# Gestural interaction

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# Gesture

- non-verbal / non-vocal communication in which visible bodily actions communicate particular messages

- include movement of the hands, face, or other parts of the body

- Gesture recognition: interpreting human gestures via mathematical algorithms.

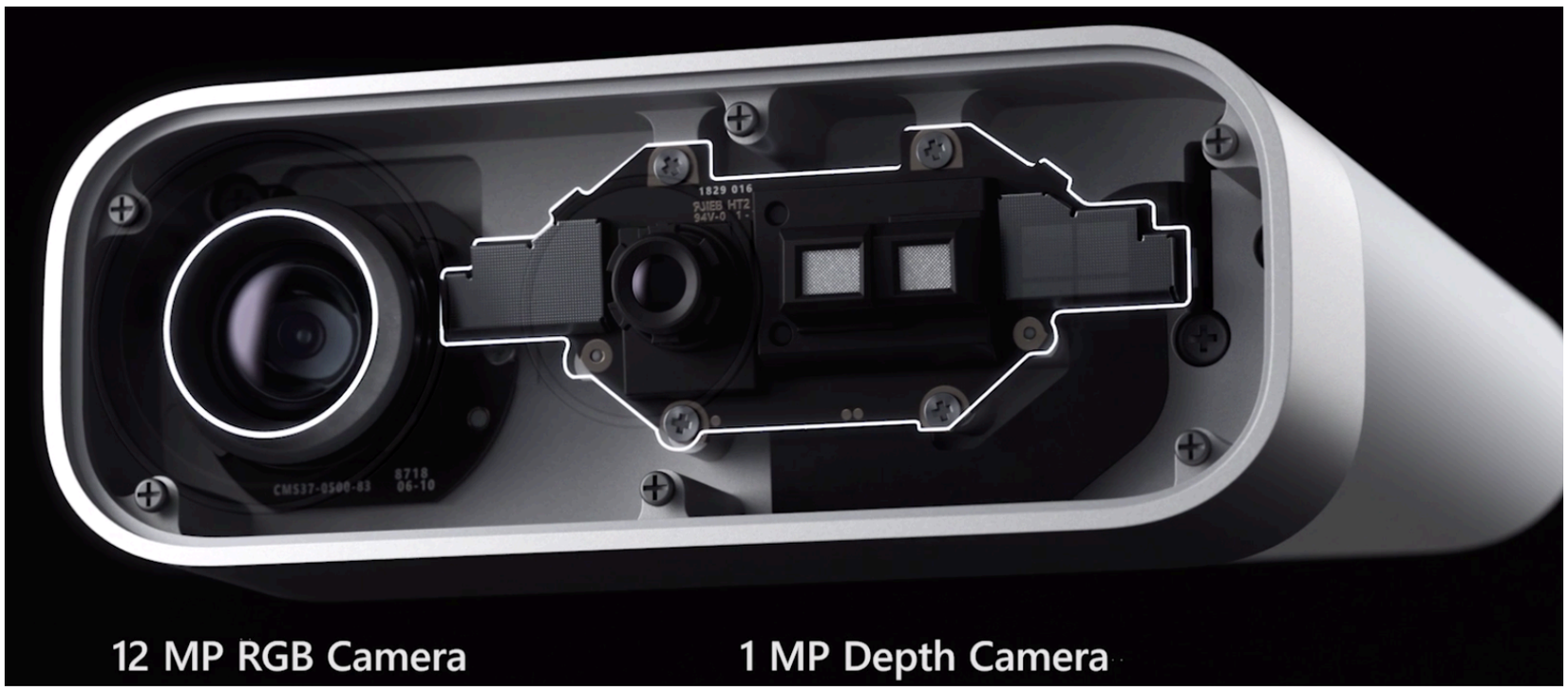
- posture, gait, proxemics, human behaviors…

- Touch gestures
- **Touchless gestures** — we focus on this

# Touchless gestures

- Gestures to interact with devices without touching
- Based on computer vision, image processing, inertial measurement units (accelerometer + gyro + magnetometer).
- Technology: stereoscopic cameras, infra-red, Inertial motion capture gloves, wired gloves, laser-scanners
- Social acceptability of gesture
- Gorilla arm

Leap motion - two monochromatic IR cameras and three infrared LEDs


Kinect - depth sensor, spatial microphone array, video camera, and orientation sensor

# 3D User interfaces

- human-computer interaction in which the user's tasks are performed directly in a 3D spatial context

- making movements in physical 3D space or manipulating tools, sensors, or devices in 3D space

- 3D interaction is a natural choice for large display contexts.

