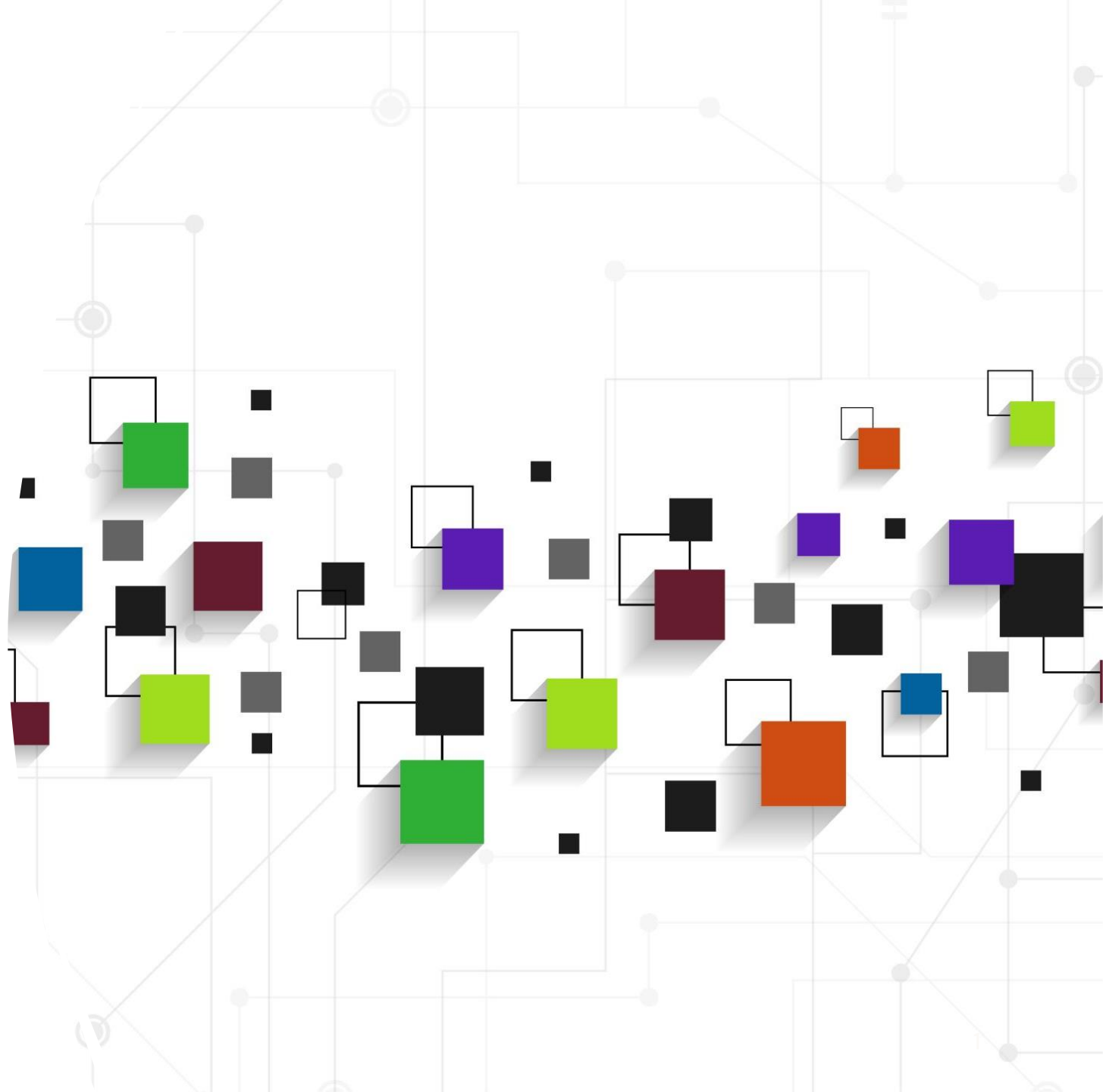


증강현실

(2023. 11. 20.)

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AR Interaction



Objective

- ✓ A comprehensive understanding of AR user interfaces and interaction techniques
- ✓ Enabling you to design interactive and user-centric AR applications

Interacting with AR Content

- ✓ You see AR images...
- ✓ How can you interact with it?

