and browsers, which takes into account the varying form factors of smart watches, smartphones, laptops, smart TVs, and computer screens.

- The production of technological developments has encouraged different ways of thinking about interaction design and UX.
- For example, input can be via mice, touchpads, pens, remote controllers, joysticks, RFID readers, gestures, and even brain-computer interaction.
- Output is equally diverse, appearing in the form of graphical interfaces, speech, mixed realities, augmented realities, tangible interfaces, wearable computing, and more.

Interface types

- Numerous adjectives have been used to describe the different types of interfaces that have been developed, including graphical, command, speech, multimodal, mobile, intelligent, adaptive, smart, tangible, touchless, and natural.
- Some of the interface types are primarily concerned with a function (i.e. intelligent), while others focus on the interaction style used (command, graphical), the input/output device used (i.e. pen/speech-based), or the platform being designed for (i.e, tablet, mobile, PC).

- Some apps and systems use increasingly stylish machine learning algorithms that are intended to recognize faces, objects, and the like.
- These interface types include the following,

Command-Line Interfaces

- Command-line interfaces (CLIs) are text-based user interfaces that allow users to interact with a computer by typing commands.
- They are not as common as GUIs in modern computing, but they are still used by many experienced users and system administrators.
- They can be used to perform a wide range of tasks, such as managing files and directories, running programs, configuring system settings, and automating tasks using scripts.

How CLIs can be used in user interface design

- System administration: CLIs are commonly used by system administrators to manage computer networks and servers.
- Software development: Often used by software developers to compile and run programs.
- Automation: Used to automate tasks, such as backing up files or deploying software updates.
- Power users: Used by power users to perform tasks more quickly and efficiently than with a GUI.

Common CLI commands

- ls: List the contents of a directory
- cd: Change directory
- mkdir: Create a new directory
- rmdir: Remove a directory
- cp: Copy a file or directory
- mv: Move a file or directory

Consideration when designing CLI interfaces

- Completeness: Provide a complete set of commands for users to complete their tasks.
- Consistency: Should be consistent in its syntax and behavior. Users should be able to learn how to use the CLI quickly and efficiently.
- Help: Should provide help to users who are new to the system or who need assistance with a specific command.

Graphical User Interfaces

- Graphical user interfaces (GUIs) are the most common type of user interface today.
- GUIs use visual elements, such as icons, windows, and menus, to allow users to interact with a computer.
- GUIs are generally easier to learn and use than CLIs, and they are more forgiving of user errors.
- GUIs are used in a wide variety of applications, including desktop computers, laptops, tablets, and smartphones.

Key elements of GUIs

- Windows: Windows are rectangular areas on the screen that contain other GUI elements, such as buttons, menus, and text boxes.
- Text boxes: Users can use text boxes to enter commands, data, or other information.
- Buttons: Buttons can be used to open windows, start programs, or perform other tasks.

- Icons: Users can click on icons to open or interact with the objects or actions that they represent.
- Menus: Menus can be displayed in a variety of ways, such as drop-down menus, context menus, and toolbars.

