The Metaverse : Prospects, Opportunities and Challenges

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Tetuan, July 1st, 2024

Outline

- Introduction

- Prospects, Opportunities and Challenges

- Applications and use cases

- Enabling Technologies & Architecture

- Some use cases

- IDC Morocco

- Concluding remarks

Immersive Technologies

Augmented Reality

(AR) adds new objects and information on top of reality, most often through a phone screen or smart-glasses.

Virtual Reality

(VR) surrounds you with video and sound to create a convincing illusion that you are somewhere else.

Mixed Reality

(MR) merges real and virtual worlds to produce new environments and visualizations, where physical and digital objects co-exist and interact in real time.

Extended Reality (XR) refers to augmented, virtual, and mixed reality

XR vs Metaverse

"**Technically speaking, the metaverse concept as outlined by Facebook (or Meta) is XR.** Mark Zuckerberg said that the metaverse is "the future we are working towards. A virtual environment where you can be present with people in a digital space." He also stated that Facebook's metaverse will be accessible from all devices and apps, so it won't be just a VR experience. **If that sounds quite a lot like XR, that's because it is.**"

THE METAVERSE

A metaverse is a shared virtual reality space. In these spaces, individuals can interact with one another in digital constructs (environments) and represent themselves with digital avatars. Like the internet, the metaverse will always stay active and live. It will never turn off, even when you are not interacting with it.

Source: Luke Baker, What is XR and how will it underpin the metaverse?, Pocketlint, Feb. 25, 2022.

Source: 4 NEW METAVERSE PLAYERS: ARE YOU IN?, Banyan Hill, Sep. 15, 2021.
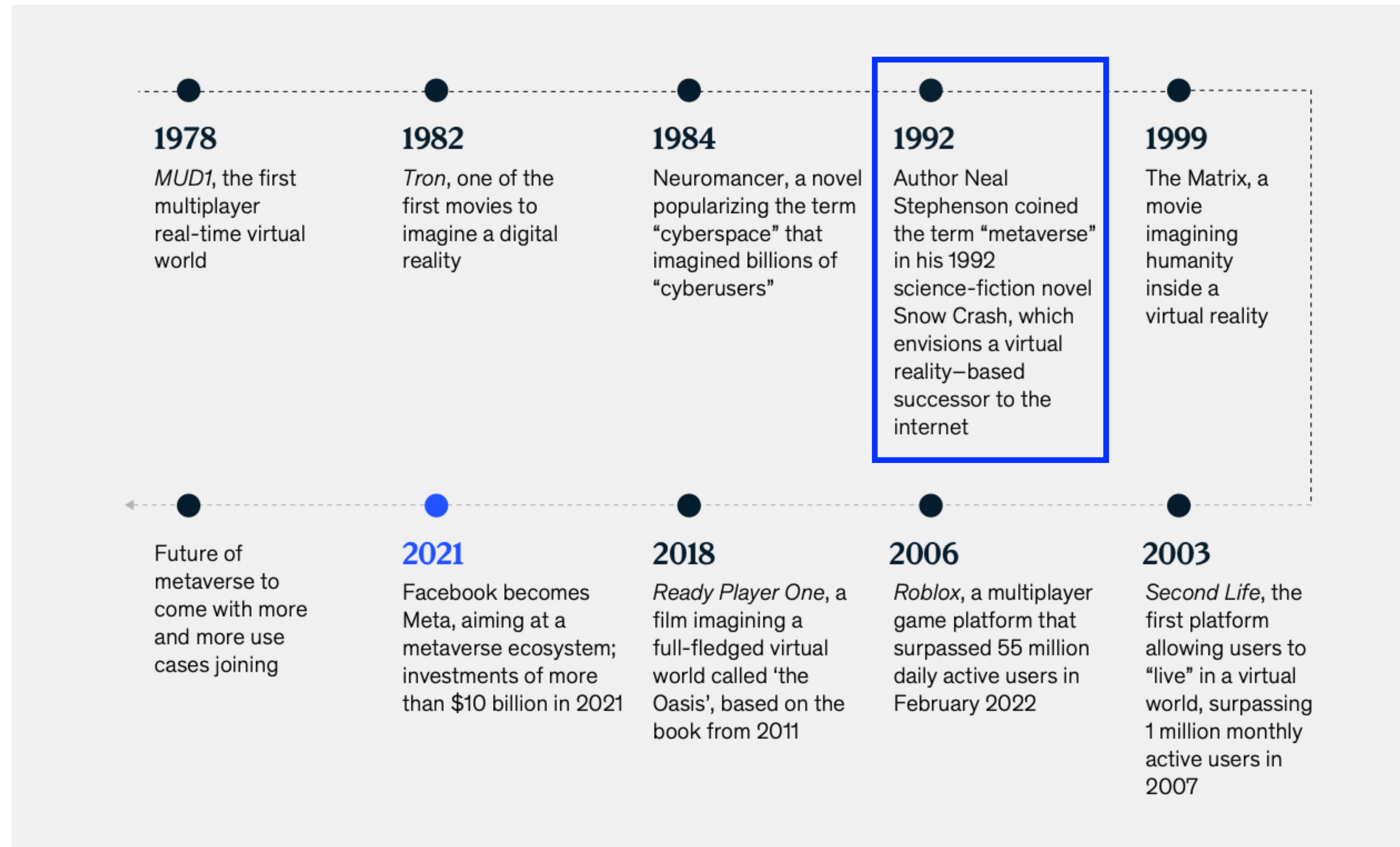
Amazing job opportunities unlocked by the Metaverse

Facebook unveiled plans t**o hire 10,000 people in the EU** for the development of its metaverse, which the company predicted will unlock future creative, social and economic opportunities with **an investment of about $10 billion only this year**.

Source: GSMA, Monday 18 October, 2021.
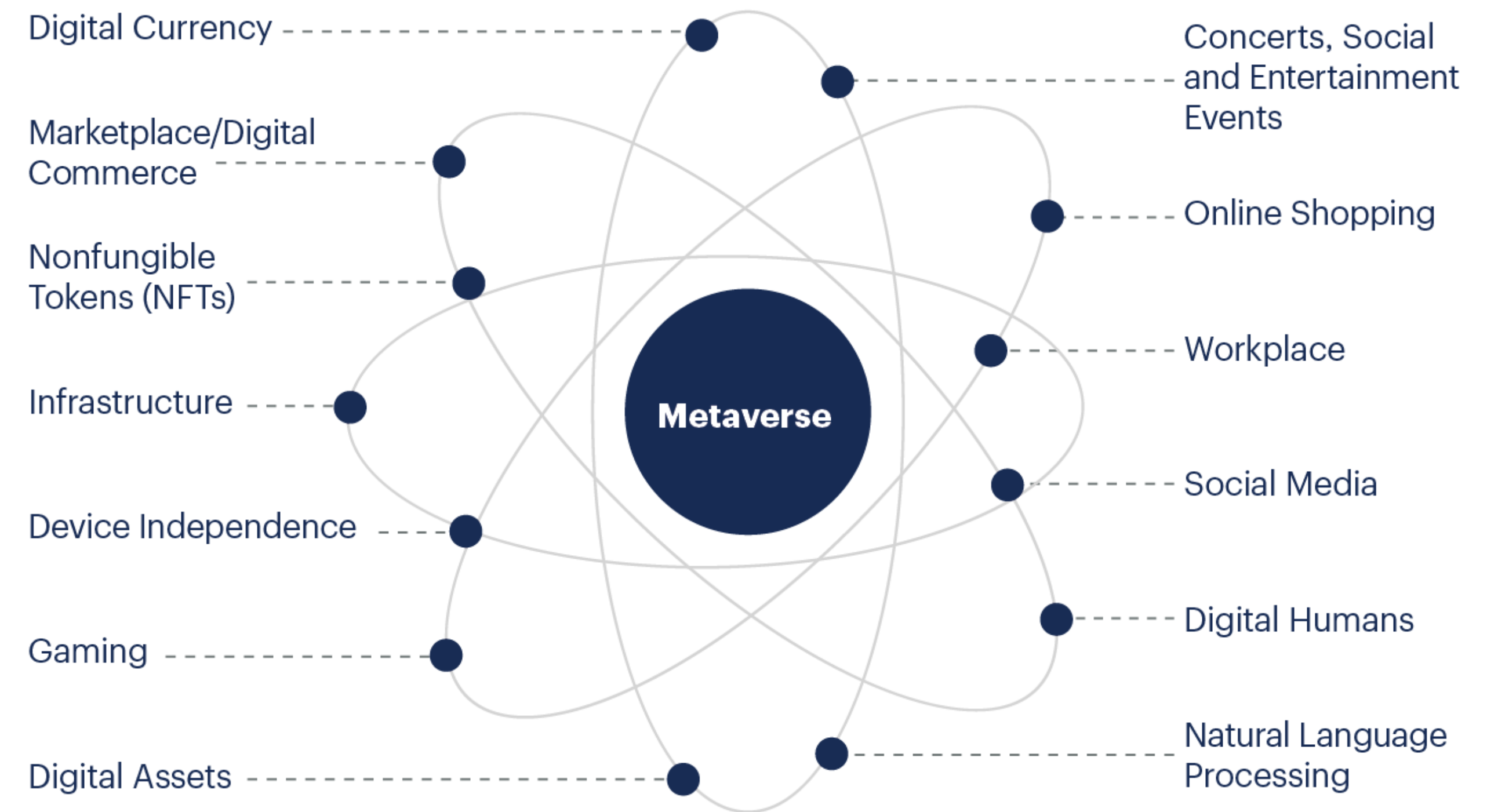
The History of The Metaverse

1978

MUD1, the first multiplayer real-time virtual world

1982

Tron, one of the first movies to imagine a digital reality

1984

Neuromancer, a novel popularizing the term "cyberspace" that imagined billions of "cyberusers"

1992

Author Neal Stephenson coined the term "metaverse" in his 1992 science-fiction novel Snow Crash, which envisions a virtual reality—based successor to the internet

1999

The Matrix, a movie imagining humanity inside a virtual reality

Future of metaverse to come with more and more use cases joining

2021

Facebook becomes Meta, aiming at a metaverse ecosystem; investments of more than $10 billion in 2021

2018

Ready Player One, a film imagining a full-fledged virtual world called 'the Oasis', based on the book from 2011

2006

Roblox, a multiplayer game platform that surpassed 55 million daily active users in February 2022

2003

Second Life, the first platform allowing users to "live" in a virtual world, surpassing 1 million monthly active users in 2007

Other most-common definitions

1. an embodied virtual-reality experience ;

2. a Web3 framework for economic interoperability ;

3. a creative platform for experiences (e.g., Roblox).

