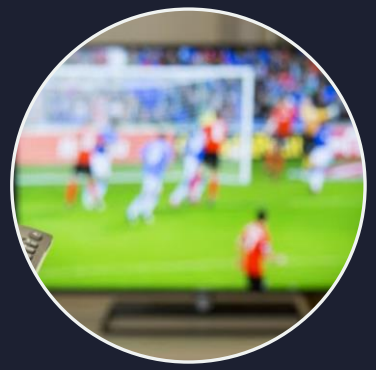
Toward convenience and portability

To go some where to see



See it from your home

Being able to carry anywhere

What is Virtual Reality (VR)?

A high-end **user interface** that involves **real-time simulation** and **interactions** through **multiple sensorial channels** for a **targeted behavior** in an **organism**.

Visuals

So vibrant that they are eventually indistinguishable from the real world

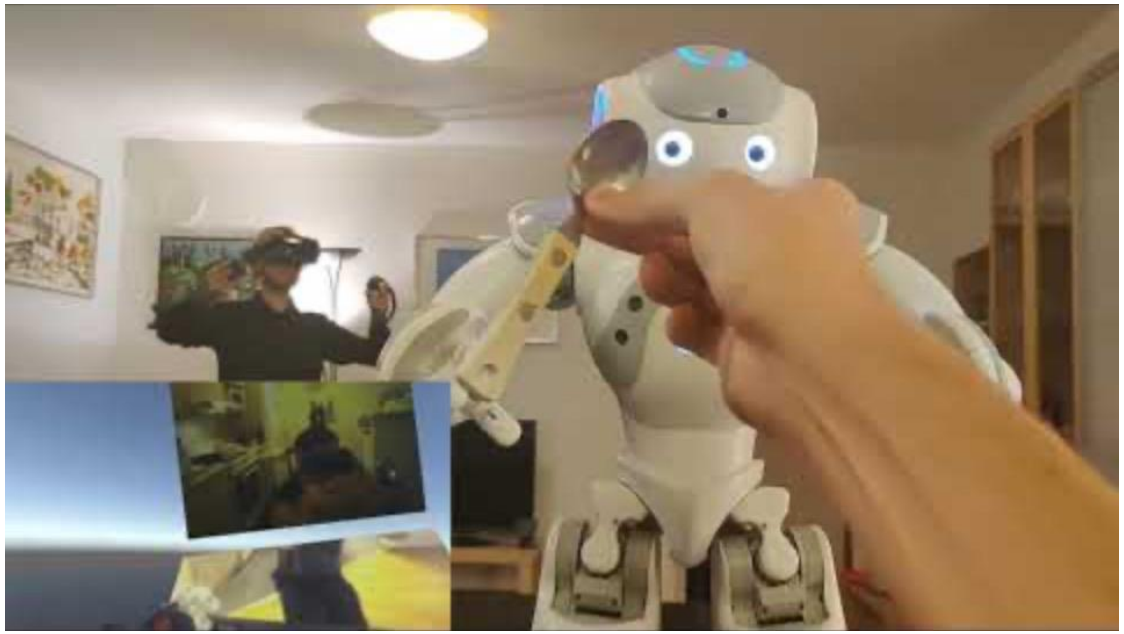
Interactions

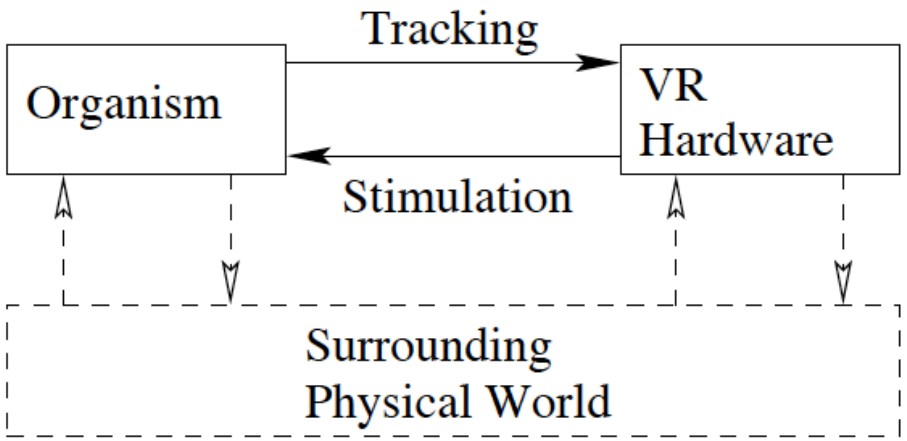
So intuitive that they become second nature