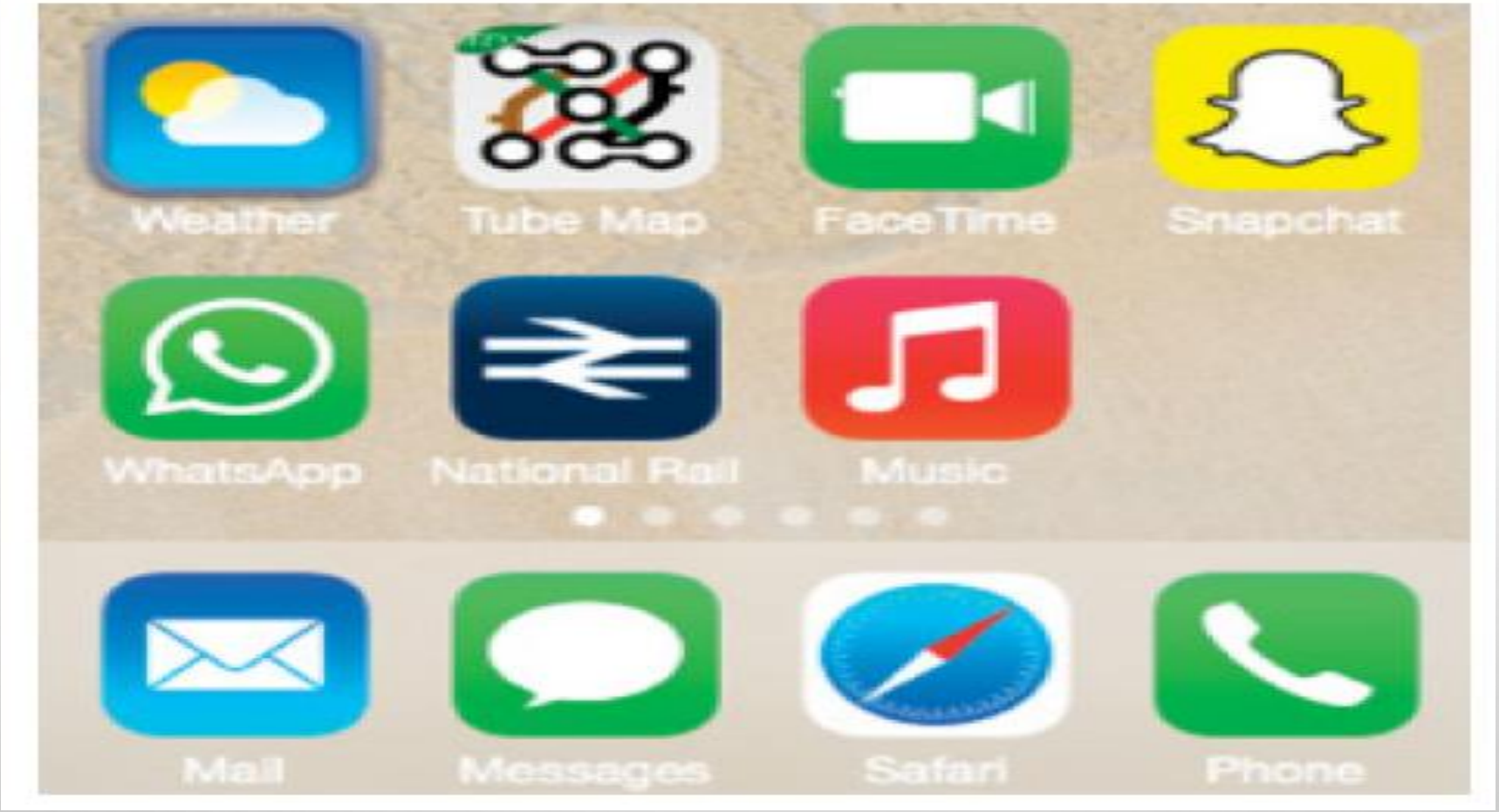

Figure 1: Icon design (Yvonne Rogers, 2023, P.214)