Some current versions may be a hybrid of these.

Elements of a Metaverse

Digital Currency

Concerts, Social and Entertainment Events

Marketplace/Digital Commerce

Online Shopping

Nonfungible Tokens (NFTs)

Infrastructure

Workplace

Metaverse

Device Independence

Social Media

Gaming

Digital Humans

Digital Assets

Natural Language Processing

gartner.com

Gartner.

Why is the metaverse getting so much attention now?

Several factors—technical, social, and financial—are converging to make the metaverse particularly significant now

A CLUSTER OF MATURING TECHNOLOGIES
> User interface: Extended reality - AR/VR/MR[1]
> Computation and storage: Cloud and edge computing; AI/machine learning
> Networks: 5G; fiber optics

BEHAVIORAL SHIFTS AMPLIFIED BY COVID-19
> Increasing "digitization" of social and work interactions
> Rise of e-commerce and shift in consumer preferences

MAJOR CAPITAL INVESTMENTS
> $80B+ corporate investments in last 12 months[2,3,4]
> $10B+ venture capital investment in 2021[5]
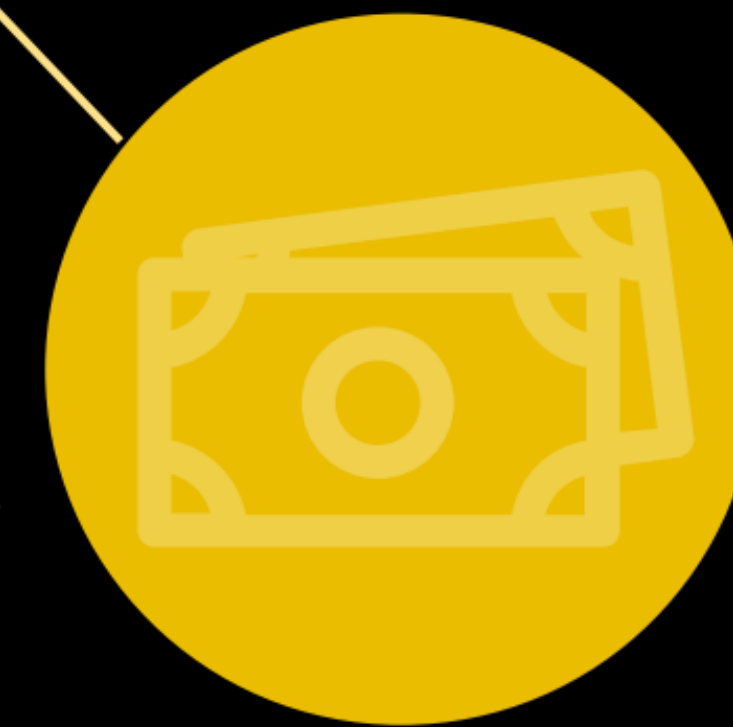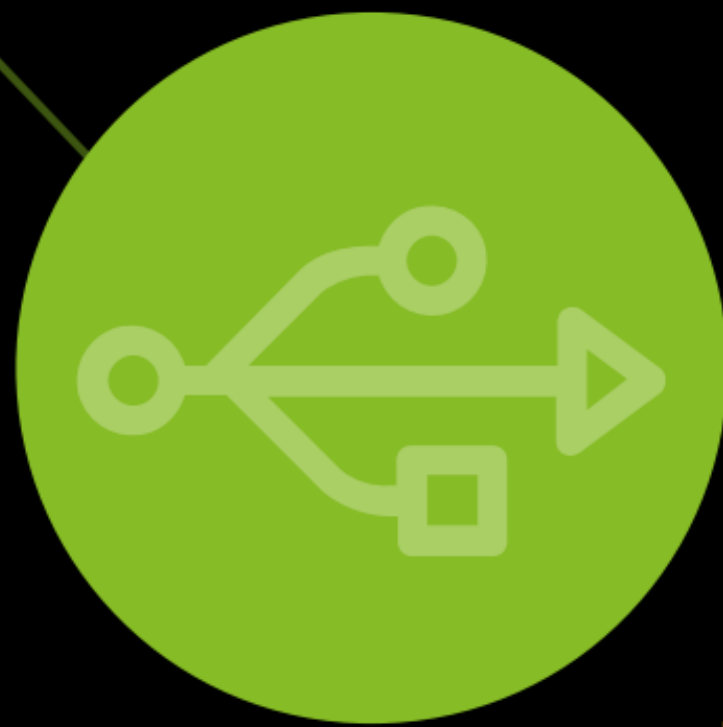
INCUMBENTS' SEARCH FOR GROWTH
> Today's digital market leaders and existing platforms are seeking new avenues to grow

EVOLVING DIGITAL ECONOMY
> Growth of digital-native assets and supporting economic infrastructure
> Increasing popularity of digital asset ownership, cryptocurrencies, and digitally native contracts

Value creation in the metaverse

The real business of the virtual world

What's the opportunity?

In **2021**, venture capital and private-equity funding into the metaverse reached

$13 billion
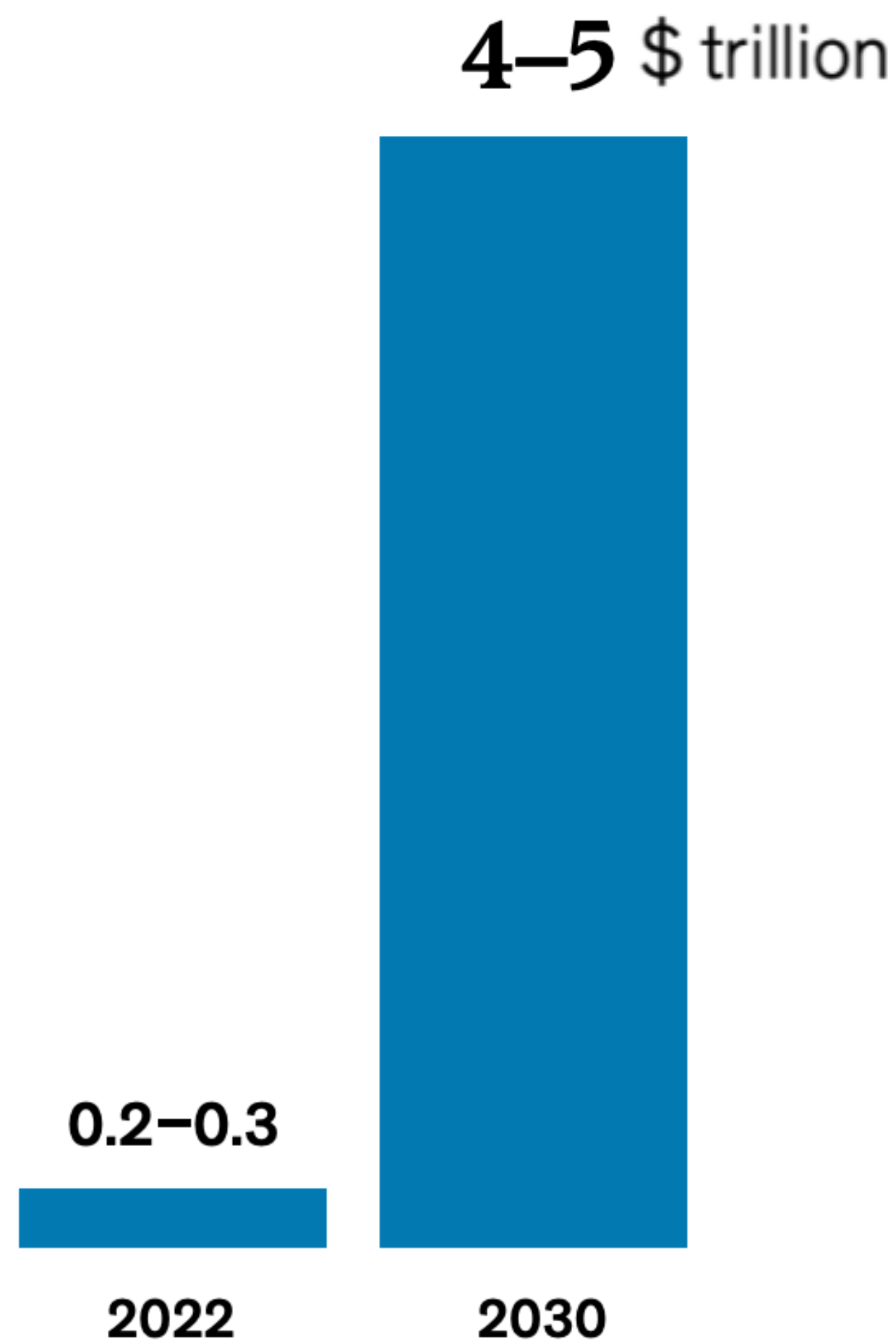
By **2030**, the value of the metaverse could reach…

~$5 trillion

In **2022** already, investment into the metaverse space is more than double what it was in all of **2021**

>$120 billion +

Source: McKinsey analysis; 2022.

Metaverse Impact Potential

4–5 $ trillion

0.2–0.3

2022   2030

Consumer use cases

☐	Virtual assets	☐	Education
☐	Gaming	☐	Health and fitness
☐	VR/AR hardware	☐	Ads
☐	E-commerce	☐	Digital media
☐	Live entertainment		

Enterprise use cases

☐	Banking	☐	Local government
☐	Construction	☐	Telecommunications
☐	Discrete manufacturing	☐	Transportation
☐	Education	☐	Utilities
☐	Central government	☐	Wholesale
☐	Healthcare provider	☐	Media
☐	Resource industries	☐	Consumer services
☐	Professional services	☐	Process manufacturing
☐	Retail	☐	Insurance
☐	Investment		

Metaverse Developing Opportunities

Today

~$55 million
daily active
users on *Roblox*

~$250 million
daily trading volume of
NFTs at peak

~$500 million
metaverse real
estate sales

+$10 billion
invested by Meta
into metaverse
development
annually

~11 million
XR headsets
shipped, 80%
produced by Meta

Tomorrow

Expanded set of
use cases

Fully immersive
environment

Interoperability
between worlds

Enhanced
concurrency

Ubiquitous
digital–physical
overlays

AR/VR device
proliferation

How XR is redefining Education ?

