



XR

EXTENDED REALITY

A history of bending reality — from wireframes to worlds

AR

Augmented Reality

Virtual elements overlaid on the real world.

VR

Virtual Reality

A fully virtual experience — you leave the room behind.

MR

Mixed Reality

Virtual objects anchored in — and interacting with — the real world.

One trick, three flavours

Every XR technology plays the same trick: convince your senses of something that isn't there.



Blend reality

Virtual objects that see your real room — a digital engine sitting on your actual workbench, ready to be taken apart.



Overlay reality

Keep the world, add a layer of information on top — directions on the windshield, a Pokémon on the sidewalk.

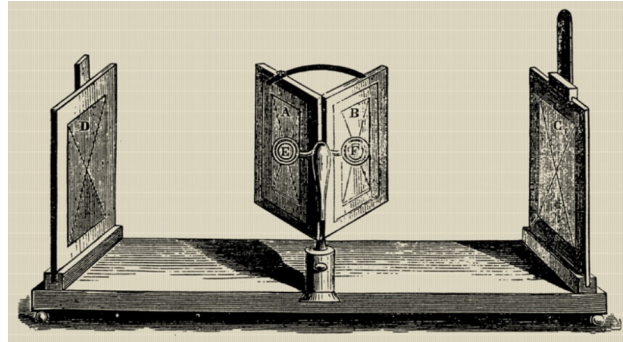


Replace reality

Shut the world out completely and build a new one. Total immersion — games, training, travel.

The dream is older than ???

1838

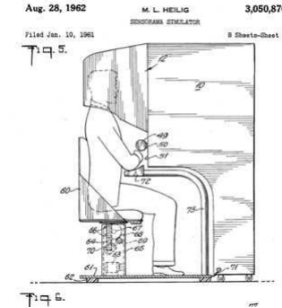


The stereoscope

Charles Wheatstone shows that two flat pictures — one per eye — fuse into solid depth. Within decades a stereoscope sits in every Victorian parlor: the world's first 'virtual travel.'



1957



The Sensorama

The Sensorama machine was the first virtual reality machine,

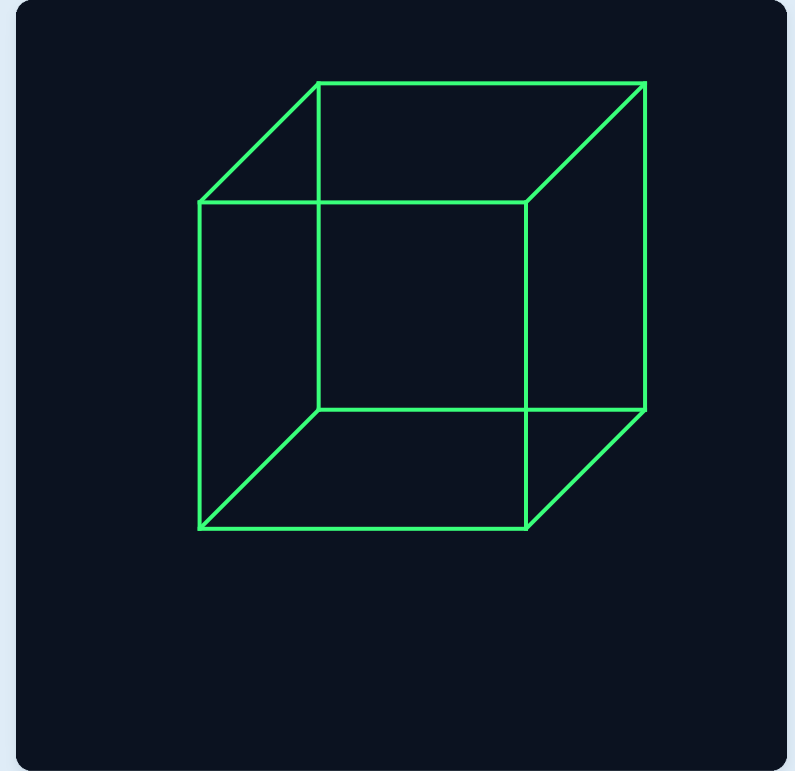
Cinematographer Morton Heilig builds an arcade cabinet with 3D film, stereo sound, a vibrating seat, wind in your face — even smells. A motorcycle ride through Brooklyn, decades before the word 'multimedia.'

