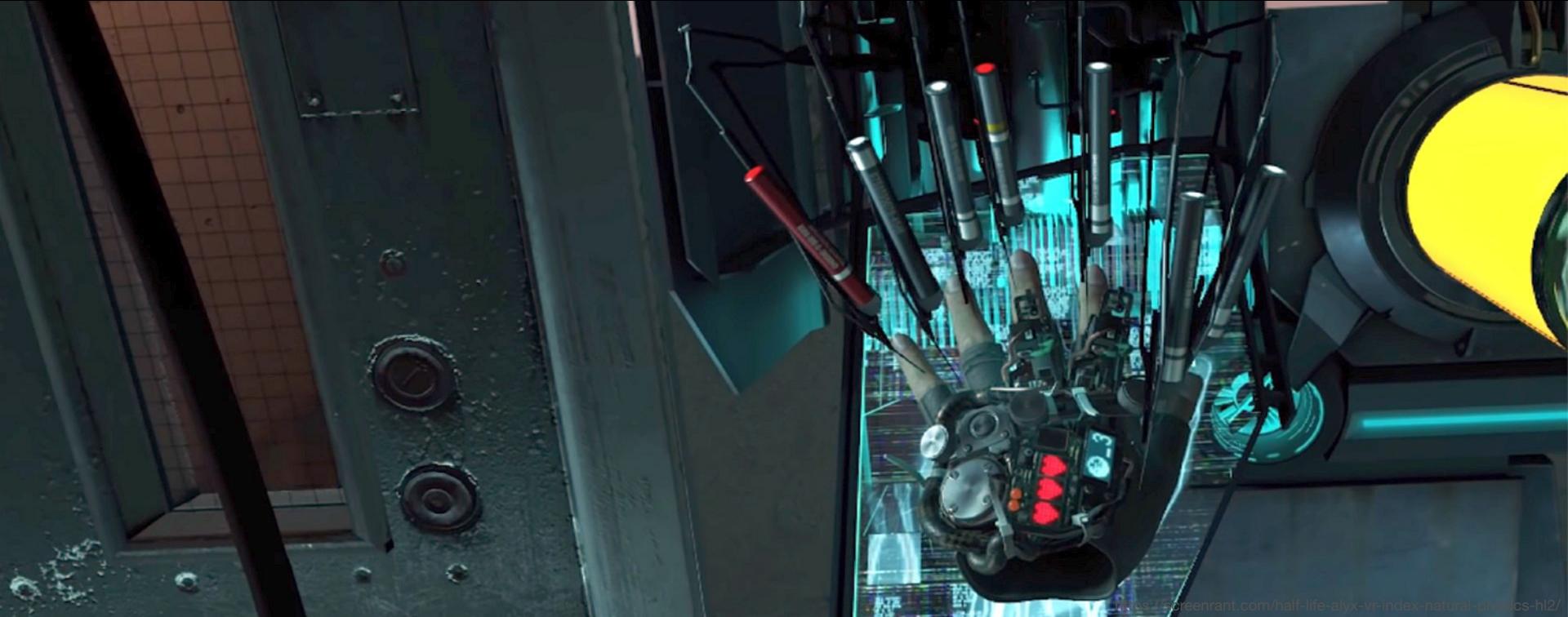


Virtual & Augmented Reality

WS 2025



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

VR Interaction

BHT

VR INTERACTIONS

LAST TIME

- VR Immersion, Presence, Self Embodiment.
- Comfort Zone
- Motion Sickness
- User Interface

A black and white photograph showing the silhouettes of several people walking on a light-colored, paved surface. The long shadows of the people are cast onto the ground, creating a rhythmic pattern. One person is in the foreground, another is further back, and a third is on the right side.

TODAY

- Interactions
- Locomotions

HOW SHOULD THE USER INTERACT WITH THE WORLD?

INTERACTION

- Definition: “a situation where two or more people or things communicate with each other or react to each another”
- In the case of HCI = Action of the user + Reaction of the computer system (and vice versa)
→ In the case of VR Experiences = Action of the user + Reaction of the VR Application

