Virtual Reality

What is it?
Virtual Reality

- **Virtual reality** — a three dimensional, computer generated simulation in which one can navigate around, interact with, and be immersed in another environment. (John Briggs - The Futurist)
- **Virtual reality** — the use of computer technology to create the effect of an interactive three-dimensional world in which the objects have a sense of spatial presence. (Steve Bryson - NASA Ames)
Virtual Reality

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Presence

Presence is the feeling of really being someplace else.
**Tracking**

**Oculus Quest**
**Oculus Rift S**
Oculus Insight tracking

**Oculus Rift**
Constellation tracking

**HTC Vive**
Valve Index
Lighthouse tracking system

https://ai.facebook.com/blog/powered-by-ai-oculus-insight/
Input
Locomotion

Moving oneself from one location to another.
Locomotion

Continuous movement

Press a button (move thumbstick) to continuously move in some direction (relative to head or hand).

Can cause motion sickness.
Locomotion

Motion sickness

We are moving!

WTF? Reset plz!

RESET (vomit)

No we are not!
Alex: We all got motion sickness!
Alex: I have never gotten motion sick playing VR before.
AJ: Never-ever!
OJ: Never! It was my first time.
Alex: Within 45 minutes on the Index I was nauseous.
They felt bad for the entire rest of the day.
Locomotion

No locomotion

The game takes place around the player in a single location.

Only the player’s physical movement results in locomotion!
Locomotion

No locomotion

Mythos of the World Axis (2015) played by Hoopermation VR

https://www.youtube.com/watch?v=afDb4sExJho
Locomotion

No locomotion

Xortex in The Lab (2016) played by Roody Tunes

https://www.youtube.com/watch?v=LWrBrsTfzi8
Locomotion

No locomotion

Holopoint (2016) played by Disastorm
https://www.youtube.com/watch?v=78mgtArsPvs
Locomotion

Fixed locations to move to and stay in

Movement to these locations can be controlled by the player or be event-based.
Locomotion

Fixed locations to move to and stay in
Locomotion

Move to a projectile

You shoot a projectile and decide when to teleport to its location.
Locomotion

Move to a projectile

Teleported (2015)
https://www.youtube.com/watch?v=jBge7W7I5Uc
Locomotion

Forward motion by moving the controllers up and down

Simulates the movement of hands as if running.
Locomotion

Forward motion by moving the controllers up and down

69 Ways to Kill a Zombie (2017) played by Achievement Hunter
https://www.youtube.com/watch?v=MVLNGK2Aymk

Haunted Oblivion VR
Locomotion

Grappling hook

You shoot a grappling hook and it pulls you forward (or the player pulls themselves on it).
Locomotion

Grappling hook
Locomotion

Blink teleportation

Instantly teleport to the desired location.
Locomotion

Blink teleportation

Pretty much in the majority of VR games where the player can move!

The Lab (2016) played by ExileLord
https://www.youtube.com/watch?v=fyzmIkcVjCg
Locomotion

Shift teleportation with vignette

Interpolate the location, but use a vignette to cover the peripheral vision.
Locomotion

Shift teleportation with vignette

Trickster VR (in 2017) played by MasterGamingVR
https://www.youtube.com/watch?v=dS60uvO5oS4
Locomotion

Shift teleportation

Interpolate the location.
Locomotion

**Shift teleportation**

*Half-Life: Alyx (2020)* played by Adam Savage’s Tested
[https://www.youtube.com/watch?v=rEtgF7YTkLY](https://www.youtube.com/watch?v=rEtgF7YTkLY)
Locomotion

Fixed play areas

Continuous

Specific mechanic

Teleportation
Locomotion

Half-Life: Alyx (2020) played by Adam Savage’s Tested
https://www.youtube.com/watch?v=rEtgF7YTkLY
Design

Tribocalypse VR (2017)
Design

Use real world dimensions!

Standard door height: 2.1 m
Average human height: 1.6 - 1.7 m
My height: 1.88 m
1.7 m is ~81% (% ) of 2.1 m


Design

Use real world dimensions!