4x

faster to train than in
the classroom

275%

more confident to apply skills
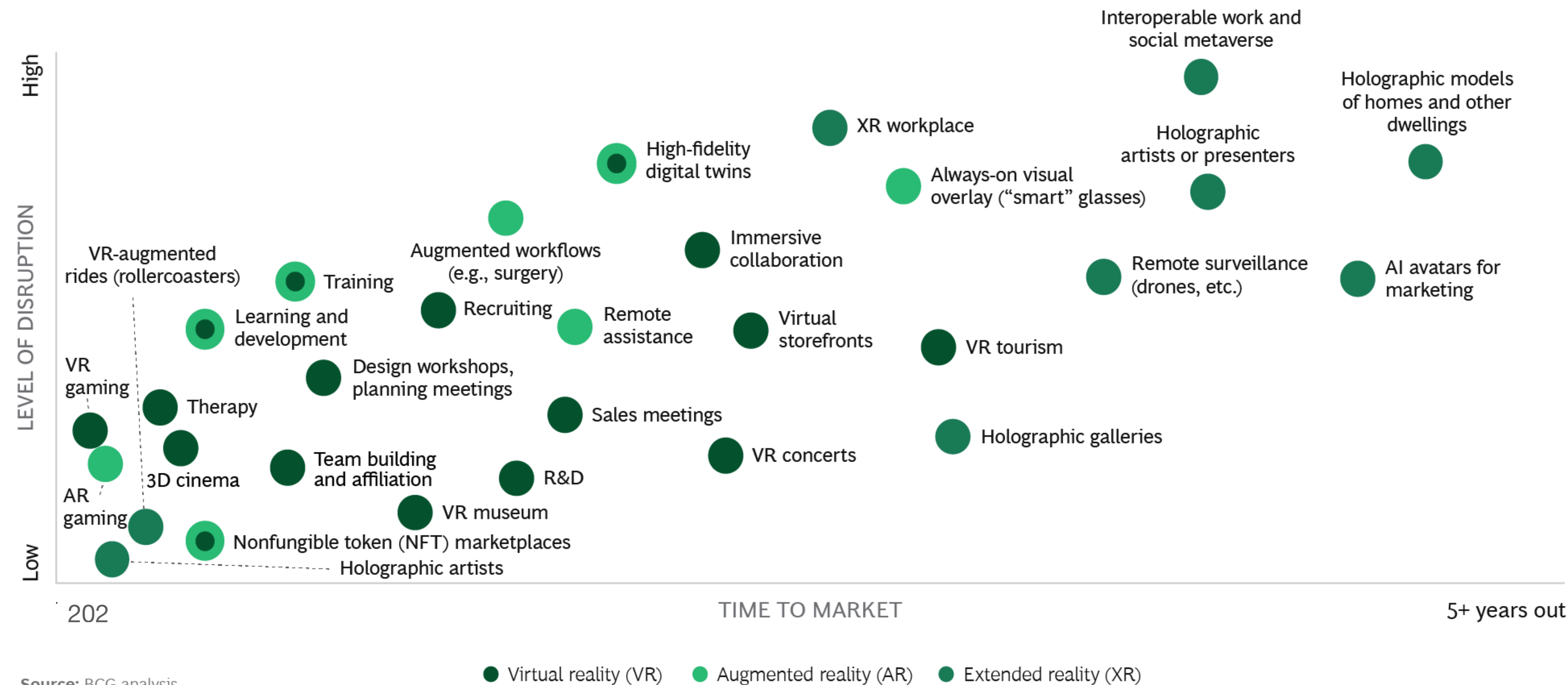learned after training

3.75x

more emotionally connected to
content than classroom learners

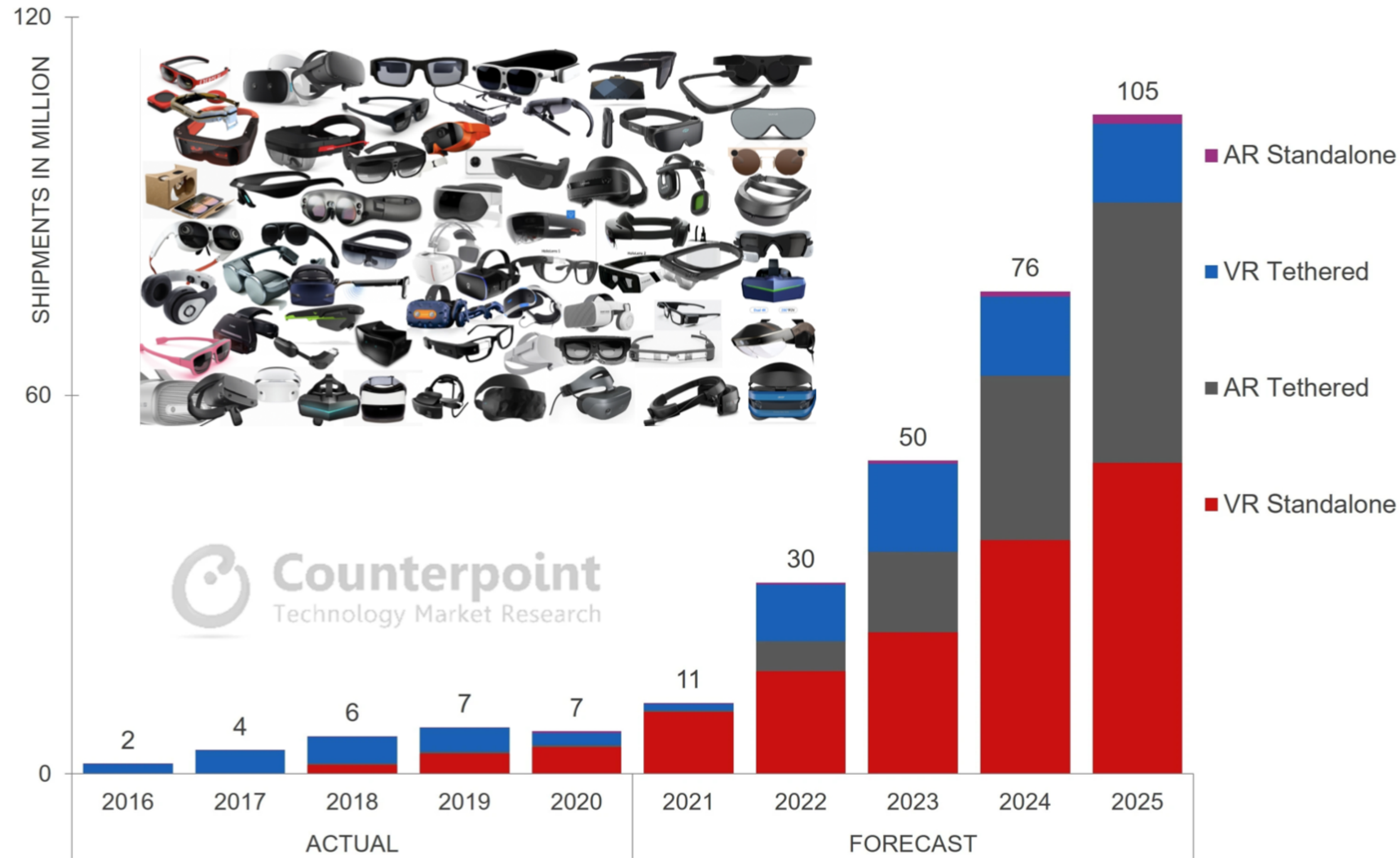**4x**

more focused than their
e-learning peers

Source;: PwC, 2020

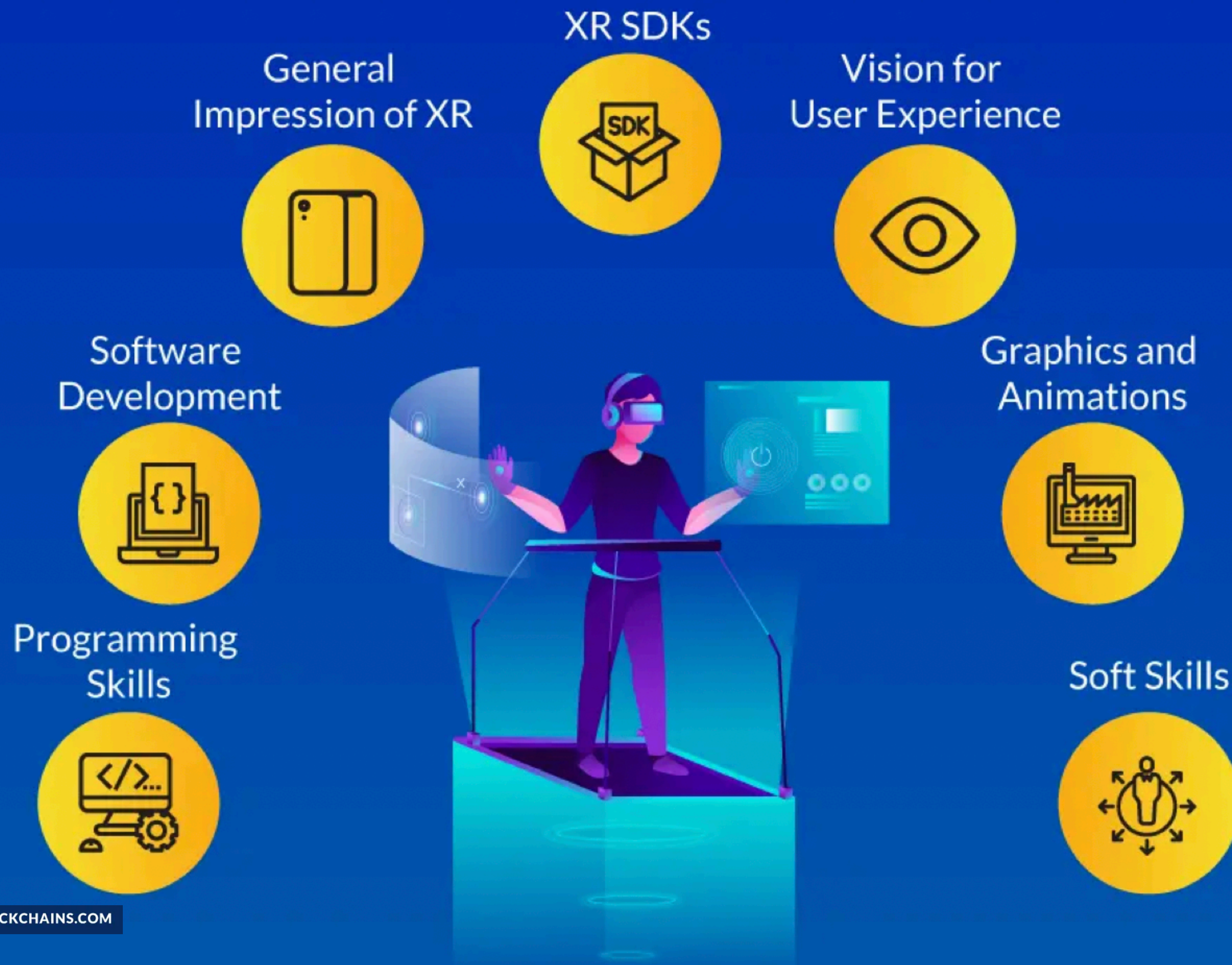# The Metaverse Is Expected to Drive Growth Across All TMT Industries

LEVEL OF DISRUPTION — High / Low

TIME TO MARKET — 202 ... 5+ years out

Interoperable work and social metaverse

Holographic models of homes and other dwellings

XR workplace

Holographic artists or presenters

High-fidelity digital twins

Always-on visual overlay ("smart" glasses)

Augmented workflows (e.g., surgery)

Immersive collaboration

Remote surveillance (drones, etc.)