Sounds

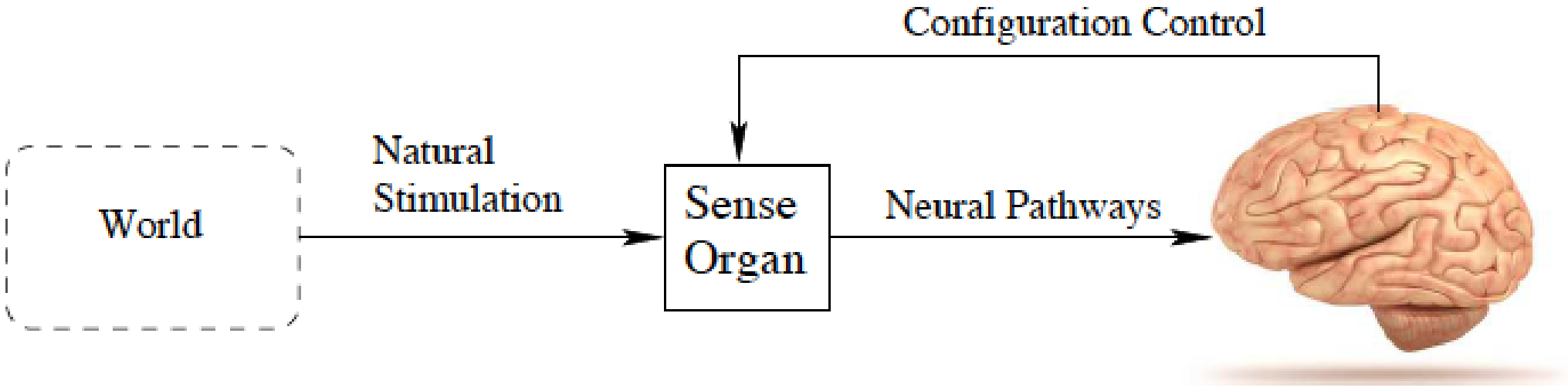
So accurate that they are true to life

VR System





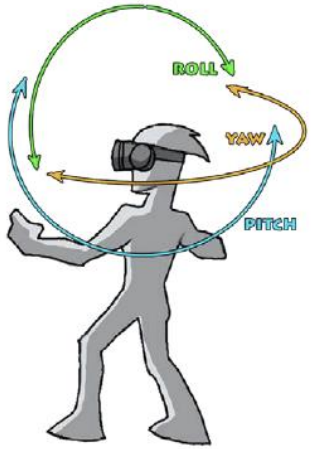
A third-person perspective



Sensors and Sense Organs

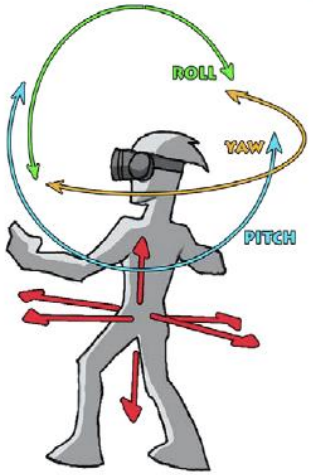
DEGREES OF FREEDOM (DOF)

3 degrees of freedom (3-DoF)



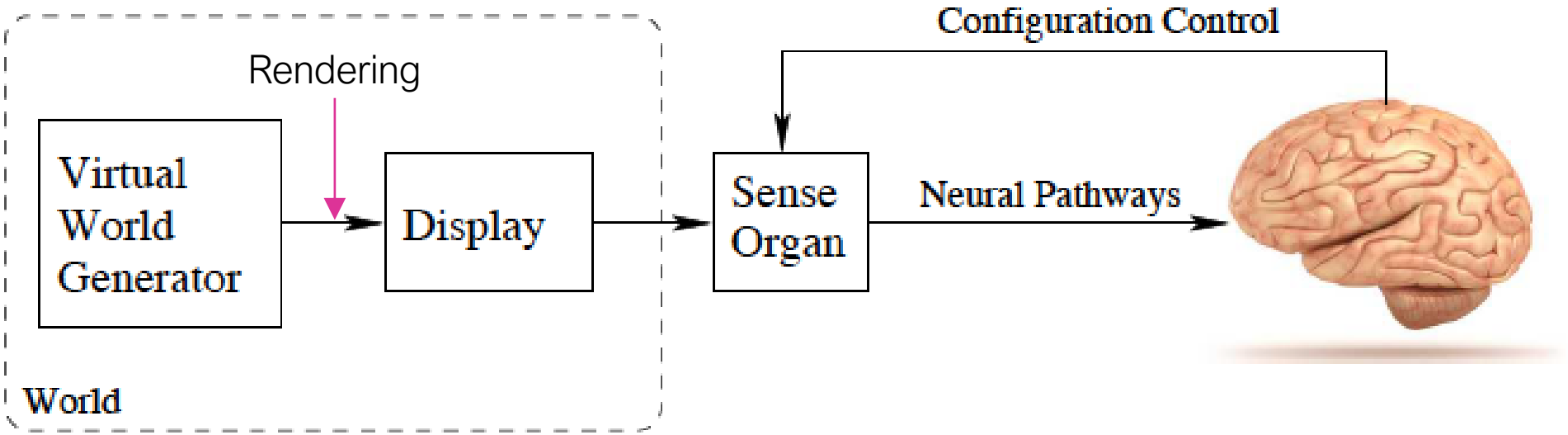
- “In which direction am I looking”
- Detect rotational head movement
- Look around the virtual world from a fixed point

6 degrees of freedom (6-DoF)