Overview

- ✓ AR user interfaces (UIs) are the visual and interactive elements that enable users to interact with and control virtual content in the real-world environment
- ✓ Well-designed UIs in AR can enhance user engagement, improve usability, and seamlessly integrate virtual content with the real world

AR User Interface Components



- ✓ Visual Elements: Icons, buttons, menus, and other visual cues providing access to AR features and functions
- ✓ Spatial Anchors: Virtual objects anchored to specific physical locations or objects in the real world
- ✓ Gestures and Interactions: Natural and intuitive ways to interact with AR content using gestures, touch, or voice commands
- ✓ Feedback and Notifications: Visual, auditory, or haptic cues that provide feedback and guidance during AR interactions

Spatial Interactions

- ✓ Object Placement: Techniques for placing virtual objects in the real world
- ✓ Object Manipulation: Methods for rotating, scaling, and moving virtual objects
- ✓ Spatial Mapping: Utilizing the environment's spatial understanding to enable interactions with real-world surfaces and objects

AR Interaction Techniques

✓ Gesture-Based Interactions

- Pinch, swipe, rotate, and other hand gestures
- Manipulating AR objects and navigating through the experience
- Easy and convenient form of interaction

✓ Touch-Based Interactions

- Tapping, dragging, and other touch-based gestures
- Interacting with UI elements and virtual objects

✓ Voice Commands

- Controlling and interacting with AR content through voice commands

Mobile Device

- ✓ Treat the device as a controller
 - Interact by moving handheld display
 - Use IMU to detect shaking, rotation, etc
- ✓ Touch screen

Dual Phone AR: Using a Second Phone as a Controller



<https://youtu.be/DCNN6-nZdz8?si=C7Vew76aIS1HP7dK>

PAIR:

Phone as an Augmented Immersive Reality Controller



https://youtu.be/t982oleAk3U?si=9WPcD-kb53r_AhQ9

Head Mounted Display

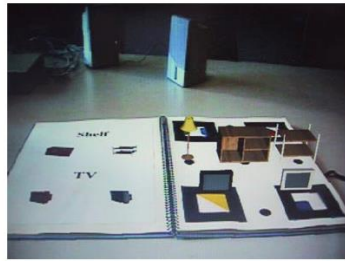
- ✓ Buttons, touchpads, handheld controller
- ✓ Speech, gesture, touch
- ✓ Physical manipulation (Tangible Interaction)

Tangible Interaction

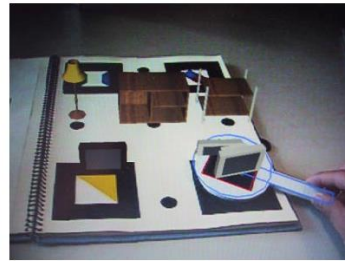
- ✓ Use objects in the real world to interact with AR content
- ✓ Attach AR content to real objects



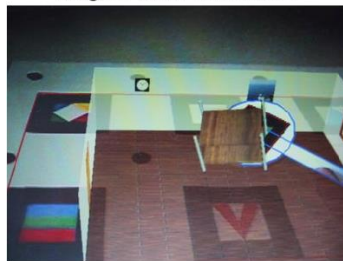
(a) External view of Magic Paddle interface



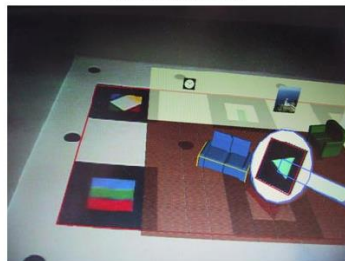
(b) Virtual furniture objects on the real book