AI avatars for marketing

VR-augmented rides (rollercoasters)

Training

Recruiting

Remote assistance

Virtual storefronts

Learning and development

VR gaming

Design workshops, planning meetings

VR tourism

Therapy

Sales meetings

Holographic galleries

3D cinema

Team building and affiliation

R&D

VR concerts

AR gaming

VR museum

Nonfungible token (NFT) marketplaces

Holographic artists

- ● Virtual reality (VR)
- ● Augmented reality (AR)
- ● Extended reality (XR)

Source: BCG analysis.

TMT: technology, media, and telecommunications

15

Global XR (VR/AR) Headset Forecast by Device Type, 2016 to 2025

Chart: SHIPMENTS IN MILLION (y-axis, 0 to 120)

Legend:
- AR Standalone (purple)
- VR Tethered (blue)
- AR Tethered (gray)
- VR Standalone (red)

Year	Total
2016	2
2017	4
2018	6
2019	7
2020	7
2021	11
2022	30
2023	50
2024	76
2025	105

ACTUAL (2016–2020) | FORECAST (2021–2025)

SKILLS REQUIRED FOR METAVERSE DEVELOPERS

General Impression of XR

XR SDKs

Vision for User Experience

Software Development

Graphics and Animations

Programming Skills

Soft Skills

17

الندوات التحضيرية للمؤتمر الهندسي العربي التاسع والعشرين
Preparatory Symposiums
for the 29th Arab Engineering Conference

7,8 سبتمبر (أيلول) 2022
7, 8 September 2022

اتحاد المهندسين العرب
Federation of Arab Engineers

لجنة تقنية الاتصالات والمعلومات
ICT
اتحاد المهندسين العرب

Metaverse Initiatives Implemented To-Date

Adoption level

High (>70%)   Medium (40–70%)   Low (<40%)

Industry	Marketing campaign or initiatives	Learning and devel-opment for employees	Meetings in the metaverse	Events or conferences	Product design or digital twinning	Recruiting or onboard-ing new employees	Customers can pay with crypto currency
Technology	68	64	54	64	54	39	23
Media and telecommunications	82	36	36	43	54	18	25
Advanced industries	64	55	36	64	64	36	9
Financial sector and insurance	67	63	56	49	56	25	31
Consumer, AF&L, and retail	95	56	59	41	50	41	14
Energy and materials	54	85	69	46	69	31	8
Healthcare and public sector	10	59	79	72	59	38	34
Tourism, transport, and logistics	56	78	56	78	56	44	22
Total sample	67	63	53	52	52	31	22

Metaverse initiatives implemented to date, by industry,[1] % of senior executives in each industry

[1]Q: *What metaverse features or capabilities have you implemented in your company to date?* (n = 258).
Source: McKinsey & Company Senior Executive Survey, April 2022

19

Better than a Zoom class: 10 metaversities to launch this fall

'Digital twin campuses' will provide students with enhanced classroom experiences through VR, such as field trips back in time and studying astronomy in outer space.

By: Micah Ward | July 7, 2022

VictoryXR will be creating "digital twin campuses," an exact digital replica of each campus for students to virtually attend classes whether they are on campus or remote. Students will also be provided with a Meta Quest 2, a virtual reality headset. Classes will be synchronous, or multi-student, to recreate the feeling of physically attending class.

The universities entering this new era of virtual reality include:

- Morehouse College
- University of Kansas School of Nursing
- New Mexico State University
- South Dakota State University
- West Virginia University
- University of Maryland Global Campus
- Southwestern Oregon Community College
- Northern Illinois University
- California State University Dominguez Hills
- Alabama A&M University

UB University Business®

How XR is redefining Industry ?

- Engineers and technicians can directly interact with prototypes using XR in an easier and cost effective way than using a physical model of an engine or chassis.

- XR is an Industry 4.0 tool.

Source; Holopundits, 2021.

How XR is redefining healthcare ?

- VR training can improve patient outcomes in surgical scenarios 83% !

- Preoperative planning

- Improving the accuracy and effectiveness of a minimally-invasive thermal therapy (microwave ablation) to destroy liver tumors.

Source; Bone & Joint Journal, 2019.

'Hologram patients' and mixed reality headsets help train UK medical students in world first

Learners put on mixed reality headsets and are immersed in a lifelike training scenario, overlaid onto their physical environment. - Copyright Cambridge University Hospitals NHS Foundation Trust and GigXR

Factors Driving the Future of the Metaverse

STANDARDIZATION

To what degree do **standards and protocols converge**? What is the level of interoperability among different platforms?

> Is there a single unified economy across platforms?
> Will digital goods purchased in one metaverse be available in another?
> Are identities persistent across platforms?
> Are there consistent design and programing standards?

USER INTERFACE

To what degree does the user interface become **intuitive and seamlessly integrated** into daily life?

> How user friendly and mobile will the predominant interface be?
> Does the interface enable seamless switching between physical and digital worlds?

MARKET FRAGMENTATION

How many market leaders emerge and what consumer and commercial use cases do they serve?

> How much competition is there in the market, and how does this affect innovation?
> How much M&A / market consolidation will we see (or will be allowed)?
> Do different platforms serve different use cases? (*e.g.*, one dominant consumer platform and one dominant enterprise platform)
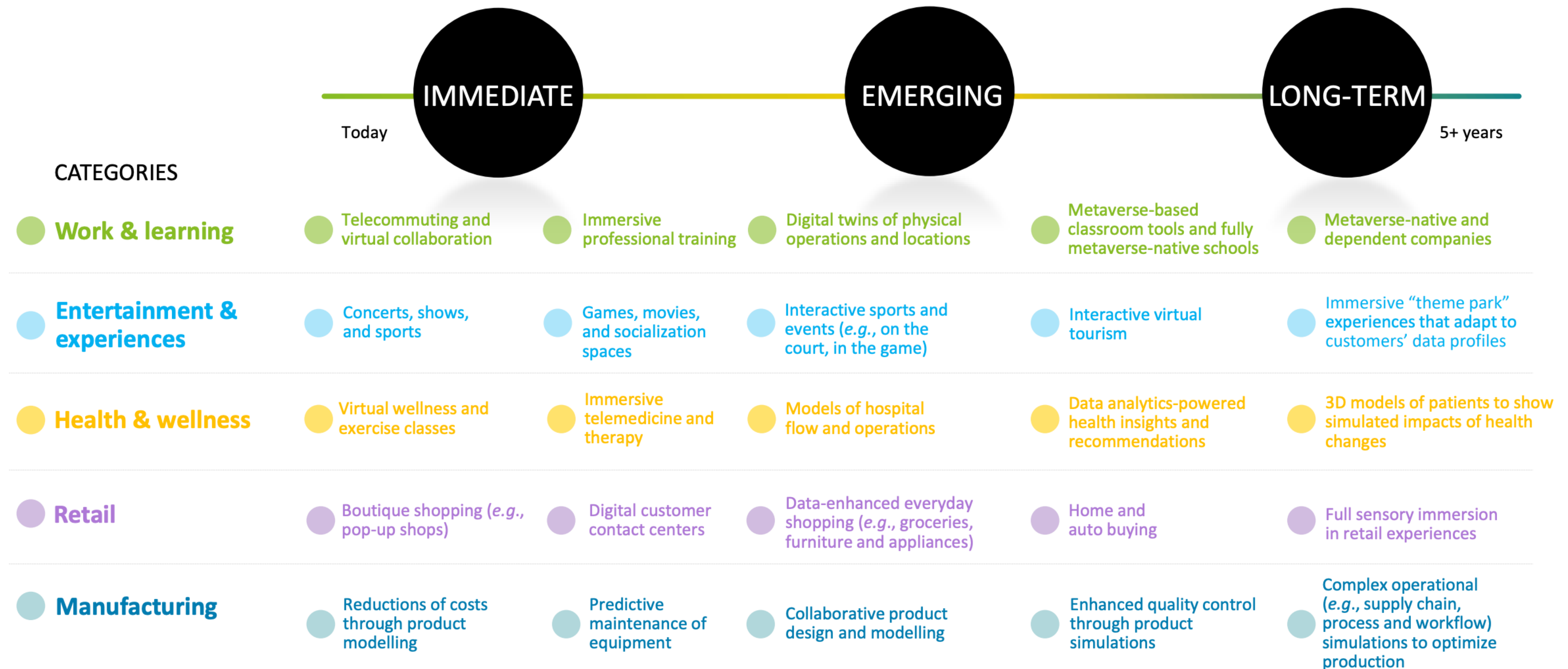
GOVERNANCE

How effectively and consistently are **content and conduct regulated**? Are IP and digital assets reliably protected?

> Is there strong government regulation or do platforms rely primarily on self-governance?
> To what degree are interactions and transactions secure and trusted?
> Is there an effective process governing tax jurisdictions and legal liability concerns?

Evolution of Metaverse Use Cases Across Industries

	IMMEDIATE (Today)		EMERGING		LONG-TERM (5+ years)
Work & learning	Telecommuting and virtual collaboration	Immersive professional training	Digital twins of physical operations and locations	Metaverse-based classroom tools and fully metaverse-native schools	Metaverse-native and dependent companies
Entertainment & experiences	Concerts, shows, and sports	Games, movies, and socialization spaces	Interactive sports and events (*e.g.*, on the court, in the game)	Interactive virtual tourism	Immersive "theme park" experiences that adapt to customers' data profiles
Health & wellness	Virtual wellness and exercise classes	Immersive telemedicine and therapy	Models of hospital flow and operations	Data analytics-powered health insights and recommendations	3D models of patients to show simulated impacts of health changes
Retail	Boutique shopping (*e.g.*, pop-up shops)	Digital customer contact centers	Data-enhanced everyday shopping (*e.g.*, groceries, furniture and appliances)	Home and auto buying	Full sensory immersion in retail experiences
Manufacturing	Reductions of costs through product modelling	Predictive maintenance of equipment	Collaborative product design and modelling	Enhanced quality control through product simulations	Complex operational (*e.g.*, supply chain, process and workflow) simulations to optimize production

Source: A whole new world? Exploring the metaverse and what it could mean for you, Deloitte, April 2022.