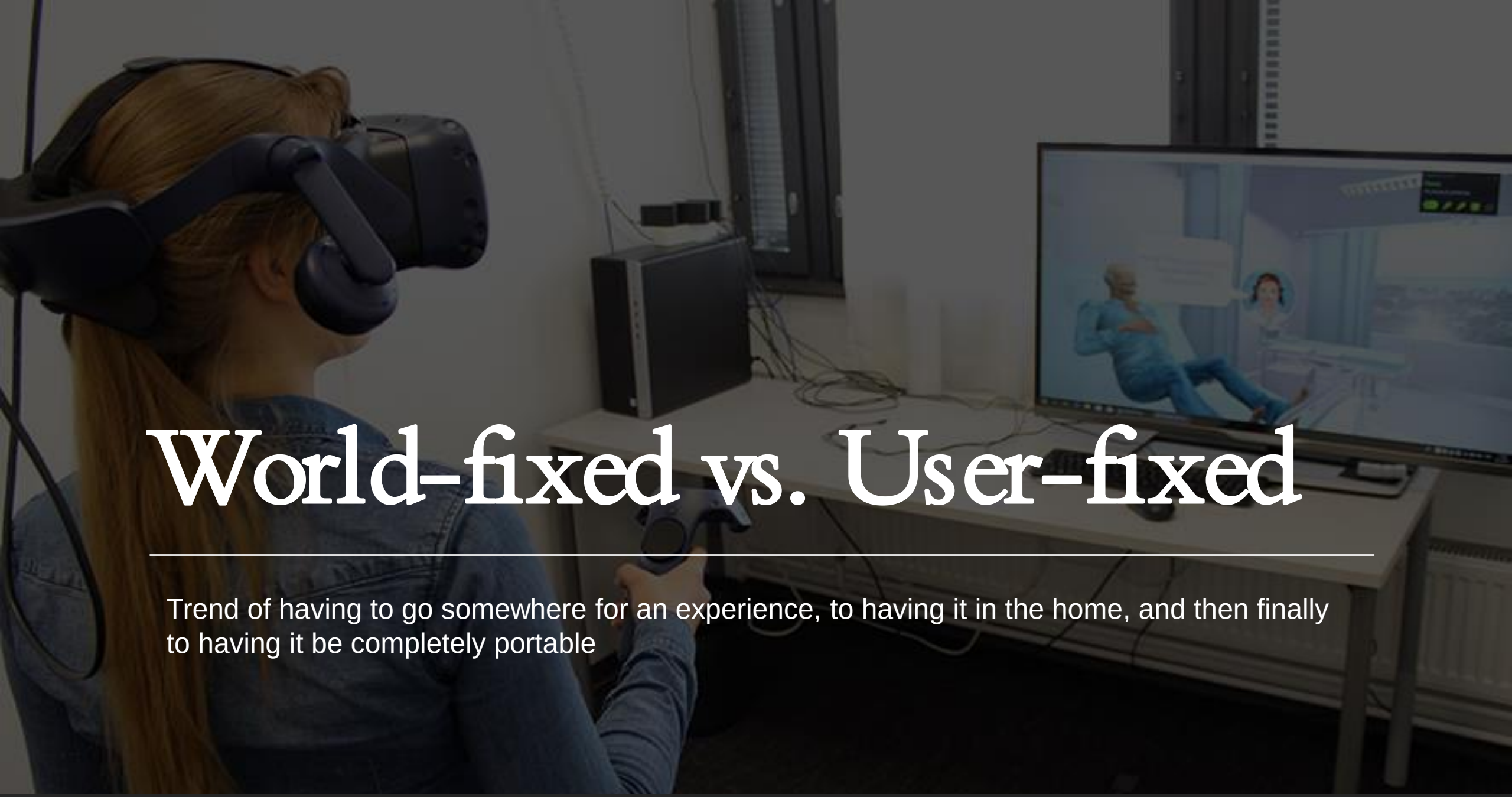


- “Where am I and in which direction am I looking”
- Detect rotational movement and translational movement
- Move in the virtual world like you move in the real world

An illustration

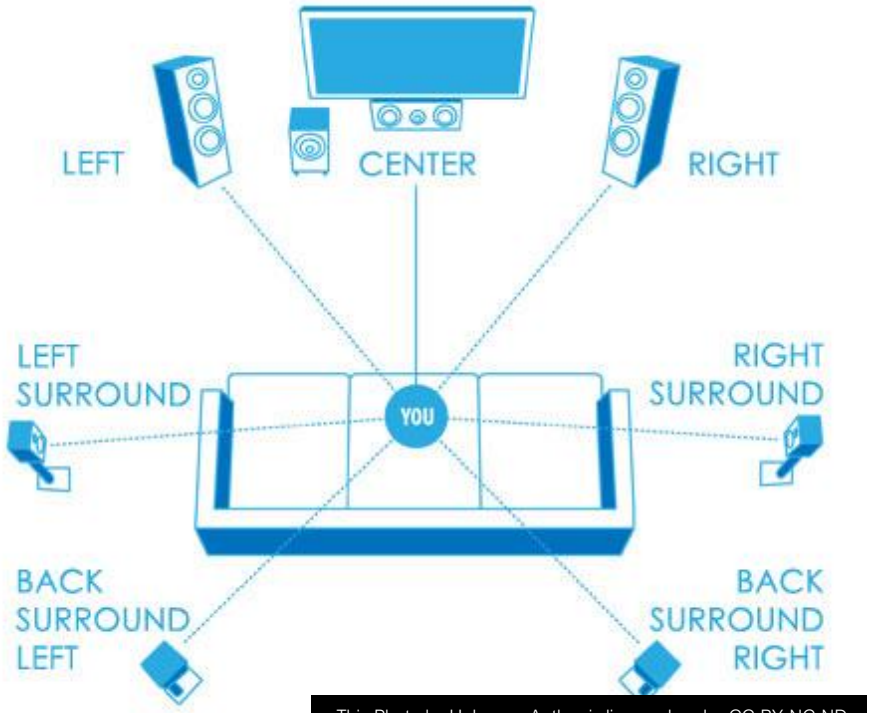


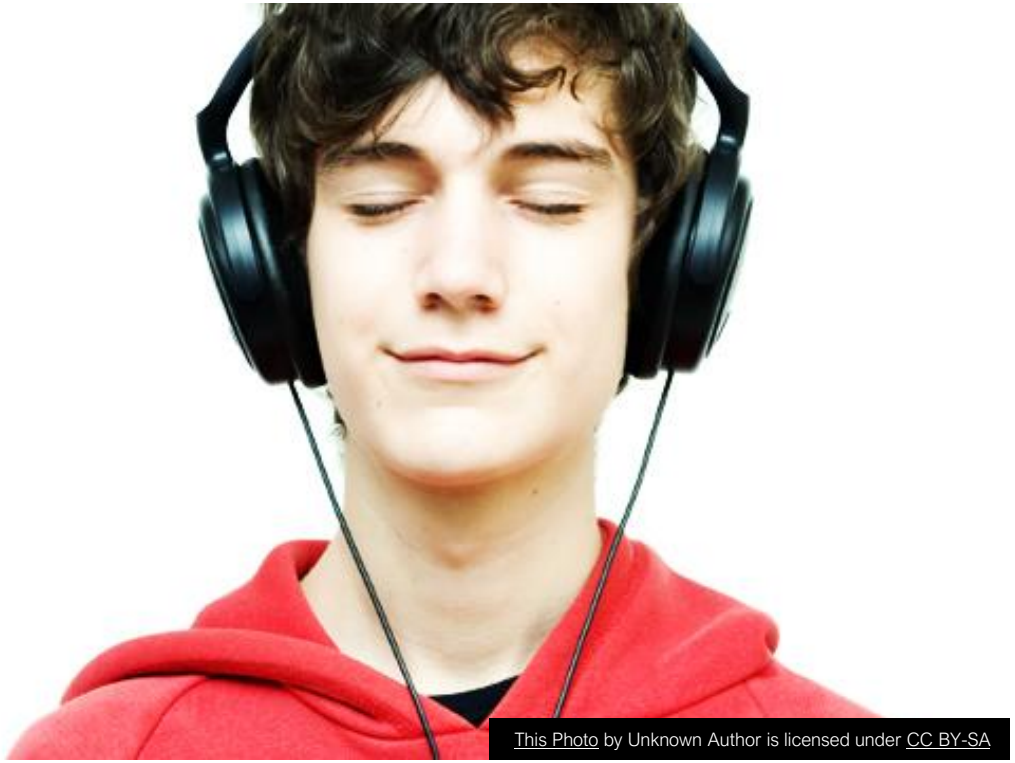
Artificial simulation



World-fixed vs. User-fixed

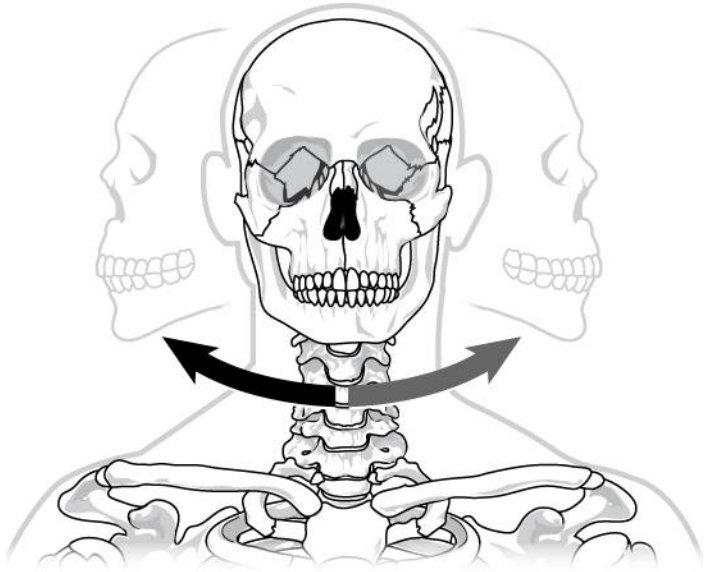
Trend of having to go somewhere for an experience, to having it in the home, and then finally to having it be completely portable