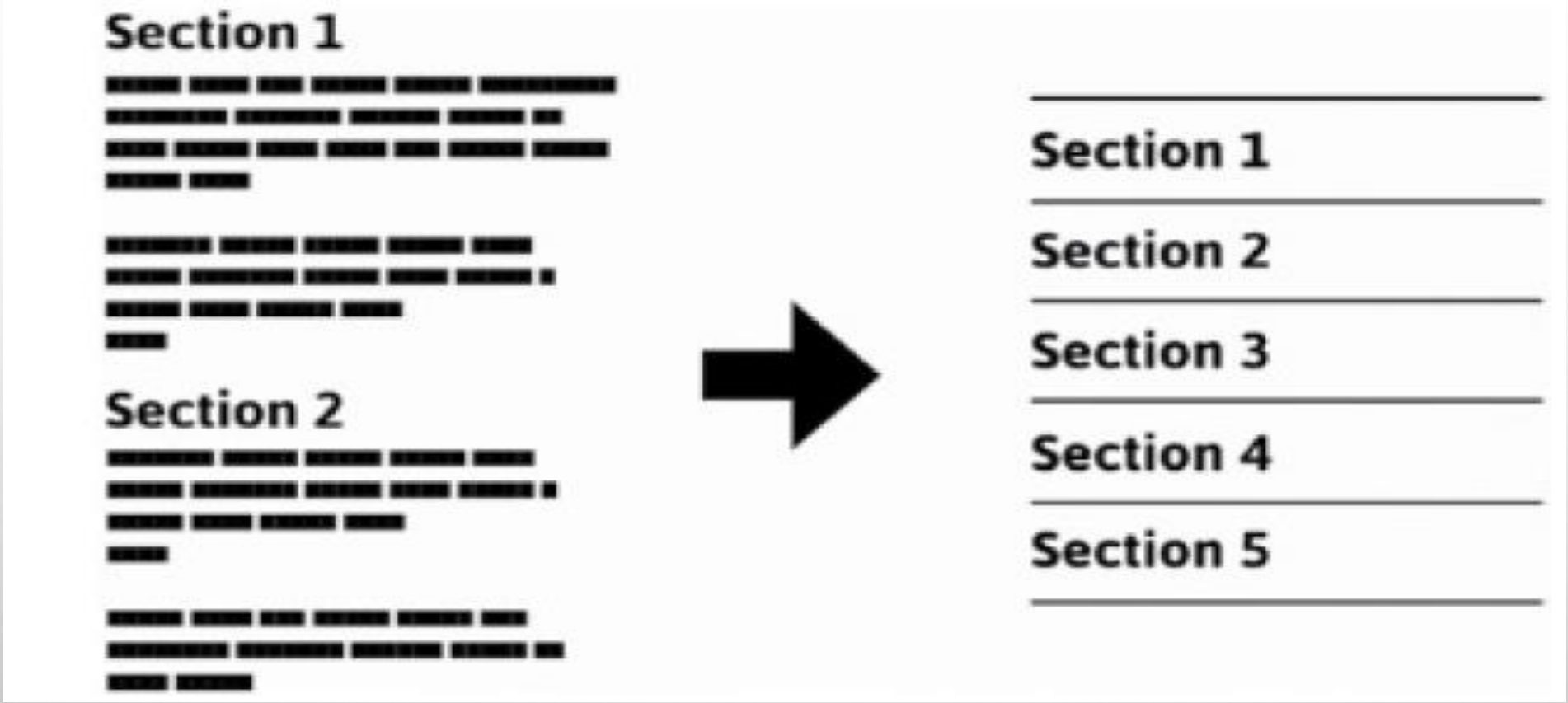

Figure 2: Template for collapsed menu (Yvonne Rogers, 2023, P.211)

Figure 3: windows element of GUI

Considerations when designing GUI

- Layout: GUI should be clear and organized. Users should be able to easily find the information and controls they need.
- Consistency: Users should be able to predict how the GUI will work based on their prior experience.
- Feedback: This will help users to avoid errors and to understand what is happening.

Multimedia interfaces

- Multimedia interfaces are interfaces that combine multiple types of media, such as text, images, audio, and video, to provide users with a richer and more engaging experience.
- Multimedia interfaces are often used in applications such as websites, games, and educational software.

- Multimedia interfaces can be more effective than traditional interfaces for a number of reasons.
- Multimedia interfaces can be more visually appealing, which can help to engage users and keep them interested.
- Multimedia interfaces can also be more informative, as they can present information in a variety of different formats.

Virtual Reality

- Virtual reality (VR) interfaces are interfaces that allow users to interact with a virtual environment using natural gestures and movements.
- VR interfaces are typically used with VR headsets, which track the user's head movements and provide them with a stereoscopic view of the virtual environment.
- VR interfaces can be used for a variety of purposes, including gaming, education, and training.

Figure 4: Snapshot of polygon graphics used to represent avatars for the "We Wait" VR experience (Yvonne Rogers, 2023, P.221)

Examples of VR interfaces

- Hand controllers: Hand controllers allow users to interact with objects in the virtual environment by grabbing them, moving them, and pressing buttons.
- Full-body interfaces: Full-body interfaces track the user's entire body movements, allowing them to interact with the virtual environment in a more immersive way.
- Glove-based interfaces: Glove-based interfaces track the user's hand movements and gestures, allowing them to interact with the virtual environment

Website Design

- Website design interfaces are the tools and software that web designers use to create and edit websites.
- Website design interfaces can be simple or complex, depending on the needs of the web designer and the type of website being created.