Some Key Metaverse Challenges

PRIVACY

Ensure responsible collection and storage of consumer data and effectively build and maintain consumer trust.

SECURITY

Establish strong security safeguards that anticipate and effectively block cybercrimes such as phishing and data hacking.

IP PROTECTION

Ensure that intellectual property and digital assets are adequately protected for the organization, partnering content creators, and consumers.

ACCESSIBILITY

Design the user experience to be accessible to all consumers, including those with visual, auditory, and mobility impairments.

CLIMATE IMPACT

Rely on sustainable energy consumption to power the metaverse (and associated technologies like cryptocurrency) and effectively measure and report emissions.

HEALTH & WELLBEING

Develop an understanding of and actively manage the physical and mental health impacts of metaverse experiences.

GOVERNANCE

Consider how content and behavioral norms are set and enforced and enact measures to manage disinformation, deception, and harm to people and property.

ENCODED BIAS

Take measures to limit the encoding of social inequalities (*e.g.*, economic, gender, and racial) in the metaverse.

HARASSMENT

Create environments and communities that are safe for all users and set and enforce policies on harassment and bullying on platforms.

Q Type to search

NEWS | TELECOMMUNICATIONS

The Metaverse Needs Standards, Too › The big players have founded a "forum"—but will it make the place come to life any sooner?

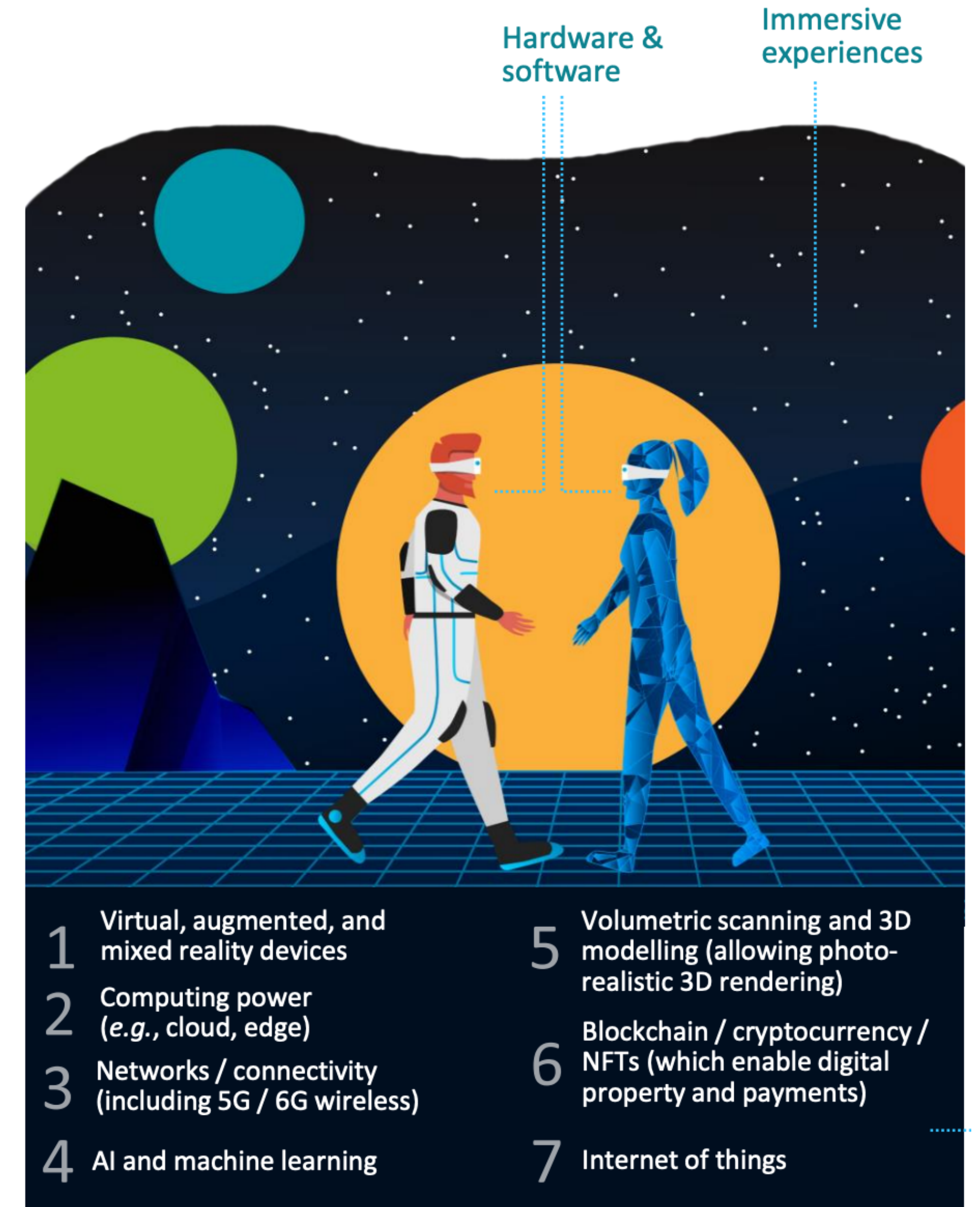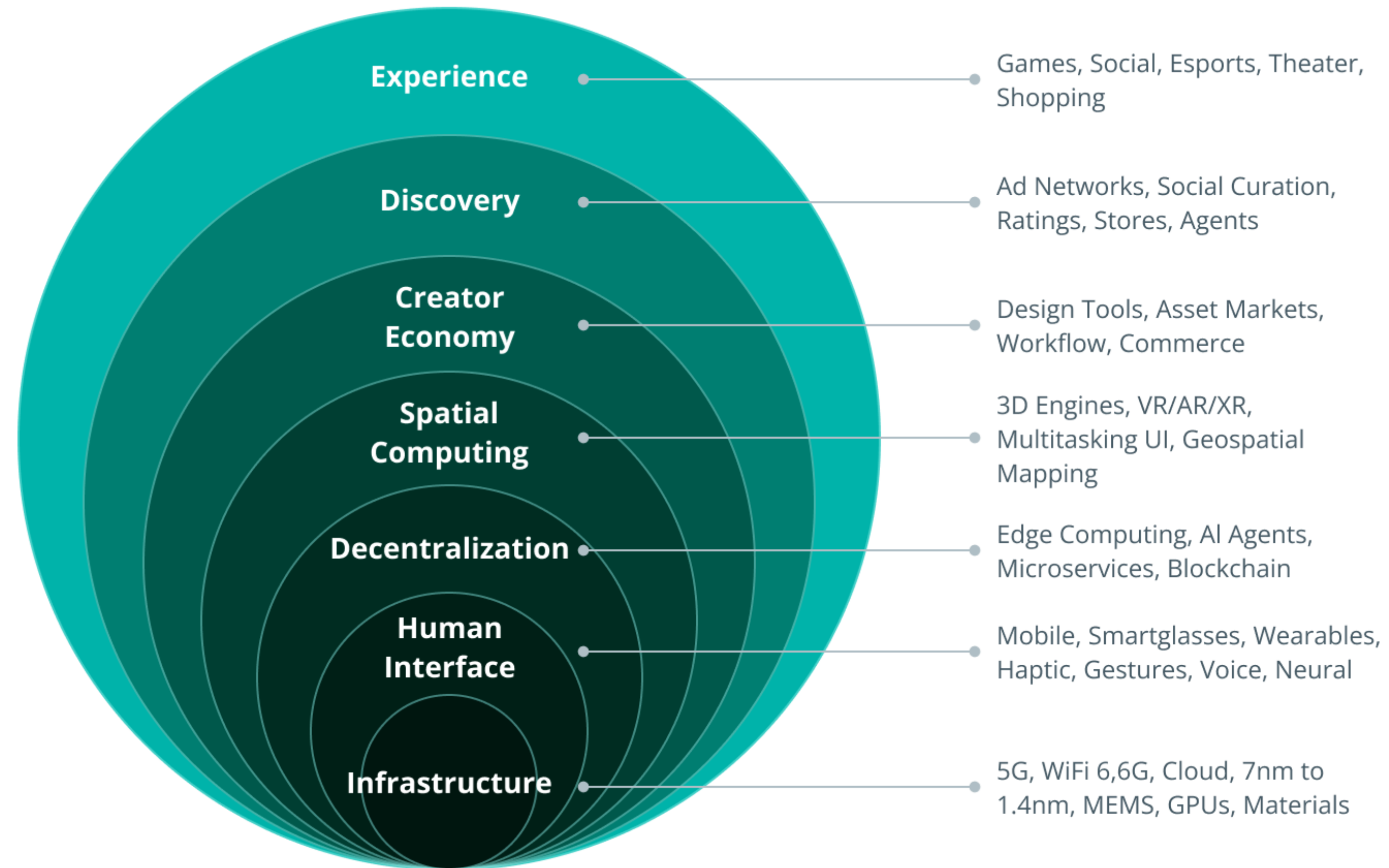BY MICHAEL KOZIOL | 31 AUG 2022 | 4 MIN READ

27

Key Metaverse Enablers

- An immersive, three-dimensional environment in which users interact with their surroundings and other users

- A platform in which the virtual world and the physical world can be linked

Source: A whole new world? Exploring the metaverse and what it could mean for you, Deloitte, April 2022.