Use-case 1: Aural

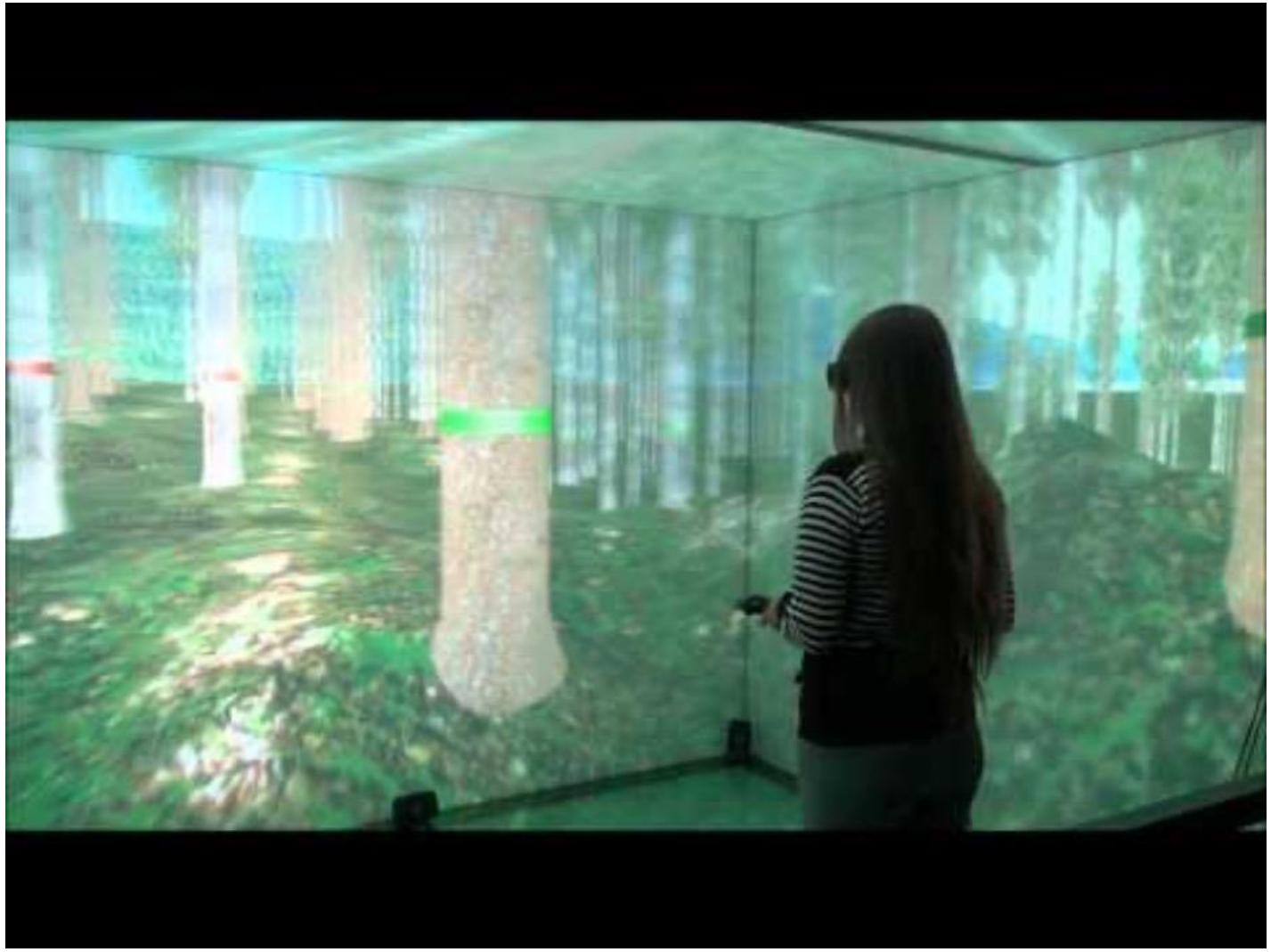
Key Differences



- Distance of the source (or stimuli) from the ears
- Power requirements to generate the stimuli of equal strength
- Degree of privacy
- No of users having the immersive experience
- Cost of the system
- Wearing electronics