Common website design interfaces

- Text editors: Text editors are used to edit the HTML and CSS code that makes up a website.
- WYSIWYG editors: WYSIWYG editors (What You See Is What You Get) allow web designers to create and edit websites without having to write any code.
- Content management systems (CMS): CMSs provide a variety of features, such as user management, content creation tools, and search engine optimization (SEO) tools.

Mobile Devices

- Mobile devices have become pervasive, with people increasingly using them in all aspects of their everyday and working lives including phones, fitness trackers, and watches.
- Customized mobile devices are also used by people in a diversity of work settings where they need access to real-time data or information while walking around.

Well-designed mobile device interfaces

- Google Maps: The app uses large text and high-contrast colors to make it easy to see the map and directions.
- Gmail: The app uses a variety of gestures to make it easy to manage emails. For example, users can swipe left to delete an email or swipe right to archive it.
- Twitter: The app uses a simple layout and large text to make it easy to read tweets.

Appliances interfaces

- Appliance interfaces are the user interfaces (UIs) that allow users to interact with appliances.
- Appliance interfaces can be simple, such as a button and a light, or they can be complex, such as a touchscreen display with multiple menus and options.
- The type of interface that is used on an appliance depends on a number of factors, such as the complexity of the appliance, the target audience, and the cost of the appliance.

Common types of appliance interfaces

- Buttons and lights: Buttons are used to select options, while lights are used to indicate the status of the appliance.
- Knob and dial interfaces: Knob and dial interfaces are used to control settings such as temperature, volume, and speed.
- Touchscreen interfaces: Touchscreen interfaces allow users to interact with the appliance using a graphical user interface (GUI).

Examples of well-designed appliance interfaces

- Nest Thermostat: Uses a large and readable display to show the current temperature and the target temperature.
- Samsung Family Hub Refrigerator: Has a large touchscreen display that allows users to access a variety of features, such as recipes, calendars, and streaming services.
- Bosch Smart Dishwasher: Has a touchscreen display that allows users to select wash cycles, view the status of the dishwasher, and receive notifications when the dishwasher is finished.

Voice interfaces

- Voice interfaces are user interfaces (UIs) that allow users to interact with computers and digital devices using their voices.
- Voice interfaces are becoming increasingly popular, as they are more convenient and hands-free than traditional interfaces such as keyboards and mice.

Considerations when designing voice interfaces

- Accuracy: The voice interface should be able to accurately understand the user's speech.
- Robustness: Users should be able to interact with the voice interface even if they make mistakes.
- Usability: Users should be able to learn how to interact with the voice interface quickly and efficiently.

Applications of Voice interfaces

- Smartphones and tablets: Voice interfaces can be used to control smartphones and tablets, such as making and receiving calls, sending text messages, and playing music.
- Smart speakers: Smart speakers, such as Amazon Echo and Google Nest, use voice interfaces to allow users to control their homes, play music, and access information.

- Voice assistants: Voice assistants, such as Siri and Alexa, can be used to perform a variety of tasks, such as setting alarms, getting directions, and making appointments.
- Automotive systems: Voice interfaces are used in automotive systems to allow drivers to control features such as the radio, climate control, and navigation system.

Pen-Based Interfaces

- Pen-based interfaces are user interfaces (UIs) that allow users to interact with computers and digital devices using a pen or stylus.
- Pen-based interfaces are becoming increasingly popular, as they are more natural and intuitive than traditional interfaces such as keyboards and mice.

Applications of Pen-based interfaces

- Tablets and smartphones: Pen-based interfaces are commonly used on tablets and smartphones to allow users to take notes, draw, and interact with apps.
- Digital notebooks: Digital notebooks, such as the iPad Pro and the Samsung Galaxy Note, use pen-based interfaces to allow users to take notes, draw, and create documents.

- Interactive whiteboards: Interactive whiteboards use pen-based interfaces to allow users to write, draw, and interact with presentations and other content.
- Graphic design software: Software, such as Adobe Illustrator and CorelDRAW, often use pen-based interfaces to allow users to draw and create digital artwork.

Touchscreens interfaces

- Touch screen interfaces are user interfaces (UIs) that allow users to interact with computers and digital devices by touching the screen.
- Touch screen interfaces are becoming increasingly popular, as they are more natural and intuitive than traditional interfaces such as keyboards and mice.