Later Sensory rides using iMax surround theatres



1968: The Sword of Damocles

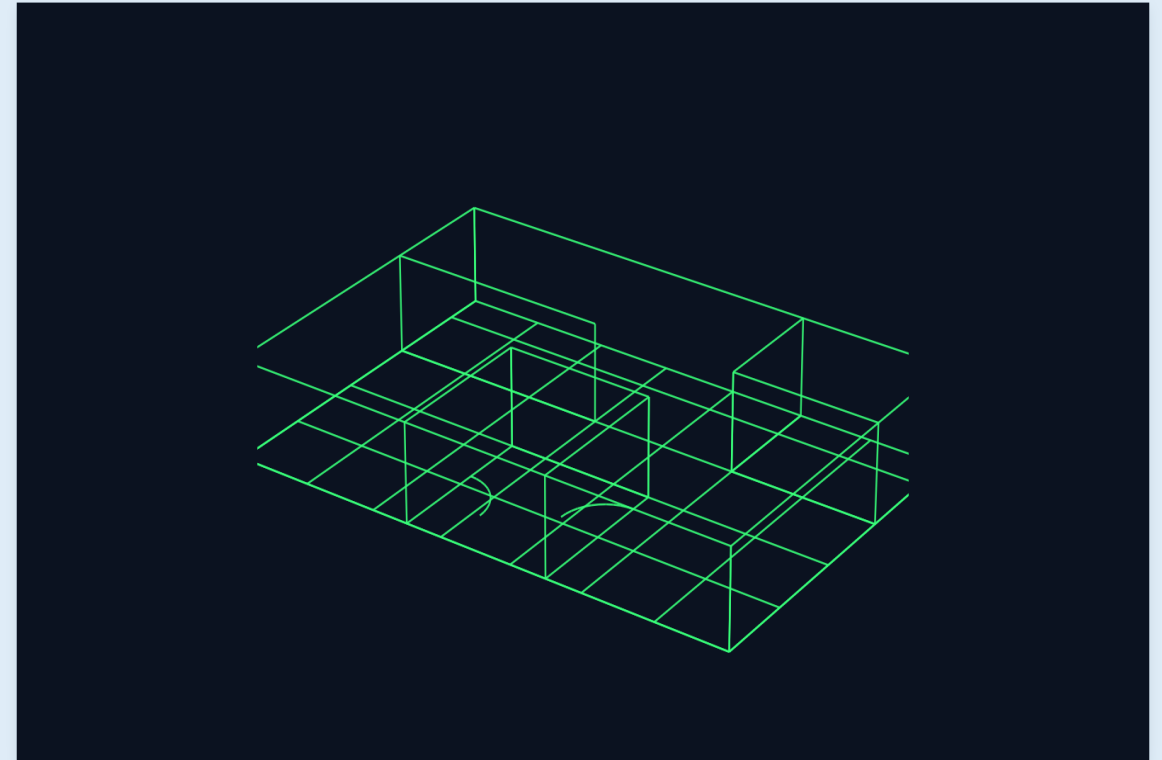
- Ivan Sutherland, University of Utah, builds the first head-mounted display.
- So heavy it hung from a ceiling arm — hence the nickname.
- It tracked your head: turn, and the cube stayed put in space. That single idea is the foundation of everything since.
- The twist: its optics were see-through. The very first VR headset was actually AR.



What the wearer saw: a glowing wireframe cube floating in the room

Walking through buildings that didn't exist

- 1980s: computers can draw only lines — wireframes — fast enough to move through.
- University of North Carolina builds a walkthrough of Sitterson Hall — their own future building — before construction.
- Walking the virtual lobby, they discover a wall makes it feel cramped — and change the design.
- The building went up amended. VR had earned its first paycheck.



A 3D wireframe floorplan — all a 1980s computer could draw in real time

The 1980s: NASA and the man with dreadlocks

NASA Ames · VIEW

The Virtual Interactive Environment Workstation (1985): a headset plus a wired glove for training astronauts and flying remote robots. Proof that serious people had serious uses.

Virtual Environment Workstation Project (VIEW) – a VR training simulator for astronauts.

First customer: the space program, not gamers.



Jaron Lanier · VPL Research

A dreadlocked musician-programmer founds VPL (1985), sells the first commercial DataGlove and EyePhone headset — and gives the field its name:

“virtual reality”



1990-2000's: “augmented reality” is born

1990

- Boeing engineer Tom Caudell needs a better way to guide workers wiring aircraft — thousands of wires, giant paper diagrams pinned to boards.
- His proposal: a see-through headset that projects the right wiring diagram onto the board itself.
- He needs a name for the idea — and coins “augmented reality.”

AR's origin story isn't a game
or a gadget —

**it's a wiring harness on
a Boeing 747.**

Expansion and Innovation

- Explosion of AR research and applications.
- 2000, Hirokazu Kato released the open-source ARToolkit, allowing creation of AR applications.
- Innovative AR experiences, such as the Human Pacman game (~2004) and the Touring Machine, a wearable AR system for tourists (2005?).
- Mobile devices also played a significant role in AR's expansion. Nokia's AR Browser, released in 2005, enabled users to view digital information overlaid onto the real world through their smartphones.