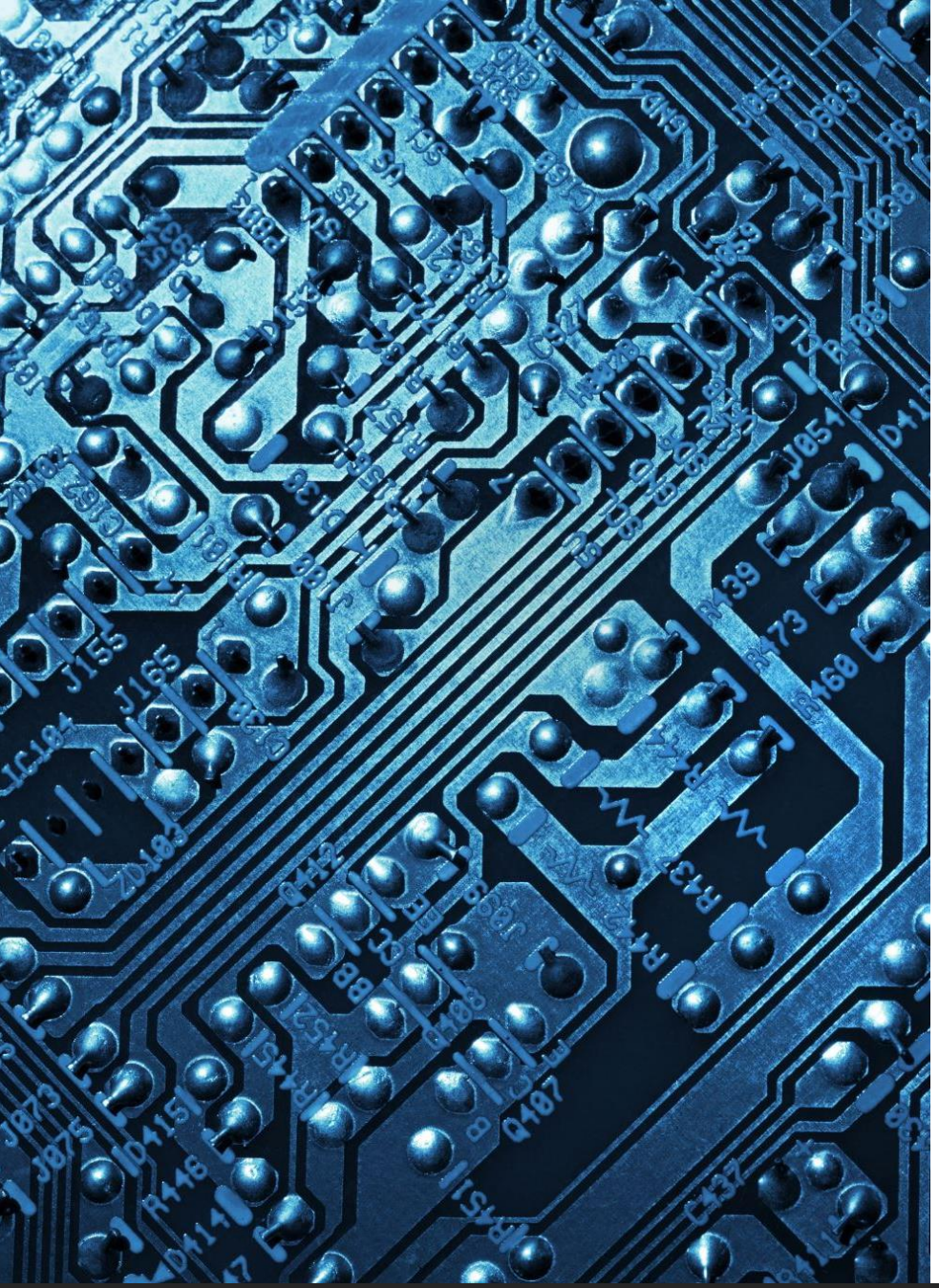
How are these factors going to affect a VR system design?

