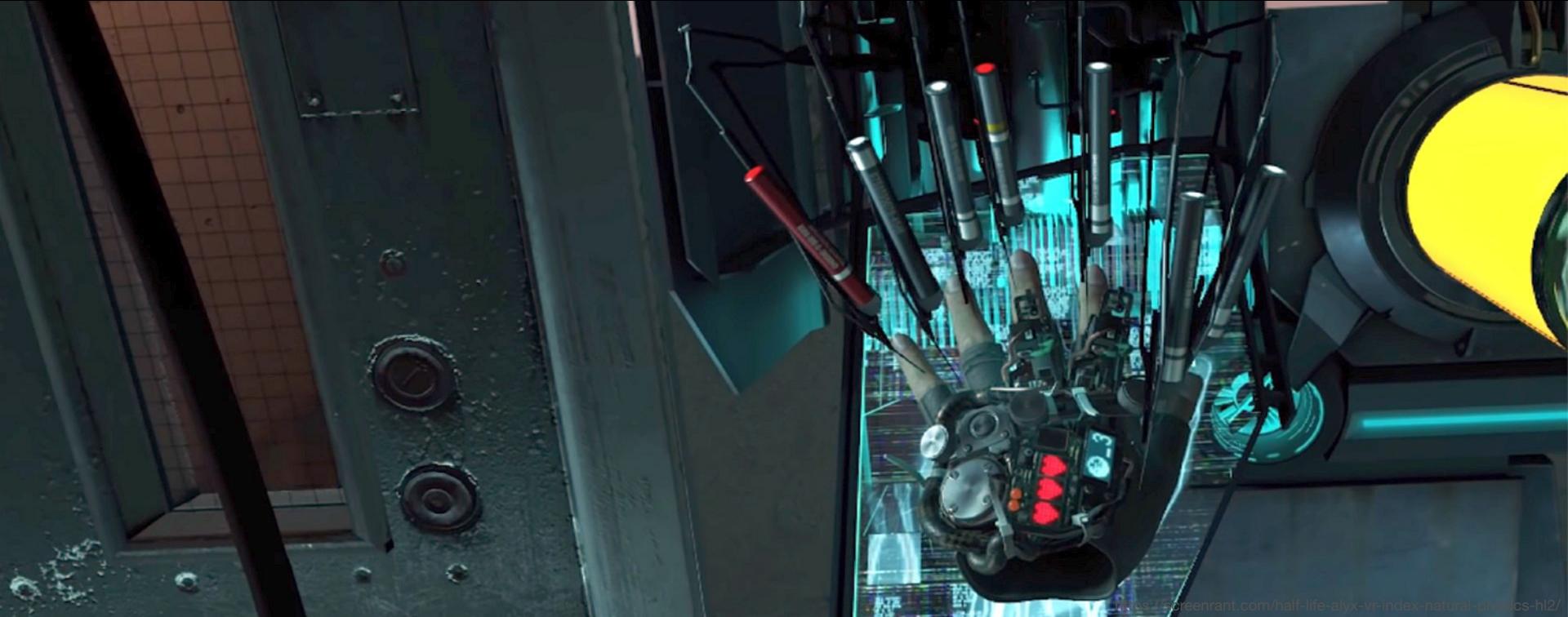


Virtual & Augmented Reality

WS 2025



<https://screenrant.com/half-life-alyx-vr-index-natural-physics-hl2/>

Klausurvorbereitung

BHT

Klausurvorbereitung

Klausur

- 02.12.25. 12:15-13:45
- ca. 20 Fragen
- keine technischen Hilfsmittel
- Stift (nicht rot)
- evtl. ein Extrablatt, falls Lücken zwischen den Fragen nicht ausreichen
- kein Spickzettel

Klausurvorbereitung

Klausur

Vorbereitung:

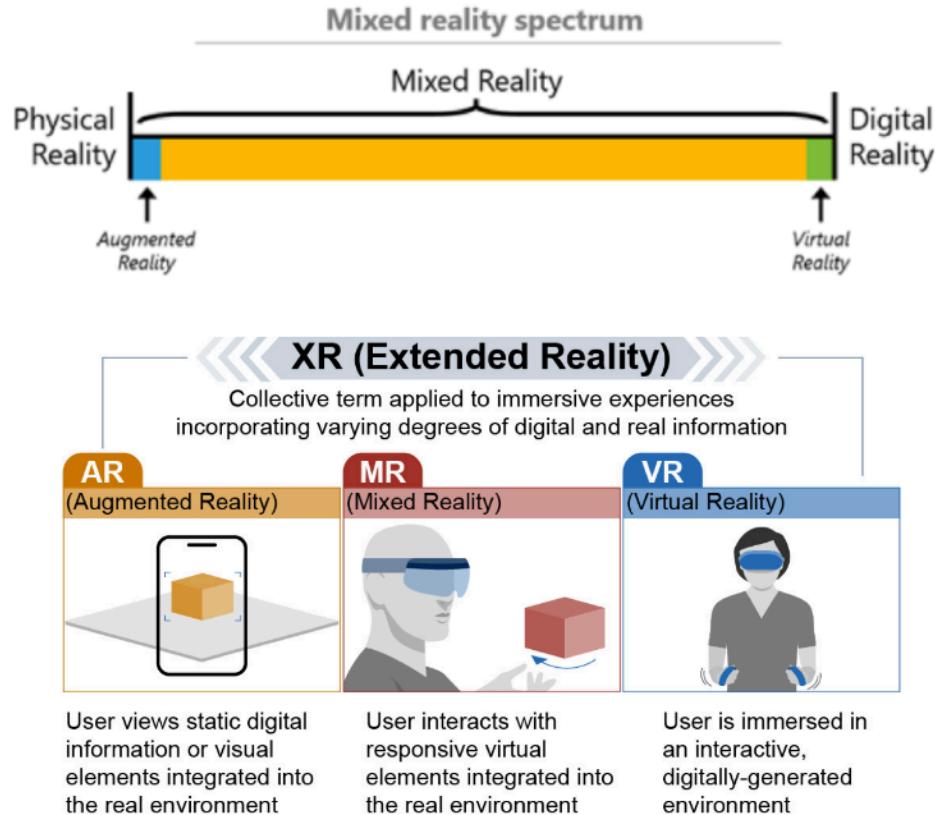
grundsätzlich sollte man zu jedem Topic/Schlagwort Satz dazu sagen können und/oder 2-3 Eigenschaften

- Was / Warum ist ... ?
- Nennen Sie x Eigenschaften von ...
- Erläutern/Erklären Sie den Begriff ...

VR Basics

Spektrum

- Was heißt AR, VR, XR?
- Was ist damit gemeint?



Inhalt

Übersicht

- 02 VR Technology
- 03 VR Immersion
- 04 VR Interface
- 06 VR Interaction
- 07 VR Locomotion
- 08 1 AR Overview
- 08 2 AR Spatial Understanding
- 08 3 AR Interaction

02 VR Technology

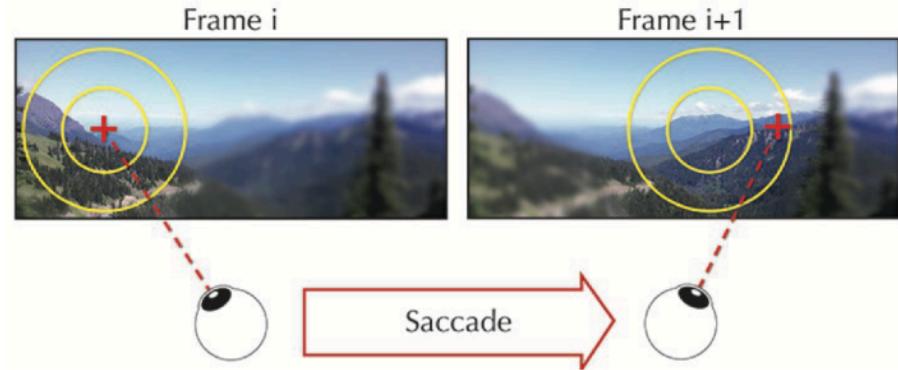
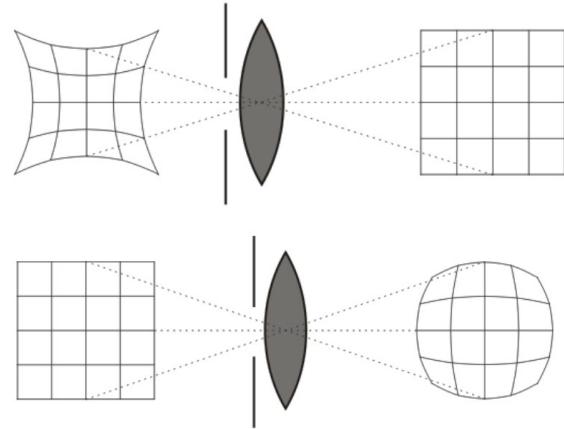
Übersicht