Figure 5: A schematic of a multitouch interface (Yvonne Rogers, 2023, P.237)

Application of Touch screens

- Smartphones and tablets: Touch screen interfaces allow users to tap, swipe, and pinch to interact with apps and content.
- Laptops and desktops: Touch screen interfaces can be used on laptops and desktops for a variety of tasks, such as taking notes, drawing, and interacting with apps.

- Self-service kiosks: Self-service kiosks, such as those found in airports and grocery stores, often use touch screen interfaces to allow users to purchase items and get information.
- In-car entertainment systems: In-car entertainment systems often use touch screen interfaces to allow drivers to control features such as the radio, climate control, and navigation system.

Touchless interfaces

- Touchless interfaces are user interfaces (UIs) that allow users to interact with computers and digital devices without touching them.
- Touchless interfaces are becoming increasingly popular, as they are more hygienic and can be used in a wider range of environments.

Examples of Touchless interfaces

- Gesture recognition: Gesture recognition interfaces use cameras or sensors to track the user's hand movements and gestures.
- Voice recognition: Voice recognition interfaces use microphones to detect the user's voice commands.

- Facial recognition: Facial recognition interfaces use cameras to identify the user's face and track their eye movements.
- Brain-computer interfaces (BCIs): BCIs use electrodes to detect the user's brain signals and translate them into commands.

Application of touchless interface

- Self-service kiosks: Self-service kiosks, such as those found in airports and grocery stores, often use touchless interfaces to allow users to purchase items and get information without having to touch the screen.
- Public displays: Public displays, such as those found in museums and shopping malls, often use touchless interfaces to allow users to interact with content without having to touch the screen.

- Gaming: Touchless interfaces are used in some video games to allow players to control the game using their hands or body movements.
- Assistive technology: Touchless interfaces can be used as assistive technology for people with disabilities, allowing them to interact with computers and digital devices without having to use their hands.

Multimodal interfaces

- Multimodal interfaces are intended to enrich user experiences by multiplying the way information is experienced and controlled at the interface through using different modalities, such as touch, sight, sound, and speech.
- Interface techniques that have been combined for this purpose include speech and gesture, eye-gaze and gesture, haptic and audio output, and pen input and speech.

- A person’s body movement can also be tracked so that it can be represented back to them on a screen in the form of an avatar that appears to move just like them.
- For example, the Kinect was developed as a gesture and body movement gaming input system for the Xbox.

Figure 6: Microsoft's Xbox Kinect (Yvonne Rogers, 2023, P.243)

Application of multimodal interface

- Smartphones and tablets: Multimodal interfaces are commonly used on smartphones and tablets to allow users to interact with apps and content using speech, touch, and gesture.
- Virtual reality (VR) and augmented reality (AR): For example, multimodal interfaces can allow users to interact with virtual objects using their hands or by speaking to them.
- Assistive technology: For example, multimodal interfaces can allow people who are unable to use their hands to interact with computers using their voice or gaze.

Shareable interfaces

- Shareable interfaces are user interfaces (UIs) that allow multiple users to interact with the same device or system at the same time.
- Shareable interfaces are becoming increasingly popular, as they can be used to support collaboration and teamwork.

Figure 7: A Smart Board in use during a meeting (Yvonne Rogers, 2023, P.245)

Application of shareable interface

- Smartboards and interactive whiteboards: Shareable are used on smartboards and interactive whiteboards to support collaboration and learning in classrooms and meeting rooms.
- Tabletop computers: Shareable interfaces are used on tabletop computers to support collaboration and games.
- Multi-user virtual reality and augmented reality: Multi-user VR and AR systems allow multiple users to share the same virtual or augmented environment.

Examples of well-designed shareable interfaces

- Google Docs: Google Docs uses a shareable interface that allows users to see and edit each other's work.
- Microsoft Teams: Microsoft Teams uses a shareable interface that allows users to collaborate on documents, presentations, and other content in real time.
- Miro: Miro is a cloud-based whiteboard and collaboration platform that allows multiple users to collaborate on whiteboards in real time.