Use-case 2:Visual

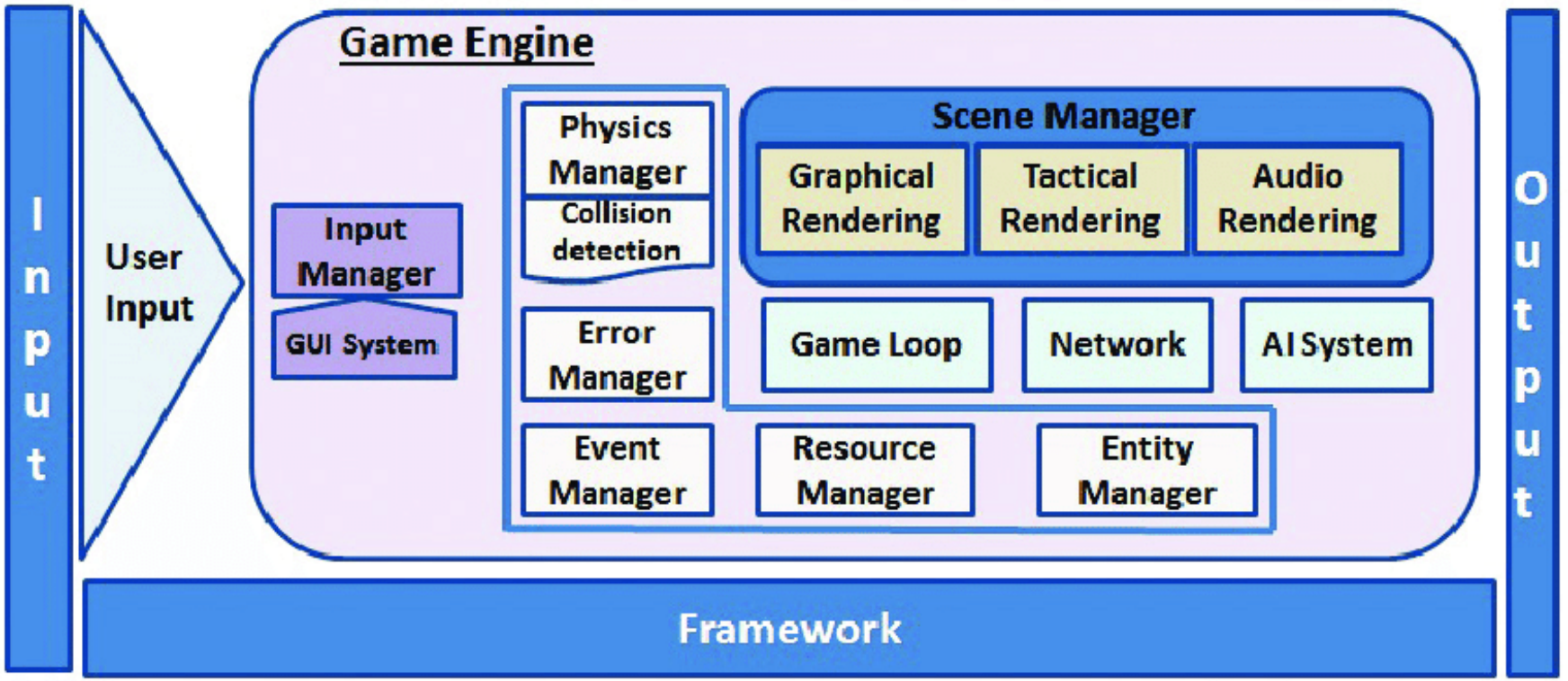


An Example

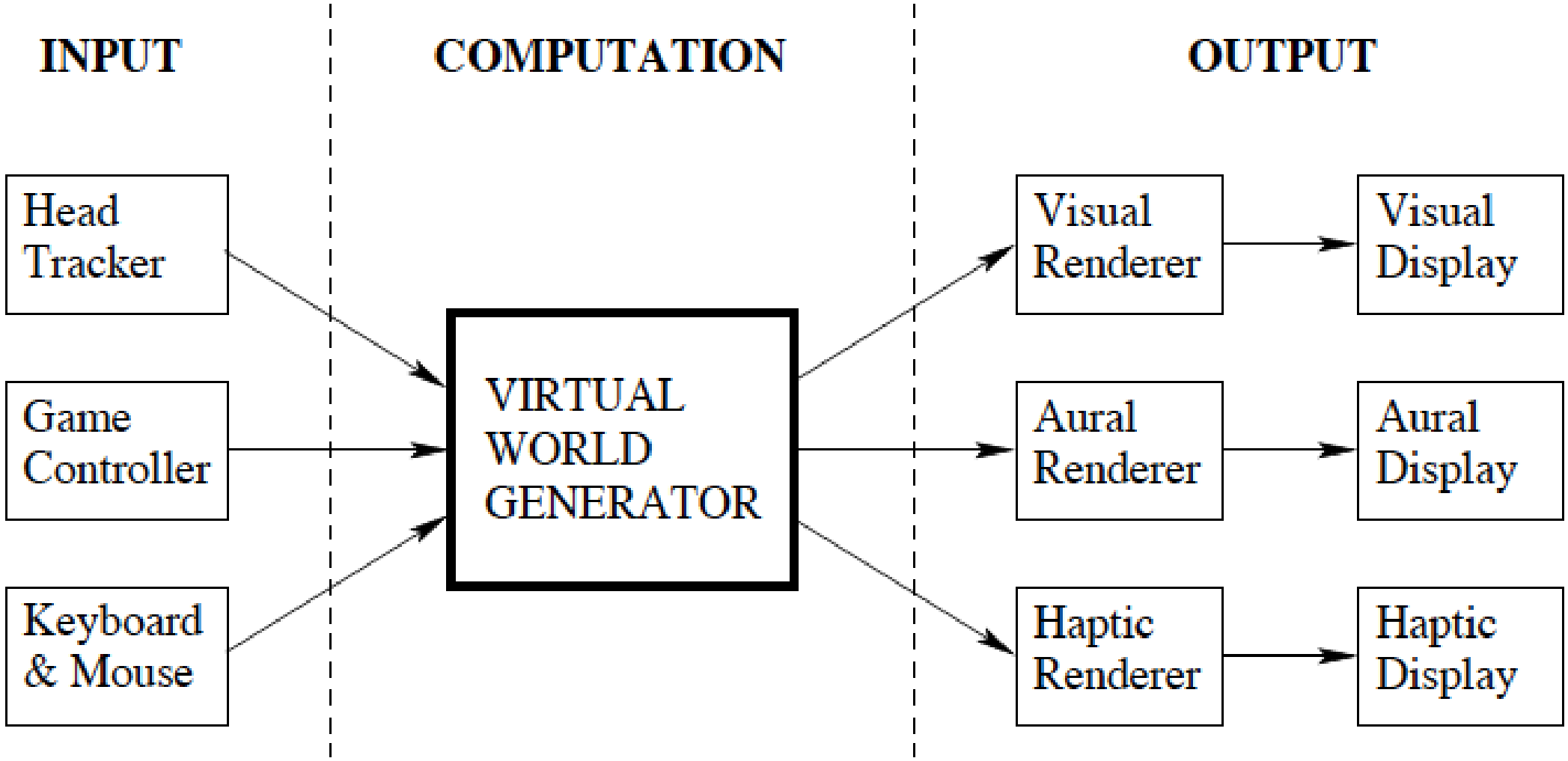
Virtual CAVE



Hardware Software Framework


Input
User Input
Game Engine
Input Manager
GUI System
Physics Manager
Collision detection
Error Manager
Event Manager
Resource Manager
Entity Manager
Scene Manager
Graphical Rendering
Tactical Rendering
Audio Rendering
Game Loop
Network
AI System
Framework
Output

Game Engine


INPUT
COMPUTATION
OUTPUT
Head Tracker
Game Controller
Keyboard & Mouse
VIRTUAL WORLD GENERATOR
Visual Renderer
Aural Renderer
Haptic Renderer
Visual Display
Aural Display
Haptic Display

Software Stack

Drivers

- System level interactions

Operating System

- To better manage the peripheral

Middleware

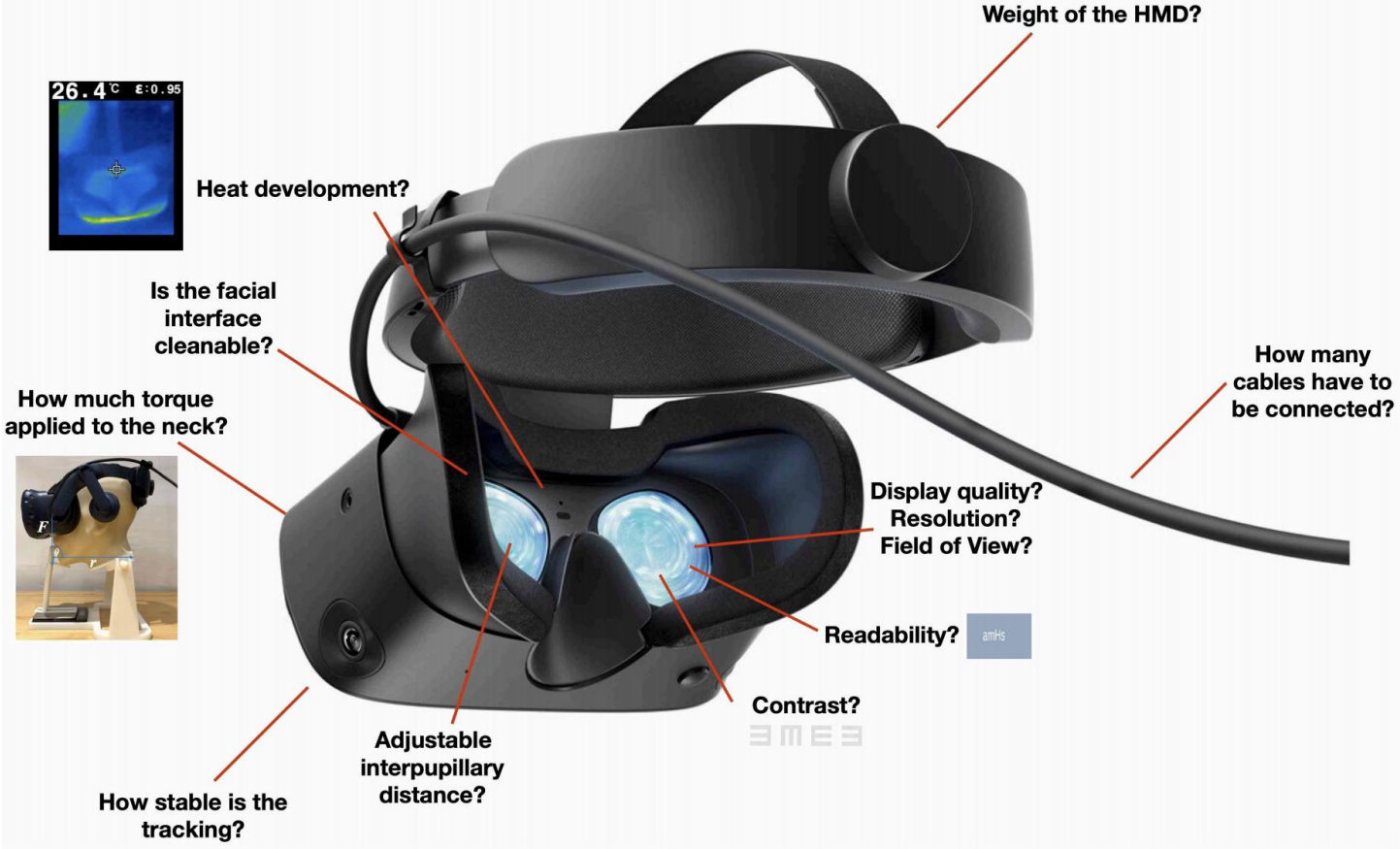
- Processing engine (Game, Audio, Video)