- ~~VR History~~
- VR Rendering
- VR Tracking
- ~~VR Devices~~
- ~~VR Periphery~~

02 VR Technology

VR Rendering

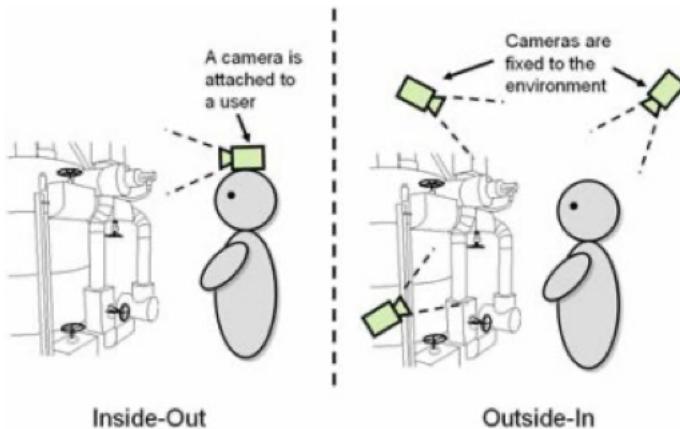
- Was gibt es bei VR-Rendering zu beachten?
 - Lens Distortion (und inverse Distortion)
 - Chromatic Aberration
 - Stereoscopic Rendering
- VR Rendering Optimizations
 - VR Frustum
 - Saccade
 - Foveated Rendering
 - Space Warp



02 VR Technology

VR Tracking

- Degrees of Freedom
- Yaw Pitch Roll / Rotationsachsen
- IMU: was ist das, welche Bestandteile
 - Accelerometer
 - Gyroskop
 - Magnetometer
- Calibration Error
- Tracker-Arten
 - Position
 - Light, Lighthouse
 - Inside Out



03 VR Immersion

Übersicht

- Immersion and Presence
- Comfort Zone
- Motion Sickness

03 VR Immersion

Immersion and Presence

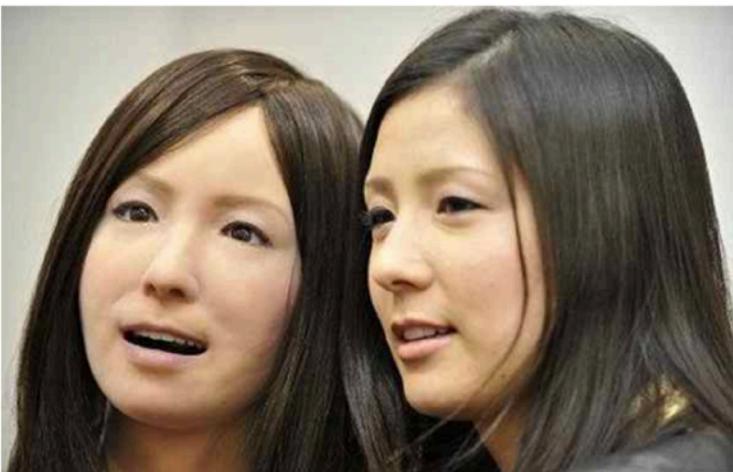


- Was ist / wie entsteht Immersion?
- Immersionsfaktoren
- Was ist Presence / wie entsteht Presence?
- Unterschied / Vergleich zu Immersion
- ungewollte Unterbrechung der Immersion / Presence: Gründe
- Wann will man die Presence unterbrechen?
- Was ist Self-Embodiment?