- technological enabler of 3D UIs is spatial tracking

- spatial tracking not sufficient on its own

- most handheld trackers include other sorts of input, because it's difficult to map all interface actions to position, orientation, or motion of the tracker

- Buttons, joystick


## 1. Headset

Soft, comfortable headset with state-of-the-art displays and custom optics provide incredible visual fidelity and a wide field of view.

## 2. Touch controllers

Touch is a pair of tracked controllers that provide intuitive hand presence in VR—the feeling that your virtual hands are actually your own.

## 3. Two Sensors

Rift sensors track constellations of IR LEDs to translate your movement into VR whether you're sitting down or standing up.

# Virtual Reality

- not physically existing but made to appear by software
- Immersive environment
- Sensory feedback: auditory, visual, haptic, …

# VR technology

- Desktop VR (e.g. first person video games)
- Head-mounted display (VR headset)
  - Two monitors for separate images to each eye
  - Stereo audio
  - Head tracking
  - Haptic feedback
- 3D mouse, the wired glove, motion controllers, and optical tracking sensors
- Virtual reality sickness

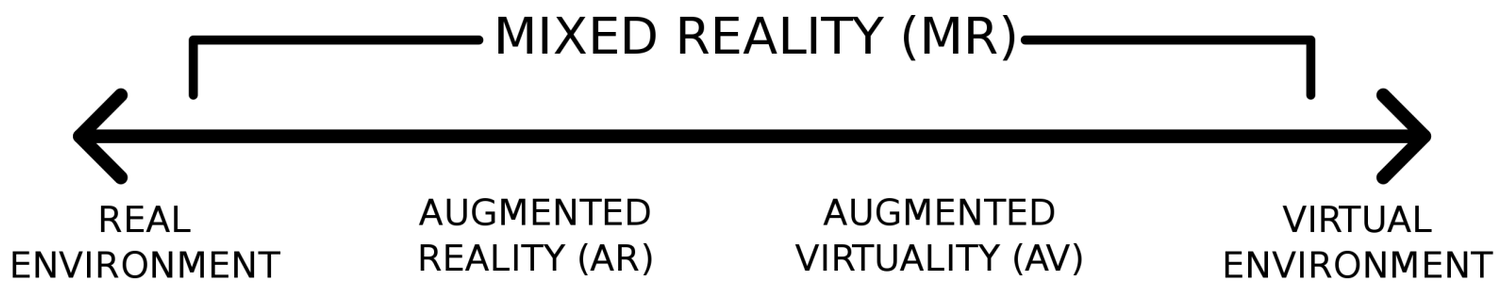
# VR applications

- Entertainment
- Robotics
- Social science and psychology
- Healthcare
- Education and training
- Fine arts
- Engineering
- Health/safety
- Cultural heritage
- Urban design
- Digital marketing