(c) Picking virtual furniture object with a paddle



(d) Placing object in a room by sliding it from the paddle



(e) Moving virtual objects by pushing it



(f) Constructed scene

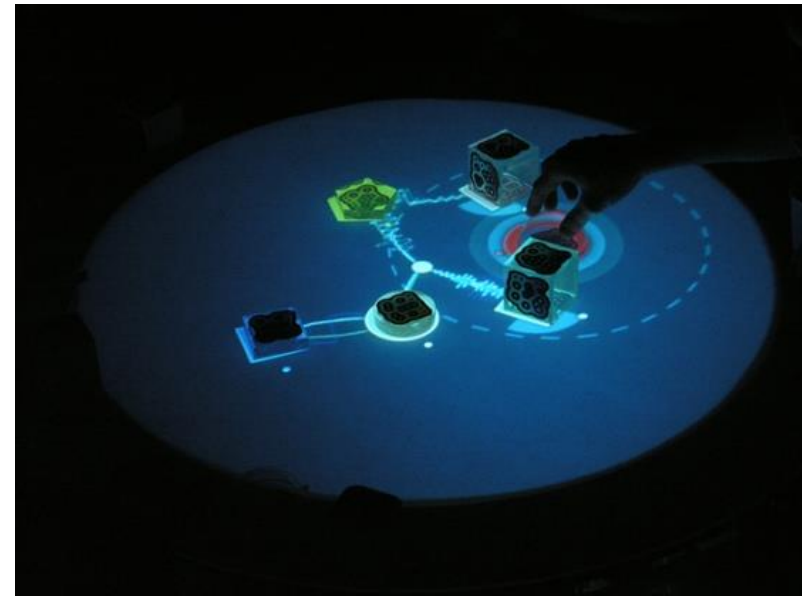
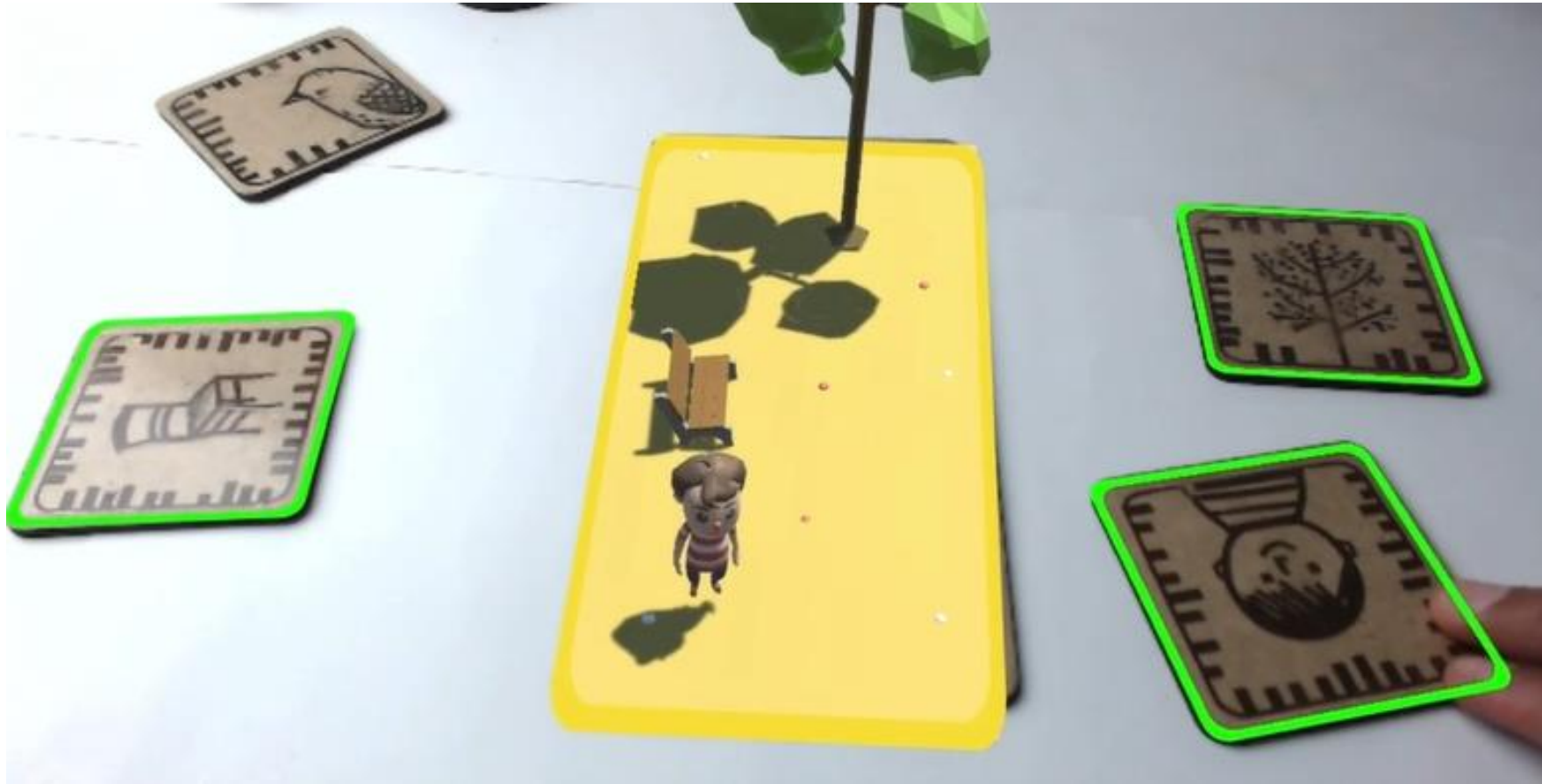