03 VR Immersion

Comfort Zone

- Was ist das Uncanny Valley?
- Was versteht man unter Comfort Zone?
- Warum ist Comfort Zone wichtig?



03 VR Immersion

Motion Sickness

- Was ist Motion Sickness?
- Wie entsteht Motion Sickness?
- Symptome / Risikofaktoren
- Wie kann man Motion Sickness reduzieren?
- Warum ist VR anstrengend?

04 VR Interface

User Interface

- Klassische UI
 - Screen Interface, UI Styling
- Was muss man beim Design von VR User Interfaces beachten?
- Unterschiede zum klassischen User Interface?
 - Icons
 - Position
 - Interaction
- Floating Interface
 - Welche Möglichkeiten?

04 VR Interface

VR User Interface

- Viewing Angle
 - Comfortable Viewing
 - Peripheral Viewing
 - Rotational Viewing
 - Curiosity Zone
- Interface Objects
 - Was ist das, wozu?
- Affordance
 - Was bedeutet das? Anwendung?



06 VR Interaction

Interaction Design

- Was ist klassisches Interaction Design?
 - Wie wird Interaktion realisiert?
 - Mouse / Touch
 - Buttons
 - Gestures
 - Abstraktionen



06 VR Interaction

VR Interaction Design

- Interaction Design für VR?
- Definition VR Interaction
- Universal Simulation Principle
- Feedback-Möglichkeiten bei VR Interactions
 - visuell
 - auditiv
 - haptisch / sensorisch

06 VR Interaction

VR Interaction Design

- VR Design Considerations
 - fitting interactions
 - fitting feedback



Example *Opening the inventory*



Press 'X' on Controller



Look down on your belt

07 VR Locomotion

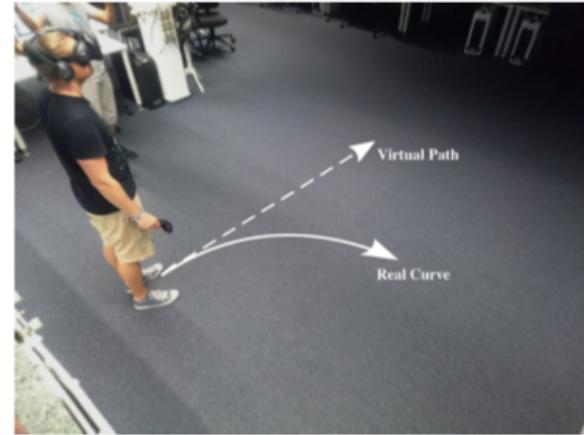
Definition

- Was bedeutet Locomotion?
- Was ist das Kernproblem von VR Locomotion?
- Setup
 - standing / seated VR
 - natural walking
- Teleportation
 - blink
 - shift/dash

07 VR Locomotion

Passive Locomotion

- Impossible Spaces
 - Idee? Wo/wie anwendbar?
- Redirected Walking
 - Was ist die grundlegende Beobachtung?
 - Gains: Rotation, Translation, Curvation