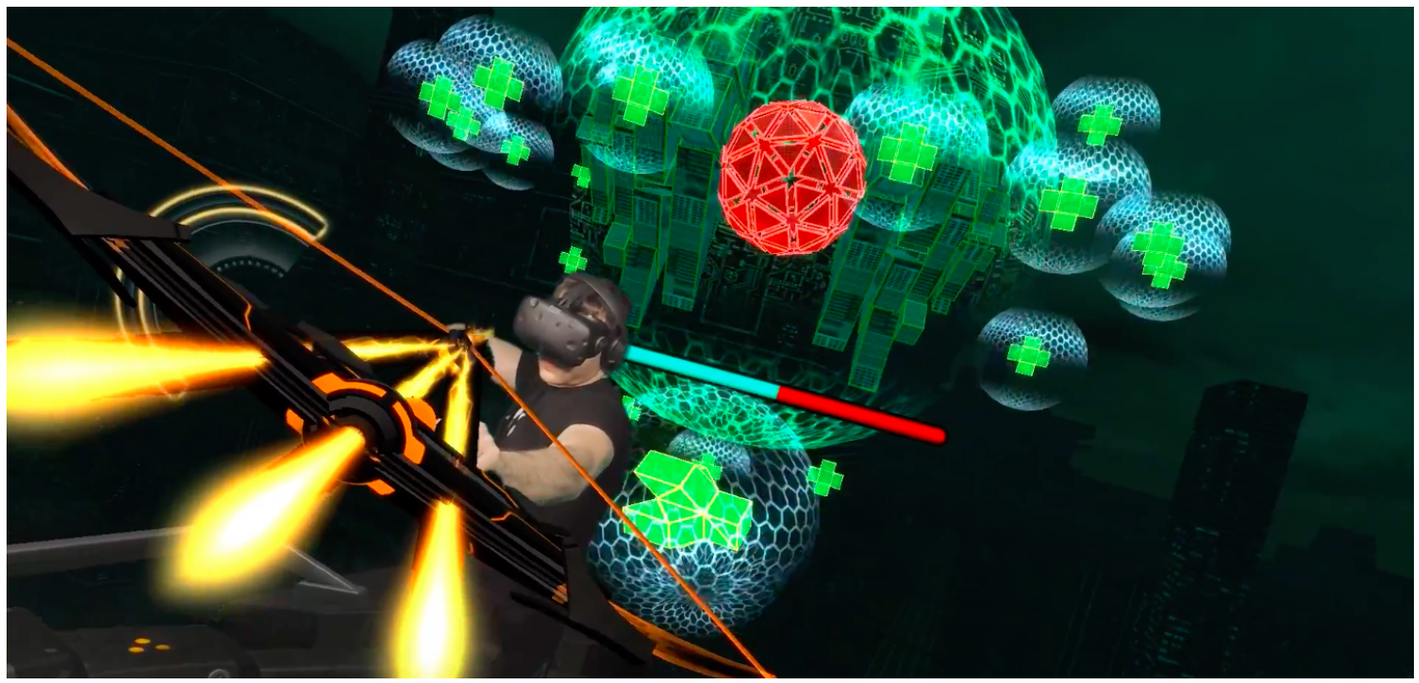
# Augmented reality

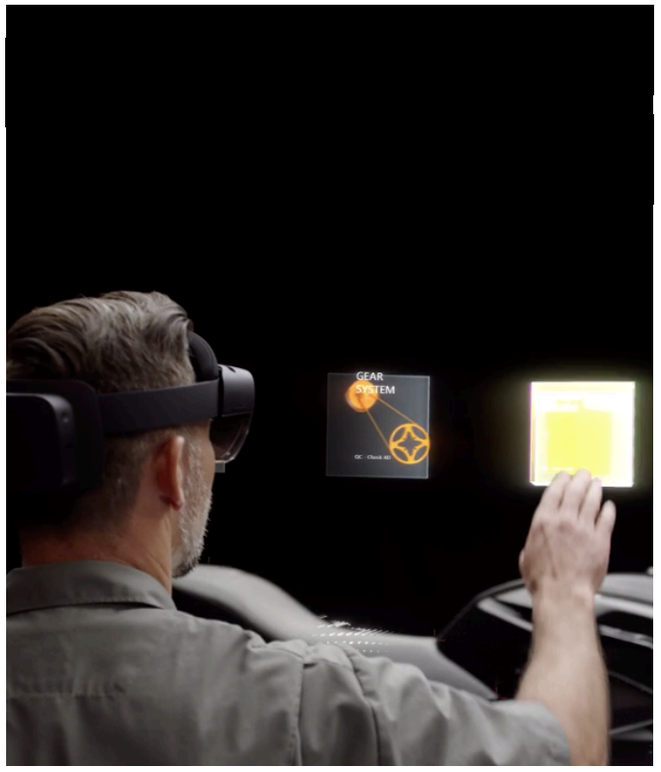
- objects that reside in the real-world are "augmented" by computer-generated perceptual information
- augmented reality alters one's ongoing perception of a real-world environment, whereas virtual reality completely replaces the user's real-world environment with a simulated one
- the information about the surrounding real world of the user becomes interactive and digitally manipulable
- overlaid on the real world
- Heads-up display

# Mixed reality




- Augmented Virtuality, i.e. merging of real world objects into virtual worlds






Microsoft HoloLens: mixed reality smartglasses developed and manufactured by Microsoft

# Interaction fidelity

- objective degree with which the actions (characterized by movements, forces, body parts in use, etc.) used for a task in the UI correspond to the actions used for that task in the real world

- continuum of realism

- Natural / magic

- Natural metaphor: extend users' abilities beyond what's possible in the real world. hyper-natural

# Precision in spatial input

- 3D interaction is performed in the air, not on a surface. There is no friction or physical support to make movements more controlled and precise.

- Humans have a natural hand tremor that causes in-air movements to be jittery.

- Interfaces based on 3D pointing using ray-casting (i.e., laser pointer metaphor) amplify this hand tremor so that it becomes worse the farther out along the ray you go.

- 3D spatial trackers are not "parkable" like the mouse—the user cannot let go of them and be assured that they will stay in the same position.

# Precision: possible solutions

- filter the output of 3D spatial trackers to reduce noise
- modify the control/display (C/D) ratio. N:1 means reducing movement in virtual world wrt real world
- Do not require to be more precise than absolutely necessary
- Progressive refinement: select, then refine selection