Hardware & software

Immersive experiences

1 Virtual, augmented, and mixed reality devices

2 Computing power (*e.g.*, cloud, edge)

3 Networks / connectivity (including 5G / 6G wireless)

4 AI and machine learning

5 Volumetric scanning and 3D modelling (allowing photo-realistic 3D rendering)

6 Blockchain / cryptocurrency / NFTs (which enable digital property and payments)

7 Internet of things

Seven layers of the metaverse

Experience — Games, Social, Esports, Theater, Shopping

Discovery — Ad Networks, Social Curation, Ratings, Stores, Agents

Creator Economy — Design Tools, Asset Markets, Workflow, Commerce

Spatial Computing — 3D Engines, VR/AR/XR, Multitasking UI, Geospatial Mapping

Decentralization — Edge Computing, AI Agents, Microservices, Blockchain

Human Interface — Mobile, Smartglasses, Wearables, Haptic, Gestures, Voice, Neural

Infrastructure — 5G, WiFi 6,6G, Cloud, 7nm to 1.4nm, MEMS, GPUs, Materials

cointelegraph.com

source: **holonext.com**

Example of VR Surgery Lesson

AI generated AR Experiences in the Virtual World
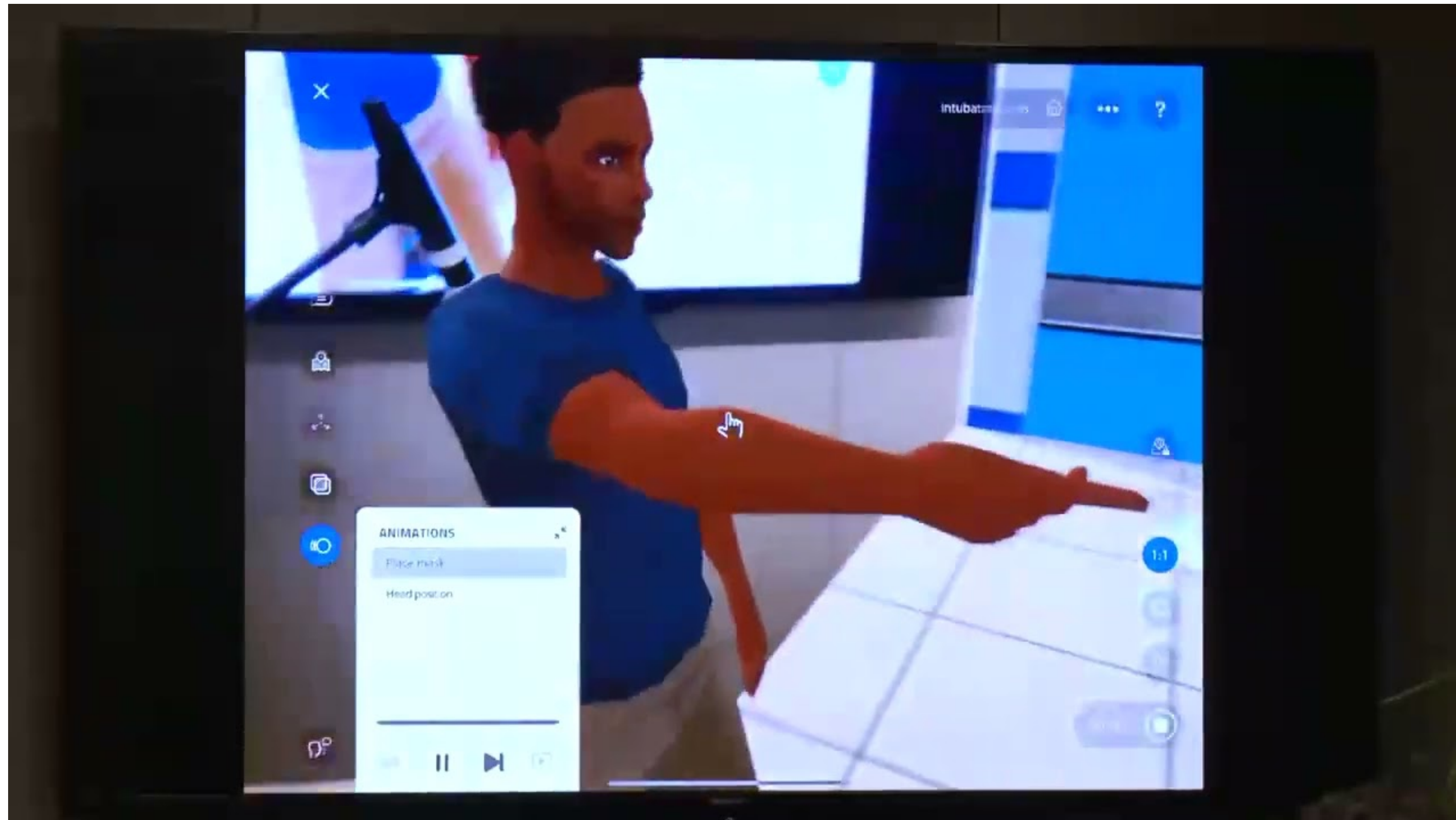
AR Surgery Training and Haptic Gloves with XR Doctor Platform

XR Doctor
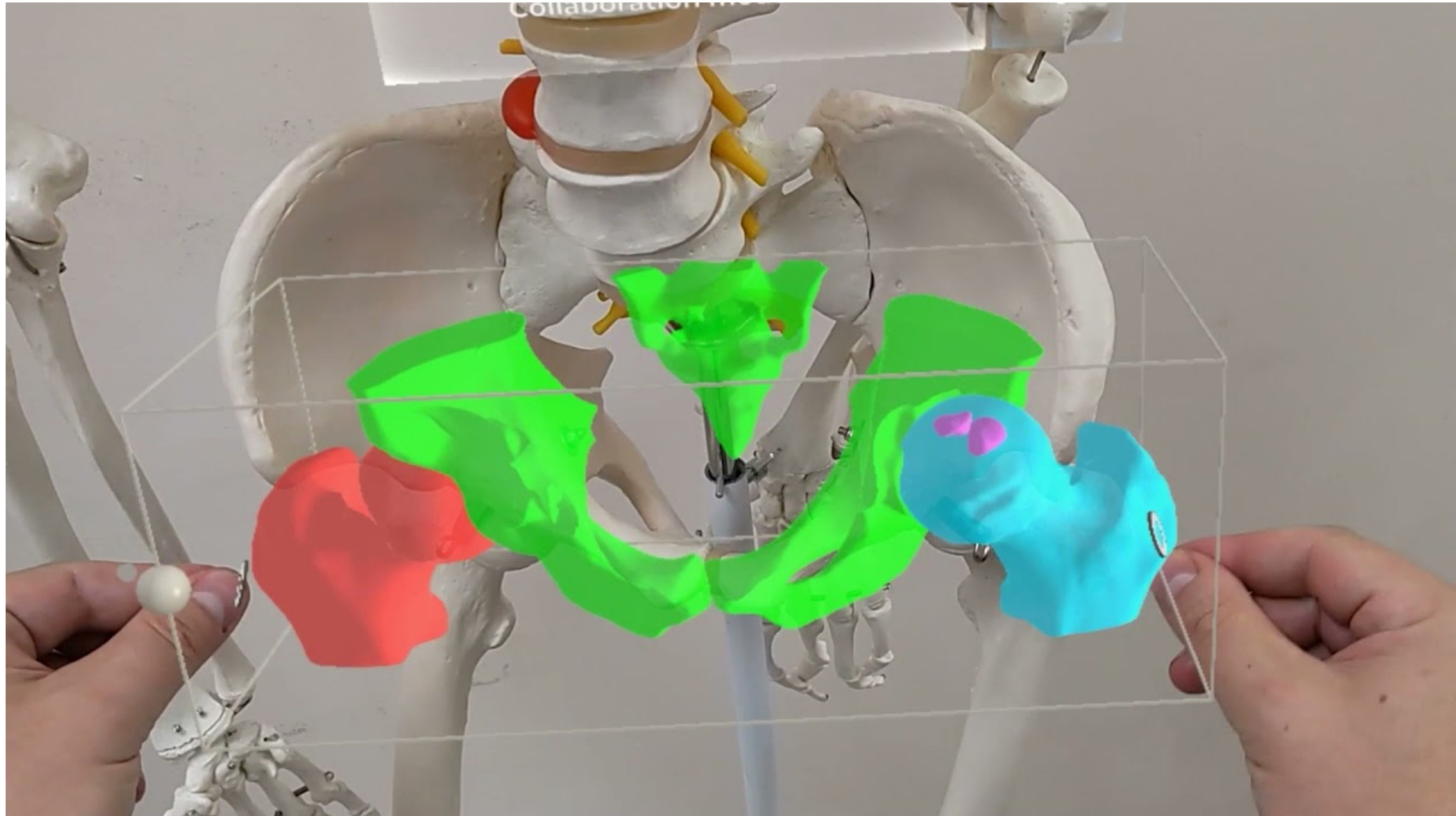
AI Avatars: What Are They?

And artificial intelligence is giving a new meaning to the creation of virtual people by pushing the boundaries of technology to yet again a new frontier - AI lifeforms.

AI-powered avatars can serve endless purposes, from being hired out by real-world companies to teach new employees, to serving as trusted confidantes in the metaverse, to name just a few use cases.

SENSORIUM

Conversational AI

a type of AI that can simulate human conversation.

Happens through natural language processing (NLP), a field of AI that allows computers to understand and process human languages.