08 1 AR Overview

Übersicht

- Terms and Definition
- ~~Brief History~~
- Devices
- Spatial Understanding

08 1 AR Overview

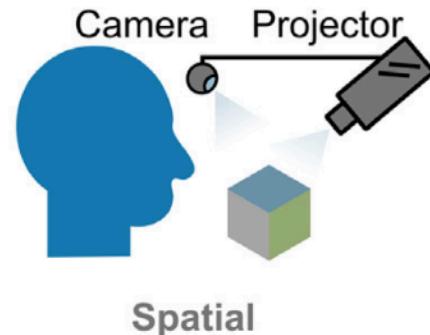
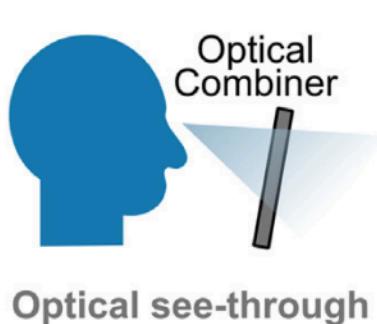
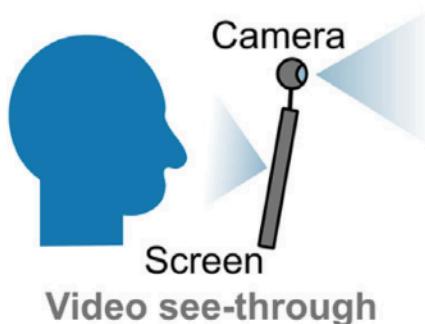
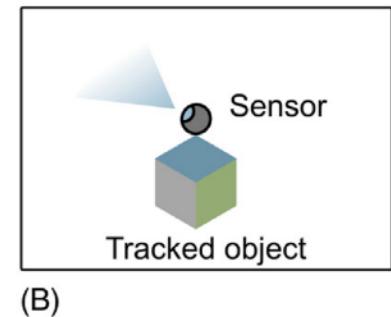
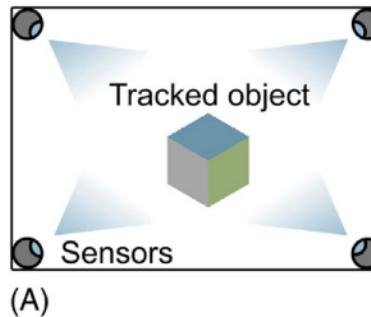
Terms and Definitions

- Was ist AR?
- Was ist kein AR?
- Definition: 3 Eigenschaften
- Konzept: 3 Schritte

08 1 AR Overview

Devices

- technische Möglichkeiten / Unterscheidungen
- LiDAR



08 1 AR Overview

Devices

- Was ist Optical See Through?
- Was ist Video See Through?
- ~~Was ist Spatial See Through?~~
- Was sind Vor- und Nachteile beider Varianten?

08 2 AR Spatial Understanding

Übersicht

- Types of Scene Understanding
- Feature Extraction
- Marker Tracking
- Plane Detection

08 2 AR Spatial Understanding

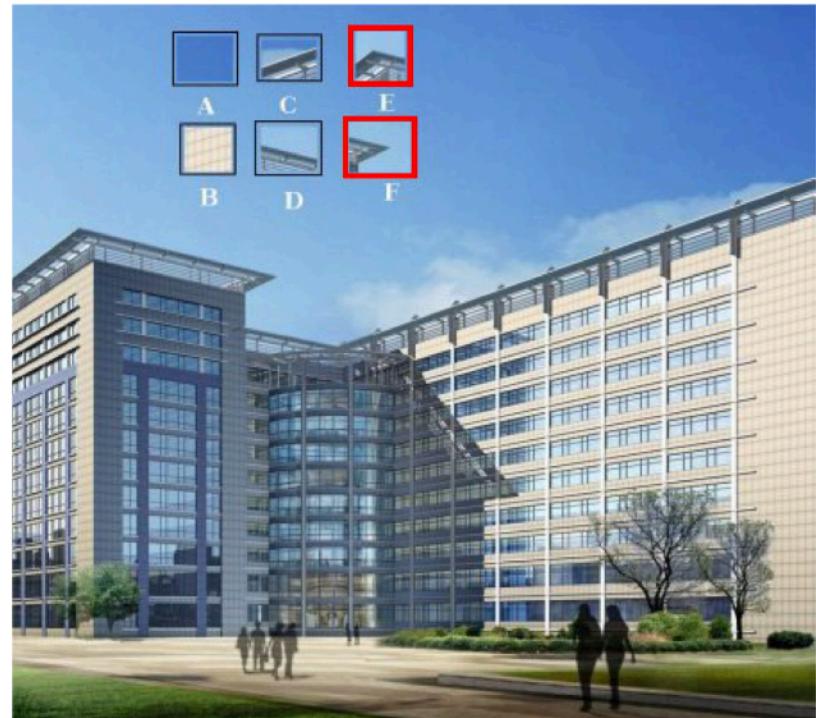
Types of Scene Understanding

- Image Detection
- Curved Images
- Plane Detection
- Face Detection
- Model Tracking
- Image Segmentation