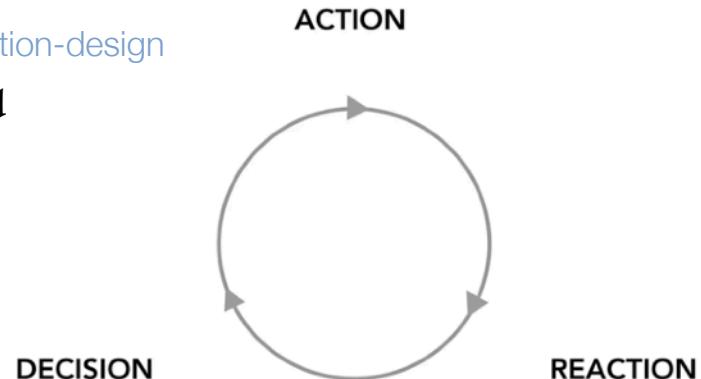
INTERACTION DESIGN

- [...] it is the design of the interaction between users and products. Most often when people talk about interaction design, the products tend to be software products like apps or websites. The goal of interaction design is to create products that enable the user to achieve their objective(s) in the best way possible.

<https://www.interaction-design.org/literature/article/what-is-interaction-design>

→ How input and output in action and perception are designed

→ Designing Interactions with Feedback



CLASSIC “SCREEN” INTERACTION DESIGN



CLASSIC “SCREEN” INTERACTION DESIGN

- Workspace: Keyboard and Mouse
- Games: Keyboard/Mouse or Gamepad
- Other screen-based-tech e.g. touchscreens utilizes more direct interactions
- Alternatives: Camera, Custom Input...
- but still rely on metaphors and abstractions
 - Icons
 - Gestures



Universal Simulation Principle:

Any interaction mechanism from the real world can be simulated in VR.

- Lavalle 2020

(early founder and head scientist of Oculus VR)

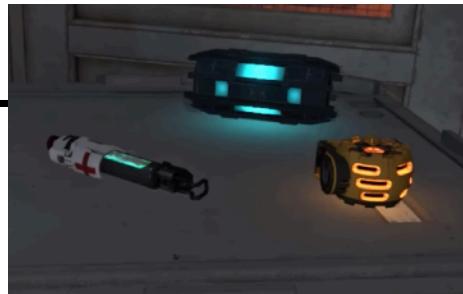


- We could throw an object by reaching to an object, grabbing it and then throwing it with a natural throwing motion
- We could open a door by turning a doorknob and pulling it open

<https://lavalle.pl/>

(Limited by the input technology)

VR INTERACTIONS



- In VR we usually interact with either the **environment** or a **user interface**
 - Often, the user interface is part of the environment
 - Interactable objects should look like it
- Non-environment interactions are difficult to remember and less intuitive
 - break of immersion
 - Needs to be learned

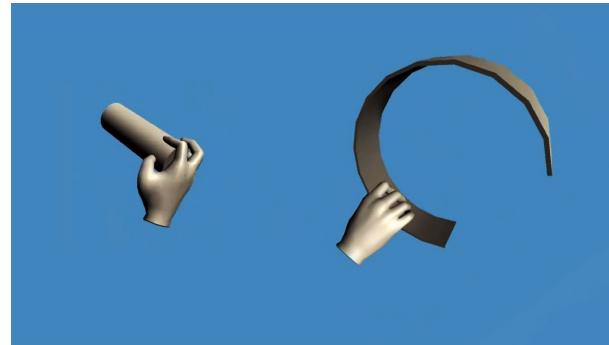
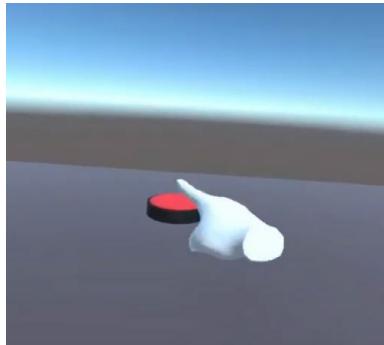
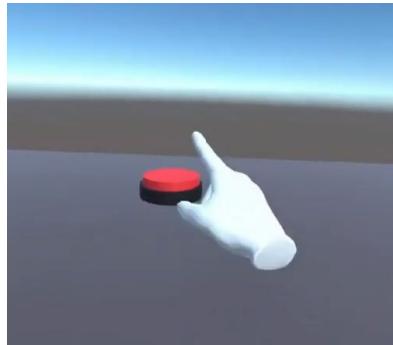
Controller-Shortcut

Du kannst ein Foto auch nur mit deinem Controller aufnehmen. Starte, indem du die  Meta-Taste bzw.  Oculus-Taste an deinem rechten Controller drückst. Drücke währenddessen den rechten Trigger und lasse dann los, um direkt ein Foto von dem aufzunehmen, was du siehst.