"synthetic brain power that makes machines capable of understanding, processing and responding to human language."
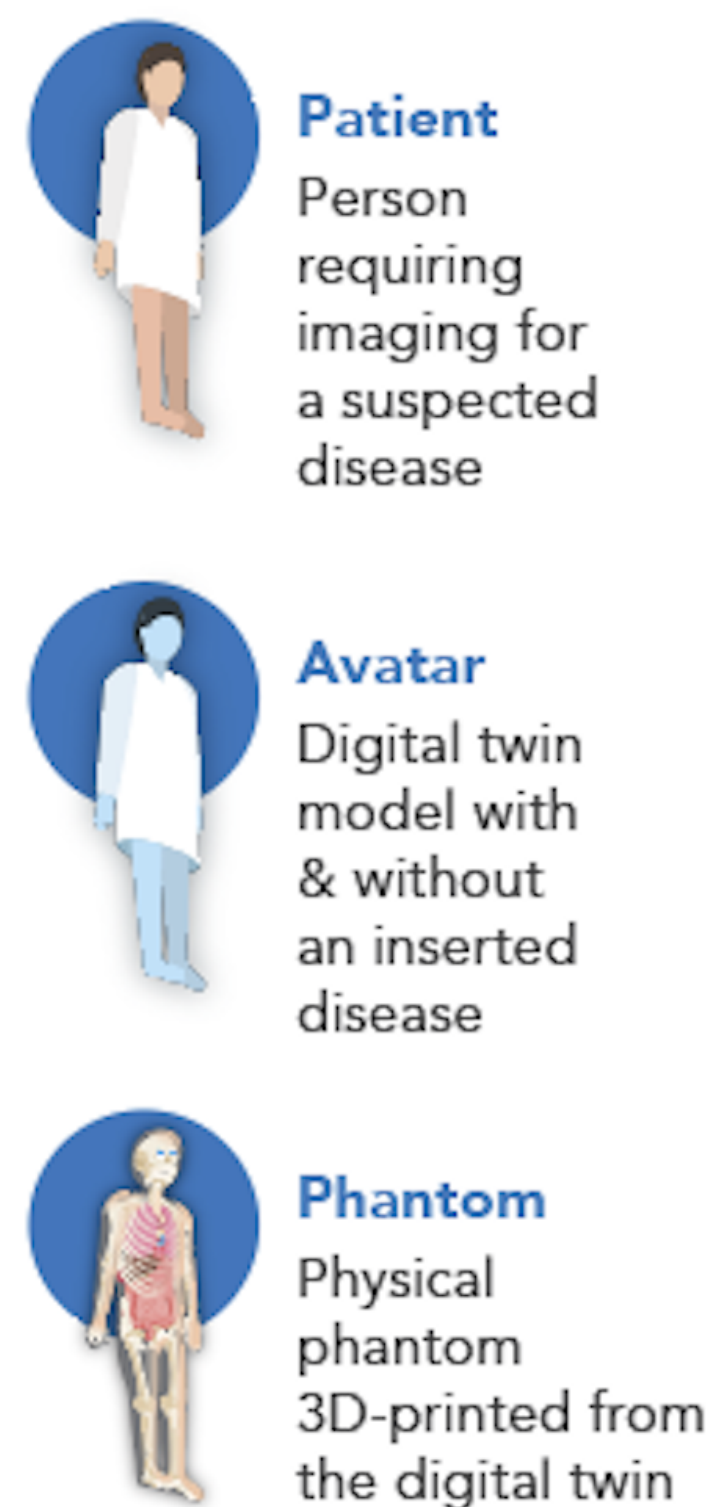
Types of Conversational AI
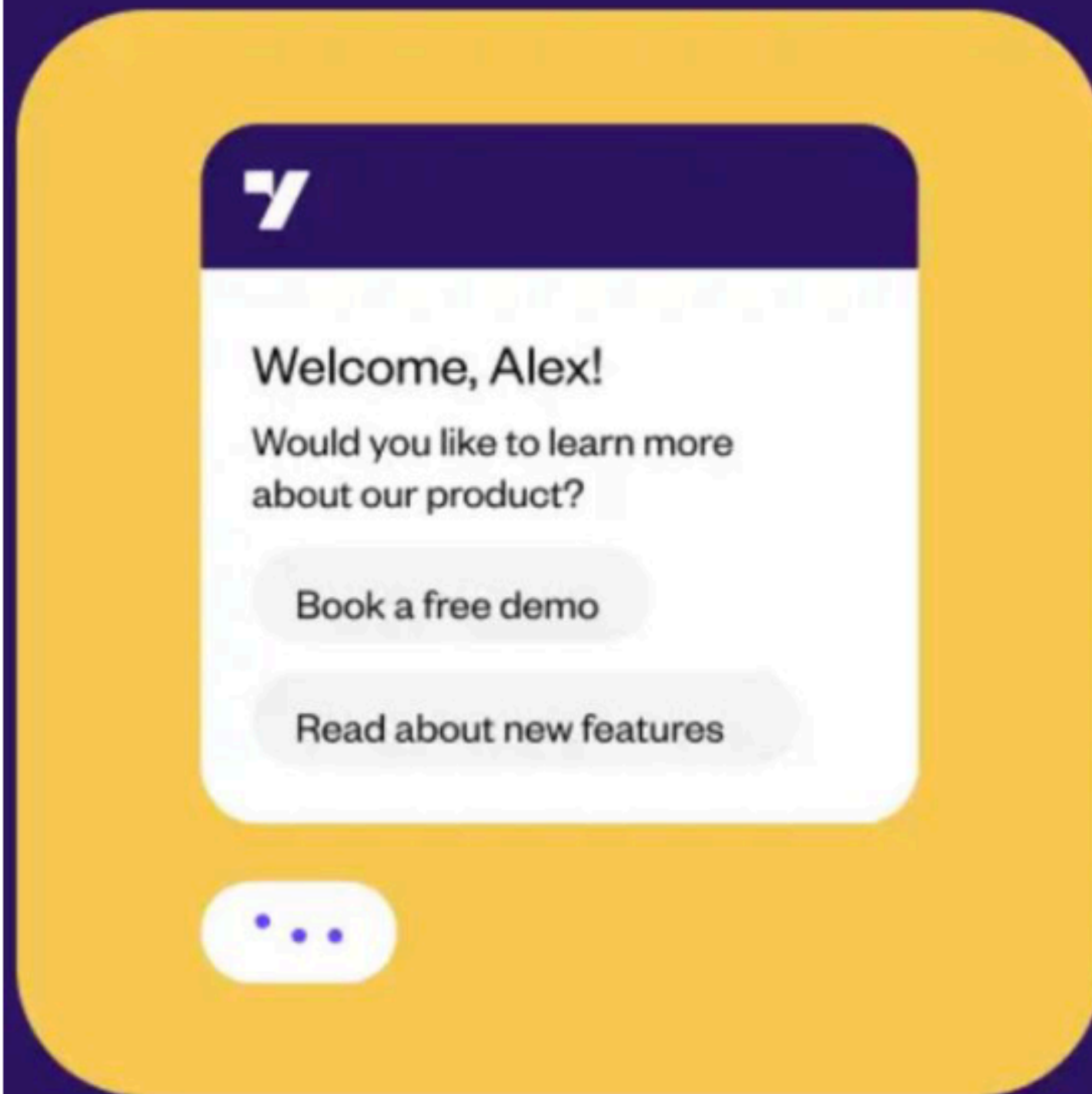
AI Chatbots