Figure 1. Magic Paddle Interface

Stic Stac



https://youtu.be/XPOgLt_73cY

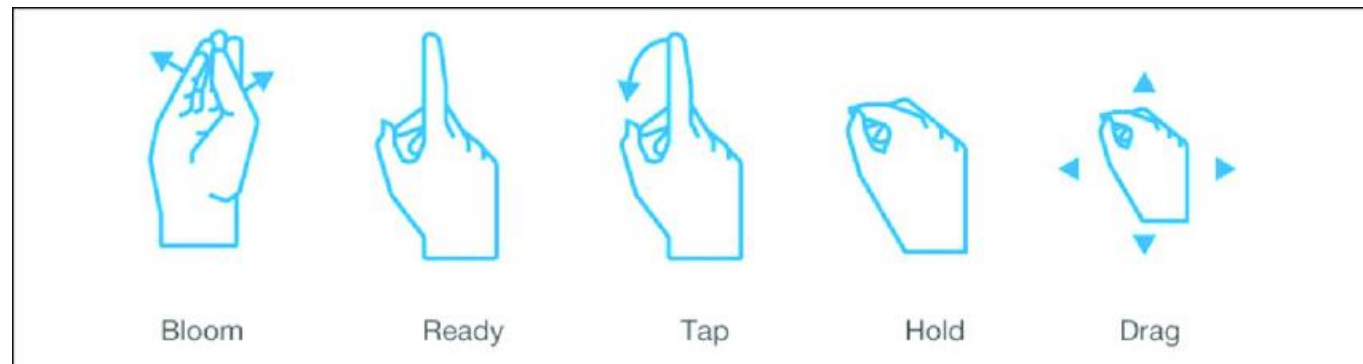
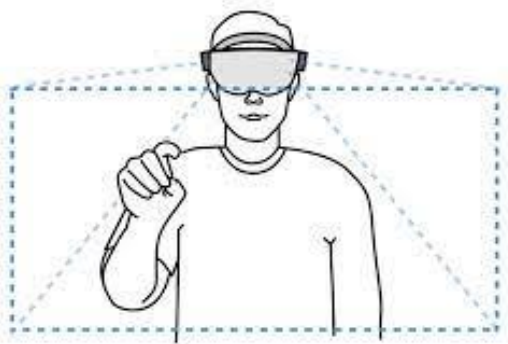
HMD Gesture Interaction

- ✓ Natural way to interact with digital artifacts and menus
- ✓ Simple click gestures: Head point and air tap
- ✓ Two-handed gestures: Full hand tracking, direction manipulation



HoloLens Gestures

- ✓ Set of basic gestures
 - Air tap = select, Bloom = open
- ✓ Easy to remember and execute