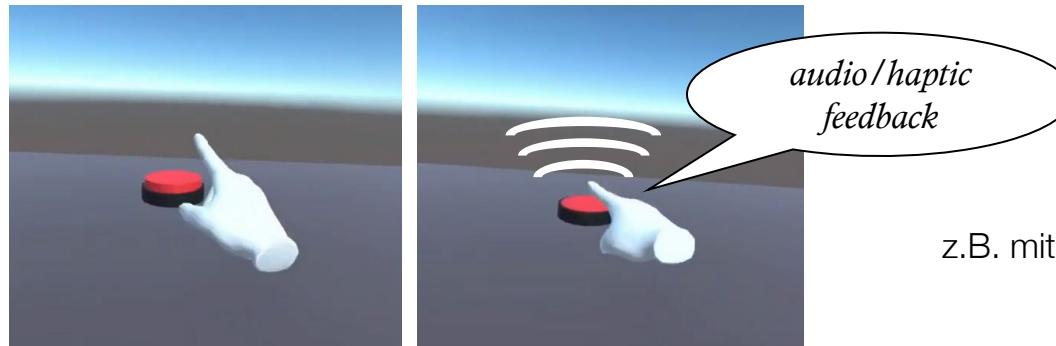
VISUAL FEEDBACK

- Change the appearance of the environment (effect of the interaction)
- and/or change the appearance of the interacting object (e.g. hand animation, material change, outline)



AUDITIVE & HAPTIC FEEDBACK

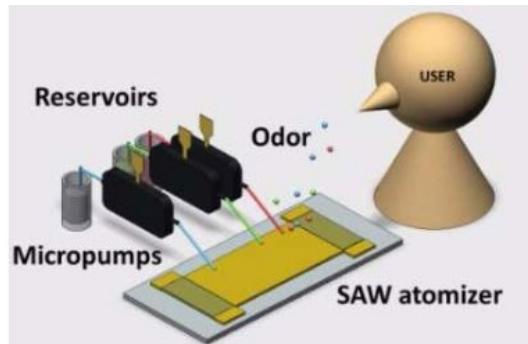
- Audio and haptic can strongly support interactions
- e.g., as a confirmation of a trigger action, or as an indicator that something can be used
- haptic strongly dependent on hardware



z.B. mit Rumble-Effekt

SMELL AND TASTE

- Could be relevant in the future
- Smell was also part of the Sensorama (1962) or today in “5D” cinema



A digital lollipop was developed at the National University of Singapore.

A depiction of a wearable olfactory display from. Micropumps force bits of liquid from small reservoirs. The SAW atomizer is a surface acoustic wave device that converts droplets into an atomized odor.

INTERACTION DESIGN FOR VR

- Feedback to see what is allowed and what not
- VR is (luckily or unluckily) a relatively young medium
 - users either expect that everything is interactable or don't expect anything
- Whatever can be done in the VR environment should be done there
 - Users will always test the boundaries
- avoid abstract button bindings on controller if possible or “use” their Placements
 - Example button on the controller could be the same on the flashlight



z.B. Magazin auswerfen
oder Waffe abfeuern

INTERACTION DESIGN FOR VR

Example *Opening the inventory*



Press 'X' on Controller

Look down on your belt

DESIGN CONSIDERATIONS FOR INTERACTIONS

- Effectiveness for the task – speed, accuracy, motion range
- Difficulty in learning – should be as easy as possible
- Easy of use in terms of cognitive load – interaction mechanism should require little or no focused attention after practice
- Overall comfort during use over extended periods

INPUT MEDIUM

Controller

- allows for button use
- “more straightforward”



Hands

- allows for gestures
- “more novel, less established rules”



FITTING INTERACTIONS

- Different experiences require different levels of interactions
- These 3 games have great interactions, in very different ways. Why?



Beat Saber



Hand Physics Lab



Half Life Alyx

Because they fit!

FITTING FEEDBACK EXAMPLES - TIPPS

- Use 3D Audio to simulate correct hearing
- Controller often allow for haptic feedback with vibrations
- Interactable objects
- Physic simulation
- General feedback for a successful or unsuccessful task
 - sound for winning, different sound for failing
 - Visual change like an animated red tint, after getting hit
- Visual Effects: Particle Systems, Fades, ...

REALISM VS. USABILITY

- Is the goal to simulate all interactions realistically in VR?
 - Can you think of examples?

EXAMPLES

Half Life Alyx Physics Interactions <https://www.youtube.com/watch?v=xRSF31dbLBU>

Hand Physics Lab <https://www.youtube.com/watch?v=w-w7omxJuOk>

Beat Saber Trailer <https://www.youtube.com/watch?v=vL39Sg2AqWg>