QuiVR, Tribocalypse VR, Nvidia Funhouse, Job Simulator

Brometheus_Tv
They pay much attention to everything. They want to mess with things and they want to poke at things. (...)  

In old Half-Life games a bunch of players were just running through the environment very quickly looking for enemies and so on. (...)  

We got to fill every nook and granny with something in a way you couldn't justify it before.

Inside Valve: Making Half-Life: Alyx for Virtual Reality by Adam Savage’s Tested [https://www.youtube.com/watch?v=cRVXhA0-TI4](https://www.youtube.com/watch?v=cRVXhA0-TI4)
Design

Details matter!

Half-Life: Alyx (2020) played by Adam Savage’s Tested

https://www.youtube.com/watch?v=rEtgF7YTkLY
Players traverse the world at a slower pace: Details matter!

In one room:
1 – 3 interactable objects
vs
10 – 30 interactable objects

In the real world you could interact with an object, so here one should also be able to!
(to a certain limit of course)
Vertical involuntary movement is worse than horizontal.

Avoid stairs.
Ladders:
- Climbable using hands.
- Blink-teleportable.

Elevators work well!
Design

User input design must be **extremely intuitive**!

Intuitive gestures with hand pointing and finger movement.

Having a player press a button lessens the use of that action.

Watch:
**Inside Valve: Making Half-Life: Alyx for Virtual Reality** by Adam Savage’s Tested
[https://www.youtube.com/watch?v=cRVXhA0-TI4](https://www.youtube.com/watch?v=cRVXhA0-TI4)
Design

Having hands as physical objects helps with immersion.

Animations when hands touch the environment.

Half-Life: Alyx (2020) played by Adam Savage’s Tested
https://www.youtube.com/watch?v=rElqF7YTkJY
This is taught in our game dev and HCI courses.

Diegetic | Non-Diegetic
---|---
Spatial | Meta

GUI
GUI

Diegetic
Part of the environment

Dead Space (2008)

Triboocalypse VR (2017)

Half-Life: Alyx (2020)
GUI

Diegetic

Not part of the environment in any way

Your regular HUD

Non-Diegetic

Neverwinter (2013)

Totem Games (2016)
In the 3D environment.

Spatial
Doom Eternal (2020)

Spatial

Not in the environment

The player character should be aware of

Meta

Need for Speed 2 (1997)
Design

Lot of detail and playtesting!

Playtesting and iteration (small changes and improvements) takes the majority of time!

Common PC game practices do not all apply.

Also important:

- Sound (binaural audio)
- Accessibility (playing one handed) etc.
- …
Recommendations

**Half-Life: Alyx In-Depth Review** by Adam Savage’s Tested
[https://www.youtube.com/watch?v=h7q5L9B-ZhE](https://www.youtube.com/watch?v=h7q5L9B-ZhE)

**Inside Valve: Making Half-Life: Alyx for Virtual Reality** by Adam Savage’s Tested
[https://www.youtube.com/watch?v=h7q5L9B-ZhE](https://www.youtube.com/watch?v=h7q5L9B-ZhE)

**Half-Life: Alyx - Angry Review Discussion** by Angry Joe Show
[https://www.youtube.com/watch?v=aWayXQq1rtY](https://www.youtube.com/watch?v=aWayXQq1rtY)

APT GameGenerator’s **VR Jam Talks**:
[https://www.youtube.com/watch?v=BPMbCL5Ua20&list=PLJsTrgudppKg88ci3OqqmN6B1RxaLkWYg](https://www.youtube.com/watch?v=BPMbCL5Ua20&list=PLJsTrgudppKg88ci3OqqmN6B1RxaLkWYg)

**Tribocalypse VR Talk** in EEVR 12:
[https://www.youtube.com/watch?v=lUgh3CssZwY](https://www.youtube.com/watch?v=lUgh3CssZwY)

**Virtual Reality Game Design Analysis Based on Tribocalypse VR** by Jens-Stefan Mikson

Variety of experiments by Ats Kurvet:
[https://www.youtube.com/user/exteriorbox/videos](https://www.youtube.com/user/exteriorbox/videos)

The VR Book: Human-Centered Design for Virtual Reality by Jason Jerald
Thanks!