2000's

How the trick works (technical slide)

1

Two tiny screens, one per eye

Each eye gets a slightly different image — Wheatstone's 1838 trick — and the brain fuses them into depth.

2

Head tracking, ~90 times a second

Sensors watch your head. Turn it, and the picture updates instantly — so the world seems to hold still around you. Too slow, and you feel seasick.

3

Hands in the world

Controllers or cameras put your hands in the scene — you reach out and the world reaches back.

+

Add outward-facing cameras → AR / MR

Let the headset see the room, and it can mix real and virtual: passthrough. Same headset, different flavour.

Architecture: from wireframe to walkthrough

- The UNC experiment became an industry: today clients tour unbuilt buildings in headsets.
- Scale is the point — a floorplan hides what a hallway feels like; a walkthrough doesn't.
- Kitchen counters at the wrong height, dark stairwells, cramped lobbies — caught while they're still pixels.
- Every fix found in VR is a fix that never becomes a change order in concrete.

*“The cheapest wall to move
is the one that hasn't been
built.”*

Architecture: the impact, in numbers

40%

shorter client feedback cycles
with VR design reviews
(Gensler)

50%+

higher client satisfaction on
VR-presented projects
(Gensler)

9 / 20

of the world's largest
architecture firms use VR in
design and construction
simulation

Clients now request changes during the walkthrough — and watch them happen live.

Manufacturing: planes before paper mockups

B

Boeing 777 — the paperless plane

First airliner designed without full physical mockups; engineers 'climbed inside' the CAD model in VR to check fit and reach.

R

Rolls-Royce — jet engines

Trent 800 engine service rehearsed in VR: every bolt and tool tagged, mechanics trained before touching metal.

F

Ford — virtual assembly

Assembly lines simulated before they're built; workers' reach and strain tested on digital humans.

13

months cut from the Ford Mondeo's development by virtual assembly

Today: AR headsets guide assembly-line workers step by step — Caudell's 1990 idea, finally standard.

Industrial design: the death of the clay model

- For a century, every new car began as a full-size clay sculpture — months of work, milled and re-milled.
- Now designers sketch full-size cars in the air with VR tools like Gravity Sketch — used at Ford and GM.
- Designers, engineers, and modelers on three continents stand around the same virtual car.
- MR digital twins let products be tested before they physically exist.

~90%

of form-finding clay work now done in
VR

~30%

faster design cycles vs. traditional
process

The 1990s: VR's great false start

Virtuality (1991)

Arcade pods with headsets and joysticks — £20,000 machines, a few minutes of blocky dactyl-dodging per token. Thrilling once; queasy twice.

Nintendo Virtual Boy (1995)

Red-and-black tabletop 'VR.' Headaches, no head tracking, dead within a year. Nintendo's most famous flop.

Why it failed

- Too heavy — headsets strained necks
- Too blurry — you could count the pixels
- Too slow — laggy tracking meant nausea
- Too expensive — real rigs cost as much as a car
- The dream outran the hardware by 20 years

The comeback: a teenager, then one wild year

2012

19-year-old Palmer Luckey duct-tapes a prototype in his garage; Oculus Rift Kickstarter raises \$2.4M

2016

The wild year: Rift ships · HoloLens brings MR · Pokémon Go puts AR in a billion pockets

2014

Facebook buys Oculus for \$2 billion — VR is suddenly serious business

Smartphones made it possible: tiny sharp screens, fast chips, motion sensors — all mass-produced for your pocket.

Games today: the promise finally kept



Meta Quest — VR goes wireless

No PC, no wires, no sensors on tripods: pull it on and you're in. The Quest line has sold in the tens of millions — VR's first true mass-market device.



Beat Saber — the killer app

Slicing blocks to music: simple, joyful, and impossible outside VR. The game that convinced skeptics — and doubles as a workout.



Simulators — the deep end

Flight Simulator and racing rigs in VR: full cockpits, true scale. The closest most of us get to a pilot's seat.

And the arcades came back — free-roam VR venues where groups play together. Virtuality's idea, 30 years on, done right.

BEAUTY



Ja

for the first

XR today — and the next ten years



Spatial computing

Apple Vision Pro treats apps as objects in your room — the computer dissolves into the world.



Everyday glasses

The race: shrink headsets into ordinary-looking glasses you'd wear all day.



Real haptic suits

Wade's X1 suit is genuinely in development — vests and gloves that push back today.



Serious medicine

Surgeons rehearse operations on patient scans; VR treats PTSD and phobias in the clinic.

60 years from a wireframe cube to this — and the hardware is still shrinking.

The technology is NOT new.

**The desire — to be somewhere else,
to be someone else — is ancient.**

Questions & war stories welcome