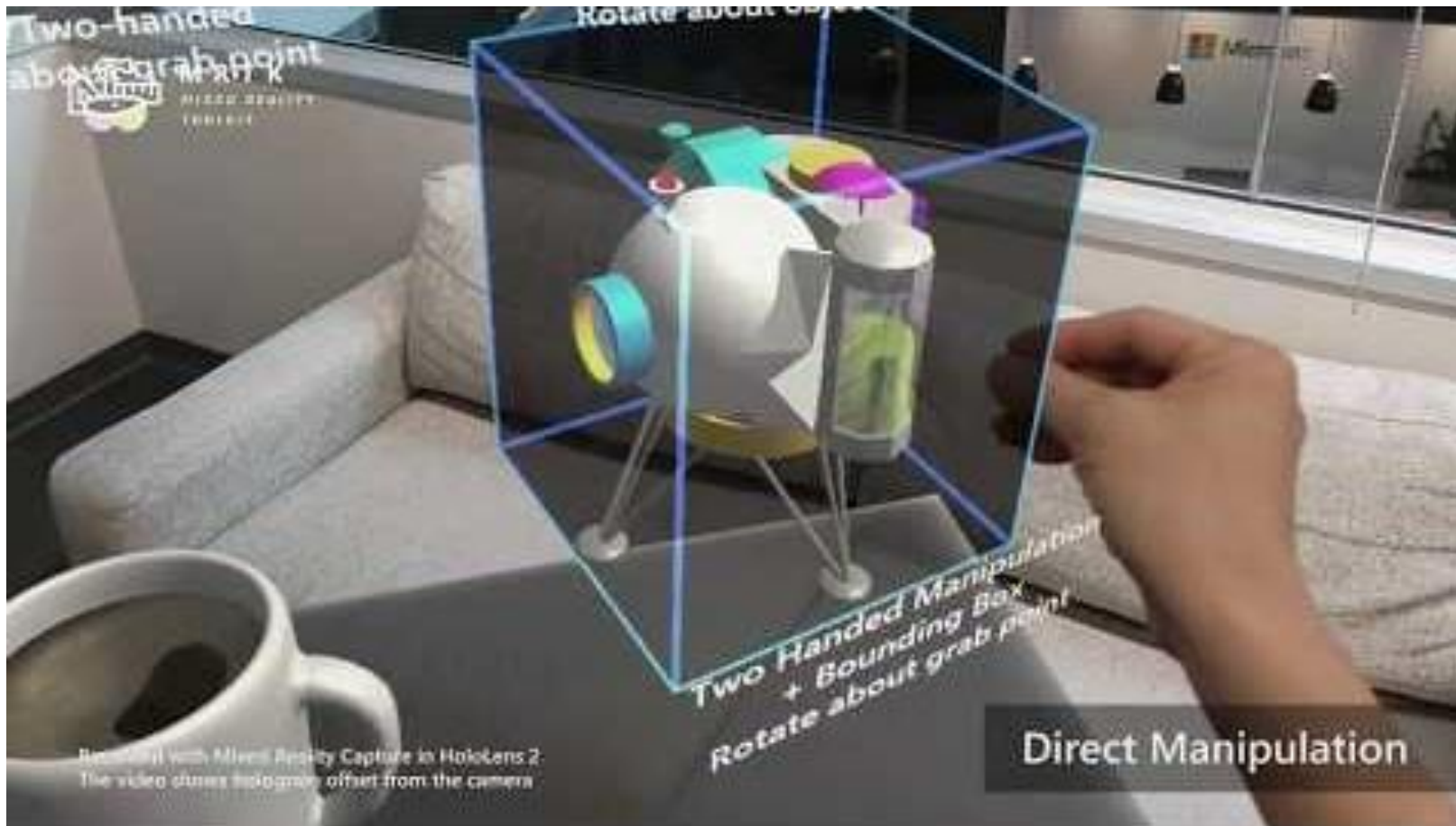


How to Design Gesture Interaction

- ✓ Keep it very simple
 - Users should be able to learn it without having to learn a completely new language
- ✓ Understand the physicality of arm movements to know when gesture interaction becomes too tiresome
 - Difficult to use big arm movements for long
- ✓ Consider affordance your users expect from digital objects
 - Expect to be able to perform the same kinds of actions similar to a physical object
- ✓ Avoid inappropriate or potentially embarrassing to perform

<https://www.interaction-design.org/literature/article/how-to-design-gesture-interactions-for-virtual-and-augmented-reality> (3 years ago, 8:25 video)