Tangible interfaces

- Tangible interfaces are user interfaces (UIs) that allow users to interact with digital information through physical objects.
- Tangible interfaces use a variety of technologies to track the movement and orientation of physical objects, and then translate this information into digital commands.
- Tangible interfaces are becoming increasingly popular, as they can be more natural and intuitive than traditional UIs such as keyboards and mice.

Application of tangible interfaces

- Education: used to create educational games and activities that help students learn about complex concepts in a hands-on way.
- Collaboration: For example, used to allow a team of engineers to design a new product by manipulating physical objects that represent different components of the product.
- Entertainment: For example, used to allow players of a video game to control their characters by moving physical objects.

Augmented Reality

- Augmented reality (AR) interfaces are user interfaces (UIs) that overlay digital information onto the real world.
- AR interfaces use a variety of technologies, such as cameras, sensors, and projectors, to track the user's position and orientation, and to display digital information in the correct location in the user's field of view.

Examples of AR interfaces

- Navigation: AR interfaces can be used to provide users with turn-by-turn navigation instructions while walking or driving.
- Education: For example, an AR interface could be used to allow students to learn about the human body by viewing digital organs and tissues superimposed on their own bodies.
- Entertainment: For example, an AR interface could be used to allow players of a video game to interact with virtual objects that are superimposed on the real world.

Wearables interfaces

- Wearables are a broad category of devices that are worn on the body. These include smartwatches, fitness trackers, fashion tech, and smart glasses.
- New flexible display technologies, e-textiles, and physical computing (for example, Arduino) provide opportunities to design wearables that people will actually want to wear.

Consideration when designing wearables

- Comfort: The wearable interface should be comfortable to wear for extended periods of time.
- Usability: The wearable interface should be easy to use, even while the user is moving or multitasking.
- Safety: The wearable interface should be safe for the user. This means that it should not be a distraction or a hazard.

Smart Interfaces

- The motivation for many new technologies is to make them smart, whether it is a smartphone, smartwatch, smart building, smart home, or smart appliance.
- The adjective is often used to suggest that the device has some intelligence and it is connected to the Internet.
- More generally, smart devices are designed to interact with other devices connected to a network, many of which are automated.

Holographic Interfaces

- Holographic interfaces are user interfaces (UIs) that allow users to interact with computers and digital devices using three-dimensional (3D) images.
- Holographic interfaces use a variety of technologies, such as lasers, mirrors, and projectors, to create 3D images that appear to float in the air.

Examples of holographic interfaces:

- Microsoft HoloLens: The Microsoft HoloLens is a wearable holographic interface that allows users to interact with virtual objects that appear to be superimposed on the real world.
- Magic Leap One: The Magic Leap One is a wearable holographic interface that is similar to the Microsoft HoloLens.
- Looking Glass Factory: The Looking Glass Factory is a company that produces holographic displays that can be used to create interactive 3D experiences.

Natural language Interface

- Natural language interfaces (NLIs) are user interfaces that allow users to interact with computers and digital devices using natural language, such as spoken or written language.
- NLIs use a variety of technologies, such as natural language processing (NLP), machine learning (ML), and artificial intelligence (AI), to understand the user's intent and to generate responses that are relevant and informative.

- NLIs are still in their early stages of development, but they have the potential to revolutionize the way we interact with computers.
- NLIs could be used to create more intuitive and accessible user interfaces, to improve the productivity of workers, and to enable new forms of communication and interaction.

Examples of NLI

- Voice assistants: Voice assistants such as Siri, Alexa, and Google Assistant are NLIs that allow users to control their devices and access information using voice commands.
- Chatbots: Chatbots are NLIs that can simulate conversation with users. Chatbots are often used in customer service applications to provide support to users.
- Machine translation systems: Machine translation systems are NLIs that can translate text from one language to another.

Key research and design considerations in interface types

- User needs and context: What are the needs of the users of the interface? What is the context in which they will be using the interface?
- Usability: How easy is the interface to use? Can users learn to use it quickly and efficiently?
- Efficiency: Can users complete their tasks quickly and easily using the interface?

- Accessibility: Is the interface accessible to users with disabilities?
- Aesthetics: Is the interface visually appealing and engaging?
- Technical constraints: What are the technical constraints of the platform or device on which the interface will be used?

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Thank you

Next Lecture We Shall Look At Emotional Interactions