08 2 AR Spatial Understanding

Feature Extraction

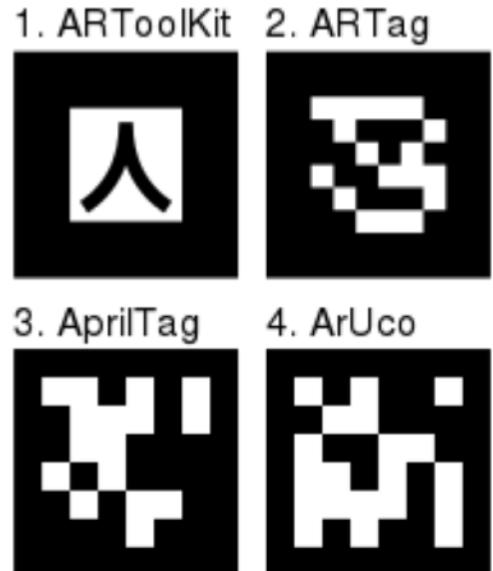
- Feature Detection
 - Harris Corner Detection
 - SIFT & FAST
- Feature Matching
 - FLANN
- Was ist Unterschied zw.
Detection und Matching?



08 2 AR Spatial Understanding

Marker Tracking

- Was sind Fiducial Marker?
 - Eigenschaften?



08 2 AR Spatial Understanding

Plane Detection

- Wie?
 - Gruppen von Punkten, welche in einer Linie liegen
 - Feature Movement Tracking



08 2 AR Spatial Understanding

Render Challenges AR

- Welche Probleme gibt es?
 - Occlusion
 - Lighting
- Wie kann man die lösen?
 - Phantom Shader
 - Light Origin Estimation

08 3 AR Interaction

Übersicht

- Input Types
- Output Types
- Applications

08 3 AR Interaction

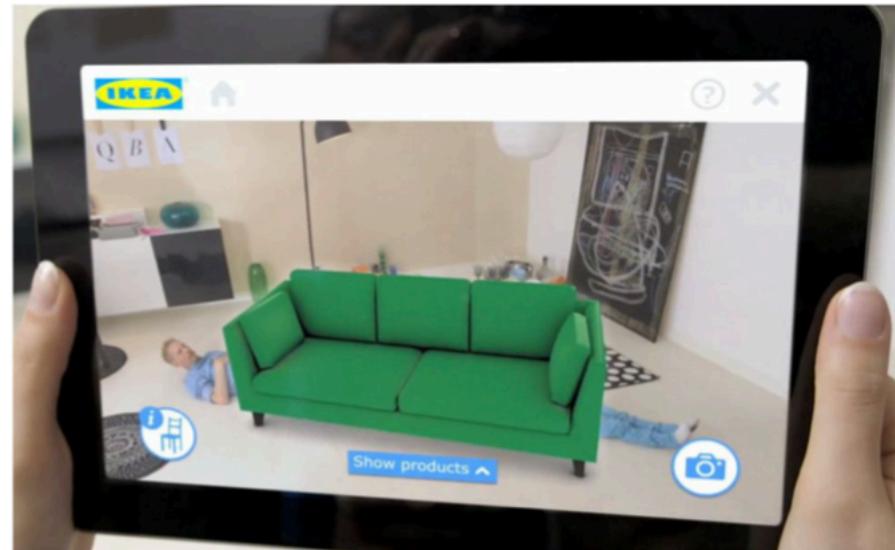
Input Types

- HMD based
 - Hand Tracking
 - Gestures
 - Eye Tracking
 - Device Movement (Virtual Camera)
 - Controller
- Spatial Technology based
 - Marker Movement
 - 3D Object Movement
- Mobile based
 - Touch Input (single + multi)
 - Device Movement (Virtual Camera)

08 3 AR Interaction

Output Types

- Mobile
 - Visual
 - Audio
 - Haptics (in hand vibrations)
- HMD
 - (stereoscopic) Visual
 - (stereo) Audio
 - Haptics (in hand vibrations, HMD vibrations)



08 3 AR Interaction

Applications

- Entertainment
- Commerce
- Socials
- Therapy
- Medicine
- Education
- Military
- History