Tools and SDKs

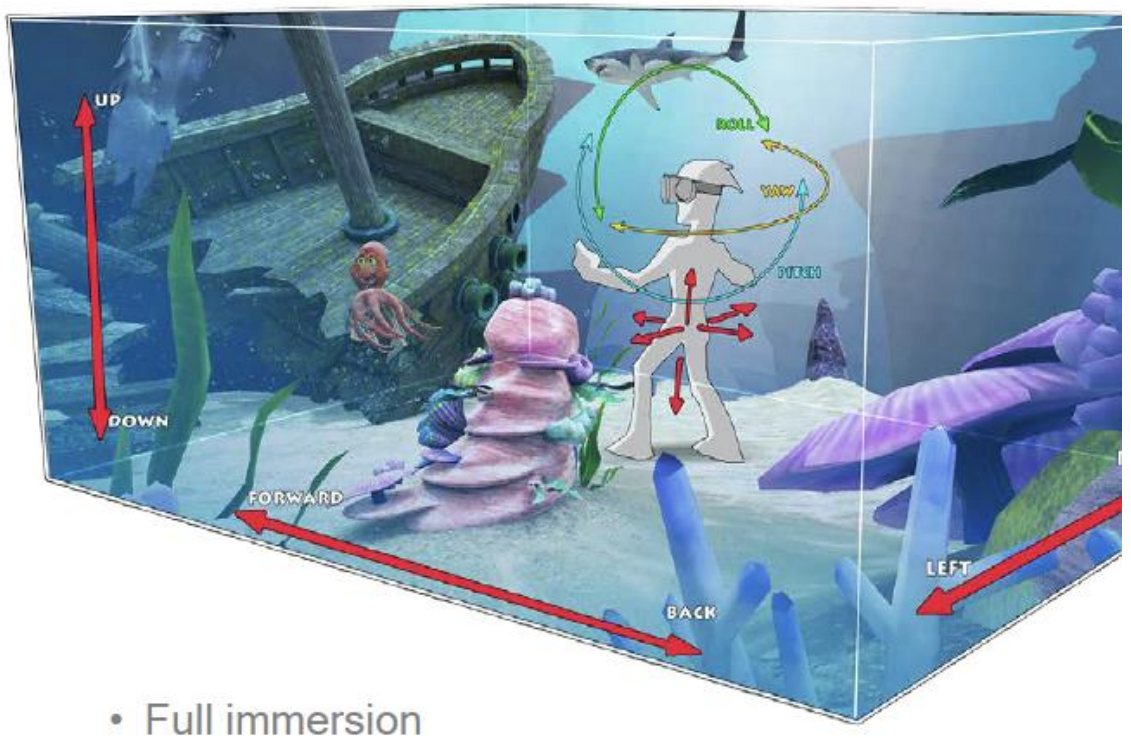
- To generate the content

Head-Mounted Display (HMDs)

- Basic one
  - Google CardBoard and VRAse use your smartphone
- State-of-the-art
  - Carl Zeiss VR One Plus
  - HTC Vive
  - Microsoft HoloLens
  - OculusVR bought by facebook
  - Samsung GearVR
  - Sensics invented the Smart Goggles
  - Sony PlayStation VR
  - Sulon Technologies

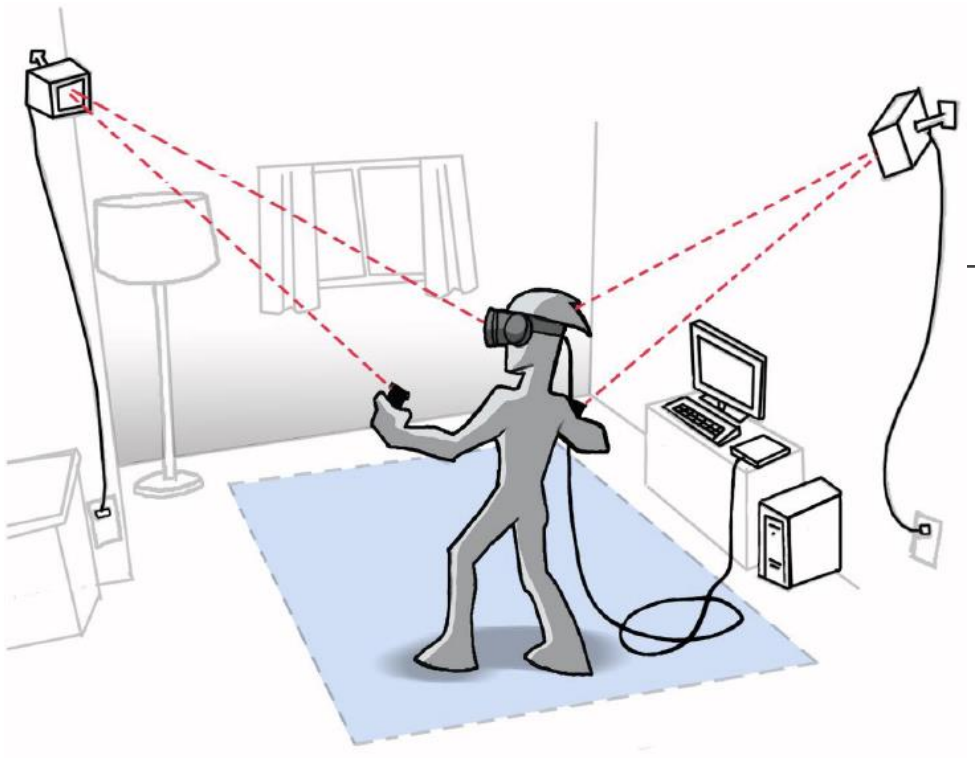

Weight of the HMD?
26.4 °C ε:0.95
Heat development?
Is the facial interface cleanable?
How much torque applied to the neck?
How many cables have to be connected?
Display quality?
Resolution?
Field of View?
Readability?
Contrast?
Adjustable interpupillary distance?
How stable is the tracking?