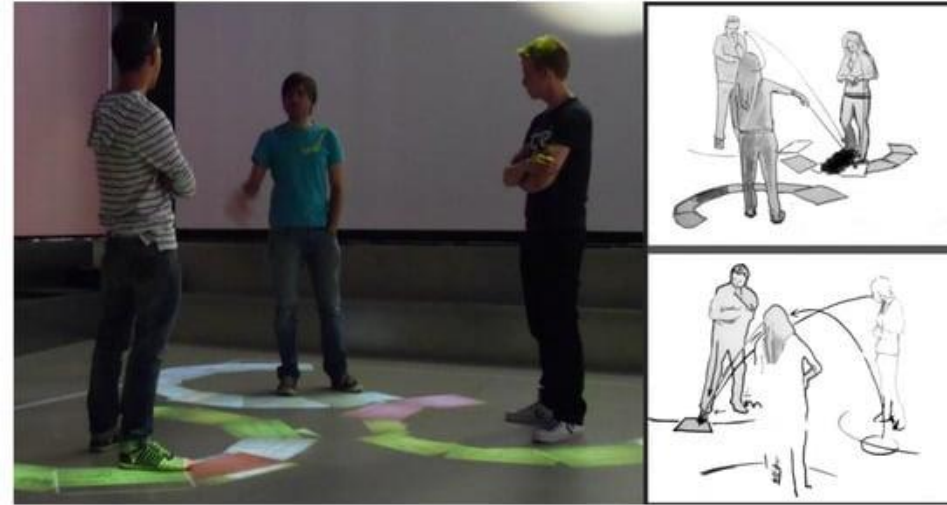
MRTK Hand Interaction



<https://youtu.be/wogJv5v9x-s>

Embodied Interaction

- ✓ Use whole body to interact with AR
- ✓ Popular for “Magic Mirror” interface
- ✓ Natural interaction



MirrorMe: The Magic Mirror



<https://youtu.be/UXIP2AoQPIU?si=veeBUW3gn4ougP7d> (2016, 0:38)

2003 - 2023 © MR&I Lab. SEJONG Univ. Seoul, Korea

Haptic Augmented Reality



<https://youtu.be/3meAlle8kZs>

UI Design Considerations

- ✓ Visibility and Contrast: Ensuring UI elements are clearly visible against various backgrounds and lighting conditions
- ✓ Information Hierarchy: Organizing UI elements to guide users' attention and prioritize important information
- ✓ Minimalism and Simplicity: Keeping UI elements minimal and clutter-free to prevent visual overload and enhance the usability

Multimodal Interactions

- ✓ Involve using multiple sensory channels and input modes
- ✓ Combine multiple interaction techniques to provide users with more versatile and flexible control over AR content
- ✓ Modalities include visual, auditory, haptic, and gesture-based inputs
- ✓ Adapt interaction techniques based on user context, preferences, and abilities to provide personalized and inclusive experiences

Visual Modalities

- ✓ Visual interactions are the most common in AR
- ✓ Examples include touch screens, gaze tracking, and marker-based recognition
- ✓ Visual inputs provide precise control and seamless integration of digital content

Auditory Modalities

- ✓ Auditory interactions involve sound and speech
- ✓ Speech recognition enables voice commands in AR applications
- ✓ Sound feedback can enhance the user experience, such as in AR gaming

Haptic Modalities

- ✓ Haptic feedback includes touch and force feedback
- ✓ Haptic devices and wearables can provide tactile sensations, enhancing realism
- ✓ Used in training simulations and medical AR applications

Gesture-Based Interactions

- ✓ Gestures use hand or body movements to control AR applications
- ✓ Hand tracking and recognition enable intuitive control
- ✓ Gesture-based interactions are prevalent in AR headsets and smart glasses

Applications of Multimodal AR

- ✓ Healthcare: Multimodal AR assists in surgeries and medical training
- ✓ Education: Interactive learning through visual, auditory, and haptic feedback
- ✓ Entertainment: Immersive gaming with gesture-based controls and sound feedback

Challenges and Solutions

✓Occlusion

- Addressing the challenge of virtual objects being occluded by real-world objects to ensure seamless integration and interaction

✓Real-Time Rendering

- Optimizing graphics and rendering techniques to maintain smooth and responsive AR experiences

✓Physical Comfort

- Designing ergonomic and comfortable input devices or minimizing physical strain for prolonged AR experiences

Testing and Evaluation

✓ Usability Testing

- Conducting usability tests to evaluate the effectiveness, intuitiveness, and user satisfaction of AR user interfaces and interaction techniques

✓ Interactive Design

- Iteratively refining and improving UI elements and interaction techniques based on user feedback and testing results

Key Points

- ✓ AR user interfaces and interaction techniques play a crucial role in creating engaging and user-friendly AR experiences
- ✓ Components include visual elements, spatial anchors, gestures, and feedback mechanisms
- ✓ Interaction techniques involve gestures, touch, voice commands, and HMD controls
- ✓ Design considerations include visibility, information hierarchy, and minimalism
- ✓ Challenges include occlusion, real-time rendering, and physical comfort

Q/A