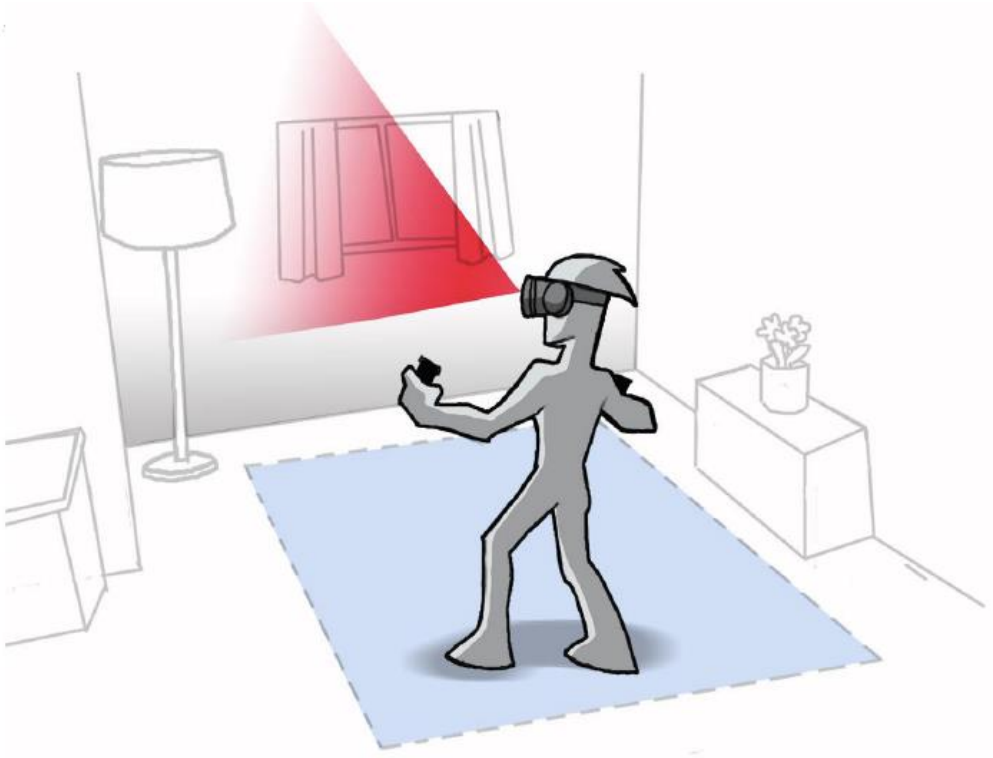
VR Metrics



- Full immersion

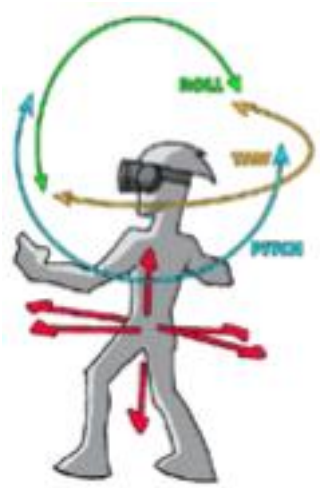
Bring the user into the story





World-fixed vs. User Fixed (Revisited)

An illustration



Motion

Motion Detection

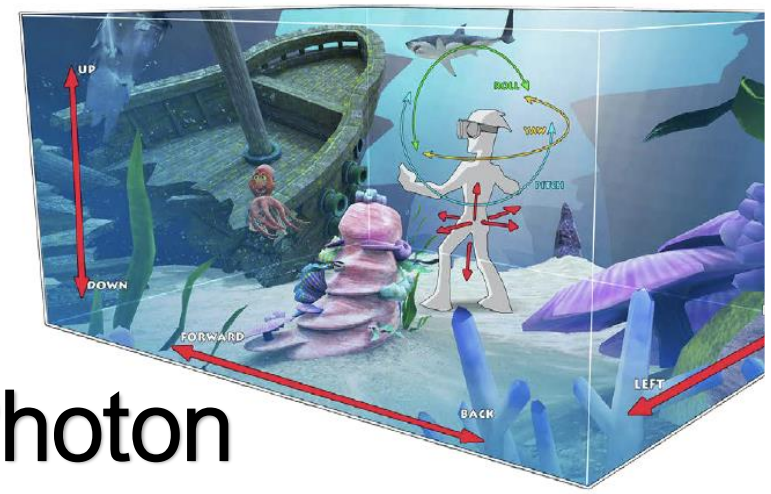
- Sensor sampling
- Sensor Fusion

Visual Processing

- View Generation
- Render

Display

- Image creation
- Quality enhancement



Photon

Applications

Children Playing

Kids chasing virtual characters in more interactive and immersive games

Young Adults Exploring

A young man exploring Rome and seeing the Colosseum as originally built

Families Communicating

Families virtually brought together with life-like communication

Professionals Working

Architects collaborating on a shared design to improve efficiency

Fitness Enthusiasts Thriving

Group running with a virtual trainer to motivate them

Industry and Enterprise

Industrial and manufacturing
- Guided training and remote support
- Improved safety
- Real-time factory diagnostics

Healthcare
- More efficient patient care
- Diagnosis and treatment assistance
- Surgical training and visualization

Education
- Immersive, self-guided, interactive visual learning
- Any subject, from history and physics to vocational

Military
- Instructional training
- In-the-field assistance

Engineering
- 3D visualization and CAD
- Colleague collaboration and communication

Retail
- Try before you buy: clothes, furniture, car, real estate shopping, etc.
- Navigation to products and personalized coupons

Marketing and advertising
- Personalized ads based on context
- Consumer data - what they like, what they look at, etc.

Emergency response
- Police, fire, security response
- Potential improvements in safety, response time, and saving lives

AR Business Today

Marketing

Web-based, mobile

Gaming

Mobile, Physical input

Mobile AR

Geo-located information and service

Driving demand for high end phones

Upcoming areas

Manufacturing, Medical, Military

Thank you