Voice bots

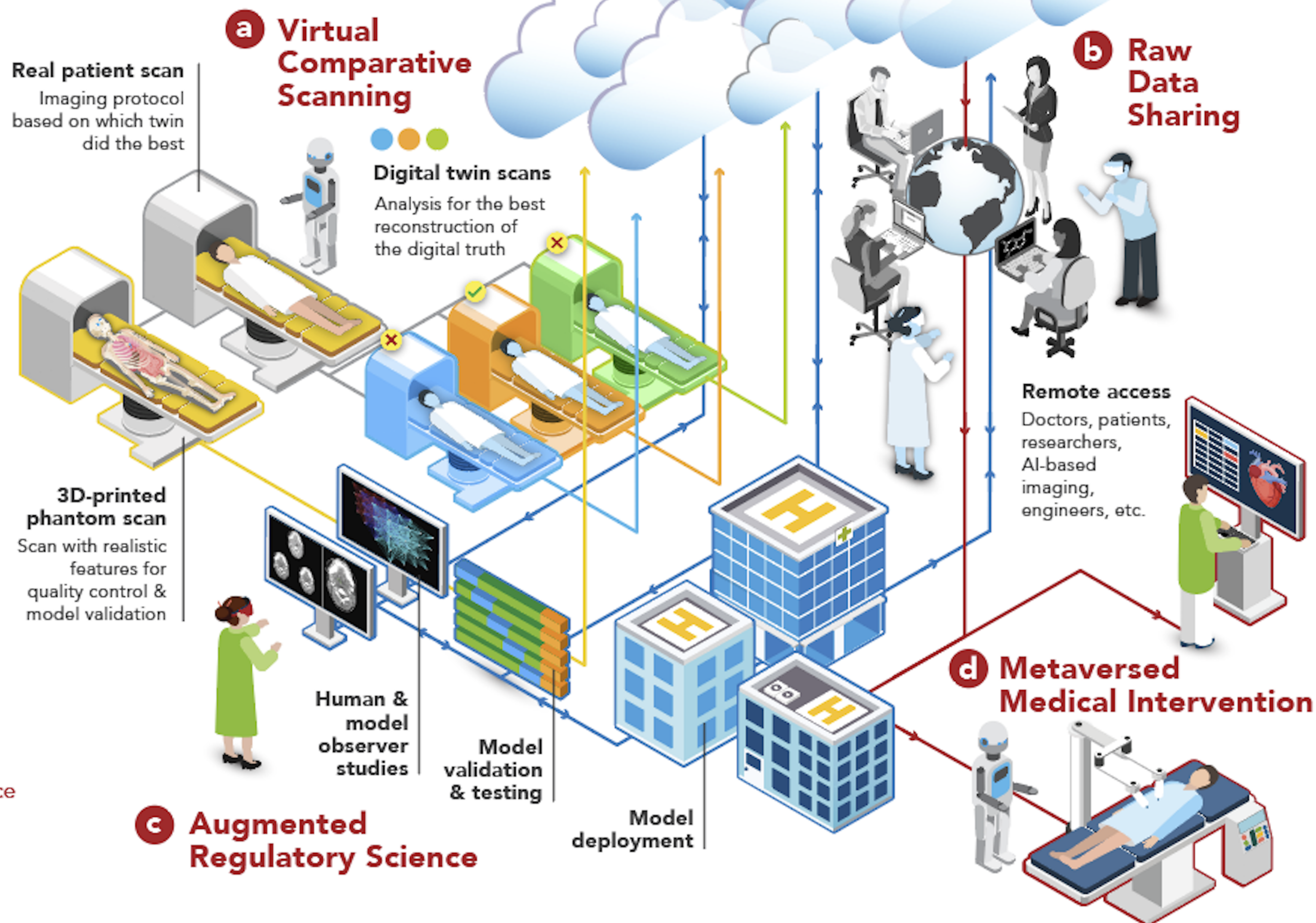**Interactive voice assistants**

Assistant / Avatars integrating AI / ChatGPT
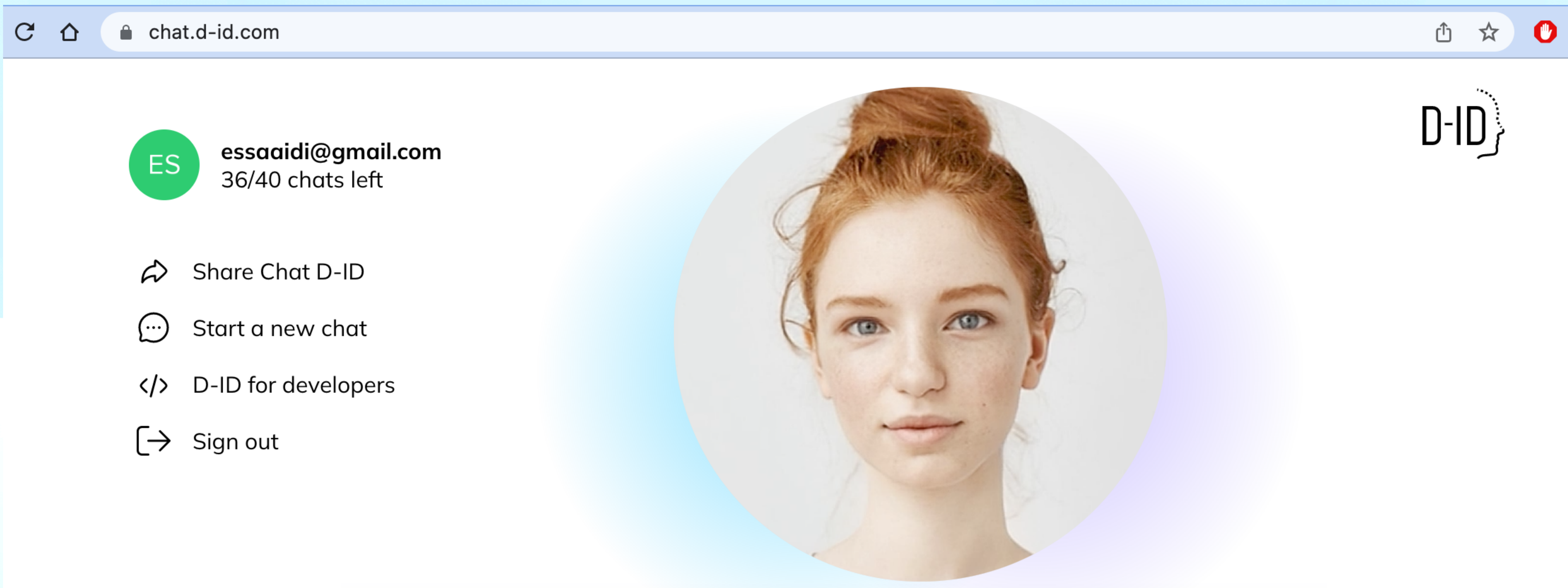
AI Avatars Debate: Are AI Doctors the Future of Healthcare?

Patient
Person requiring imaging for a suspected disease

Avatar
Digital twin model with & without an inserted disease

Phantom
Physical phantom 3D-printed from the digital twin

MeTAI
Medical Technology & Artificial Intelligence

Real patient scan
Imaging protocol based on which twin did the best

a Virtual Comparative Scanning

Digital twin scans
Analysis for the best reconstruction of the digital truth

3D-printed phantom scan
Scan with realistic features for quality control & model validation

b Raw Data Sharing

Remote access
Doctors, patients, researchers, AI-based imaging, engineers, etc.

c Augmented Regulatory Science

Human & model observer studies

Model validation & testing

Model deployment

d Metaversed Medical Intervention

39

IDC Training Programs

Interactive Digital Centre

XR for Architect.
Course Module
SAP+D, UM6P
(Sept. 2021)

VR Innovation Academy

Medium-term AR & VR developers training (EON Certified AR & VR Developer Level 1 & 2)

Masters of XR
UM6P (Underway)

Smart Workers

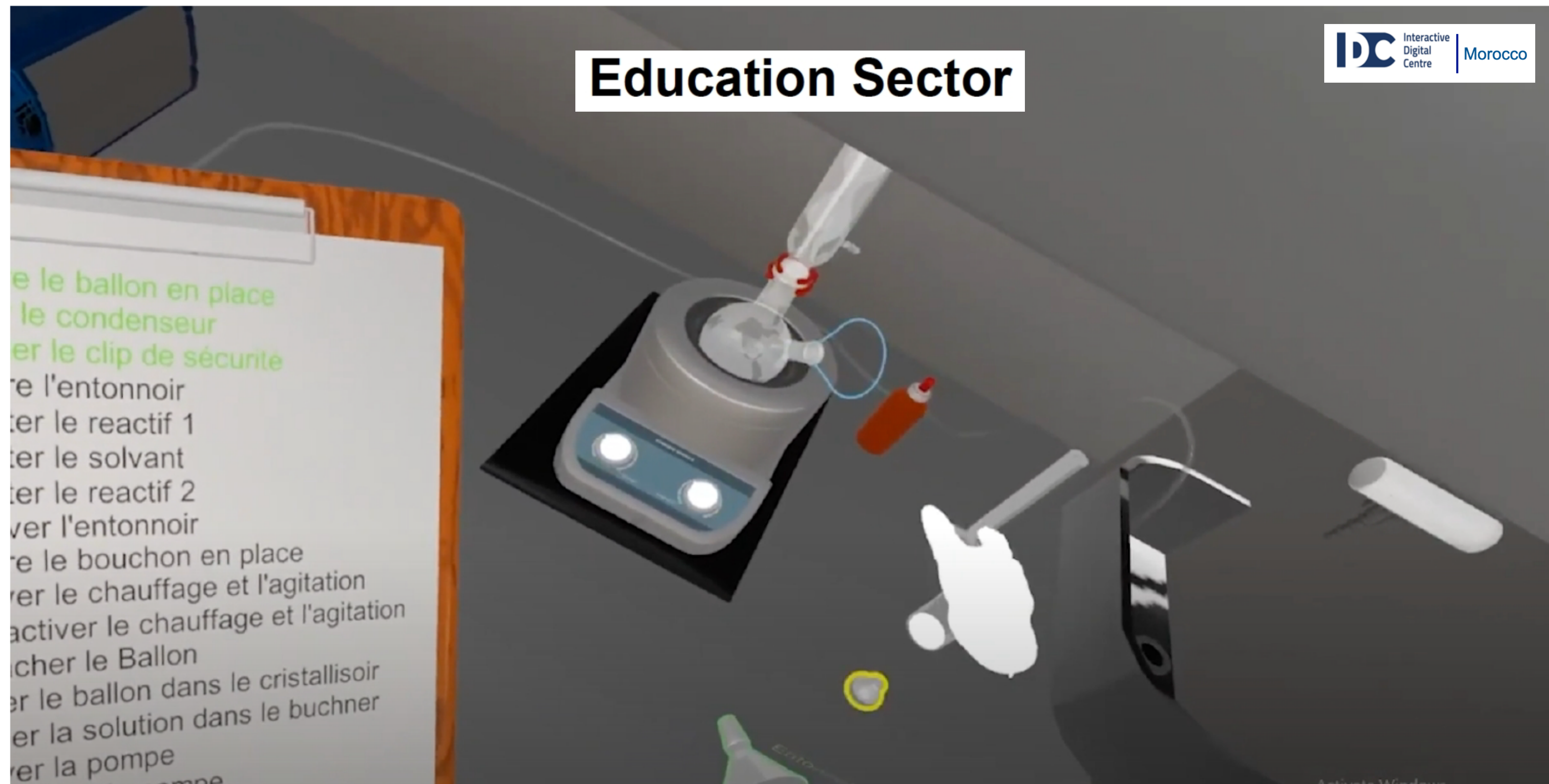This training is intended for professionals in industry that have never used VR and AR solutions before

IDC Interactive Digital Centre MOROCCO

Educators 3.0

AVR training for K12 educators, vocational trainers, and higher education professors
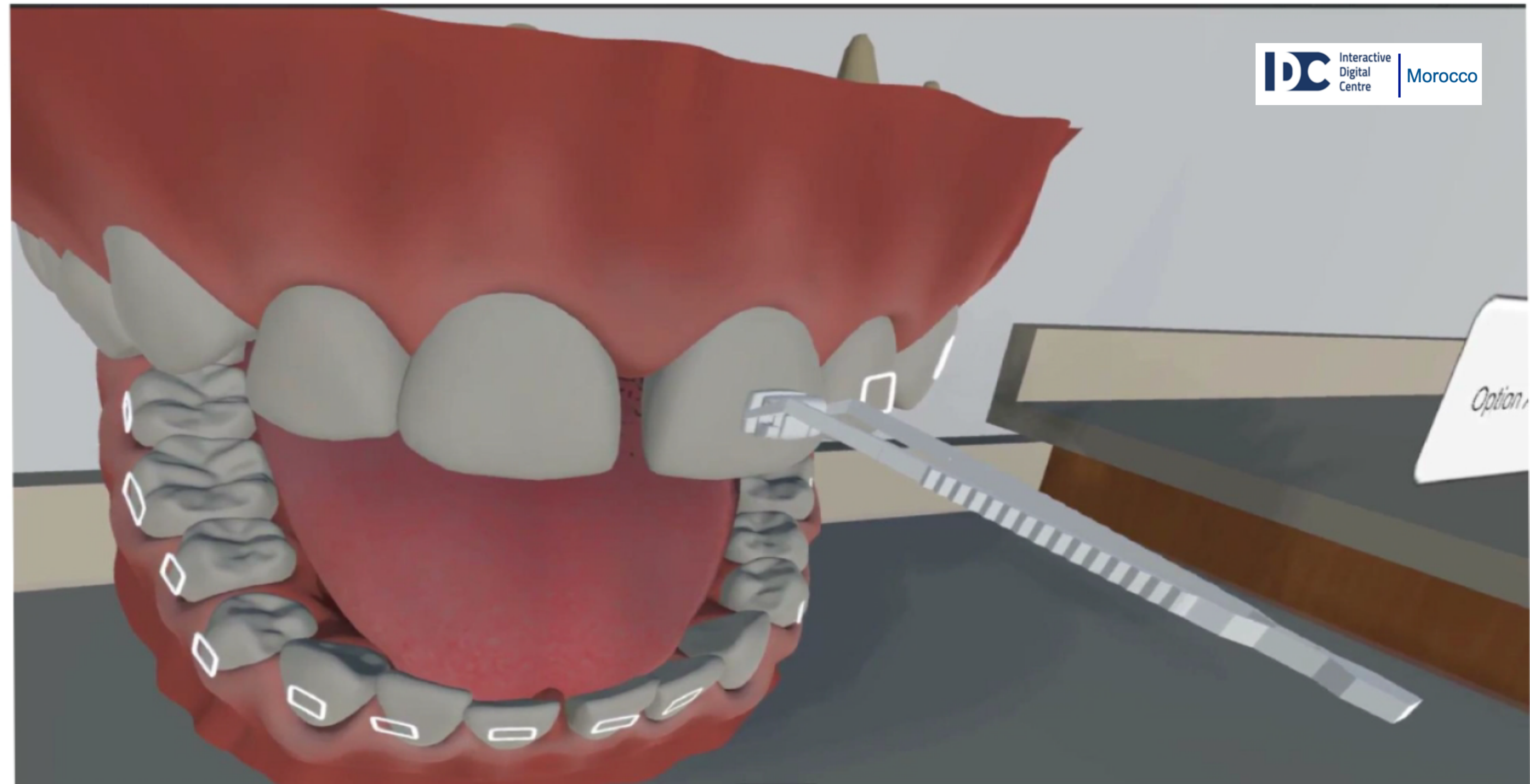
VR Chemistry Lab

IDC VRIA Students' project (1s Cohort, 2020)
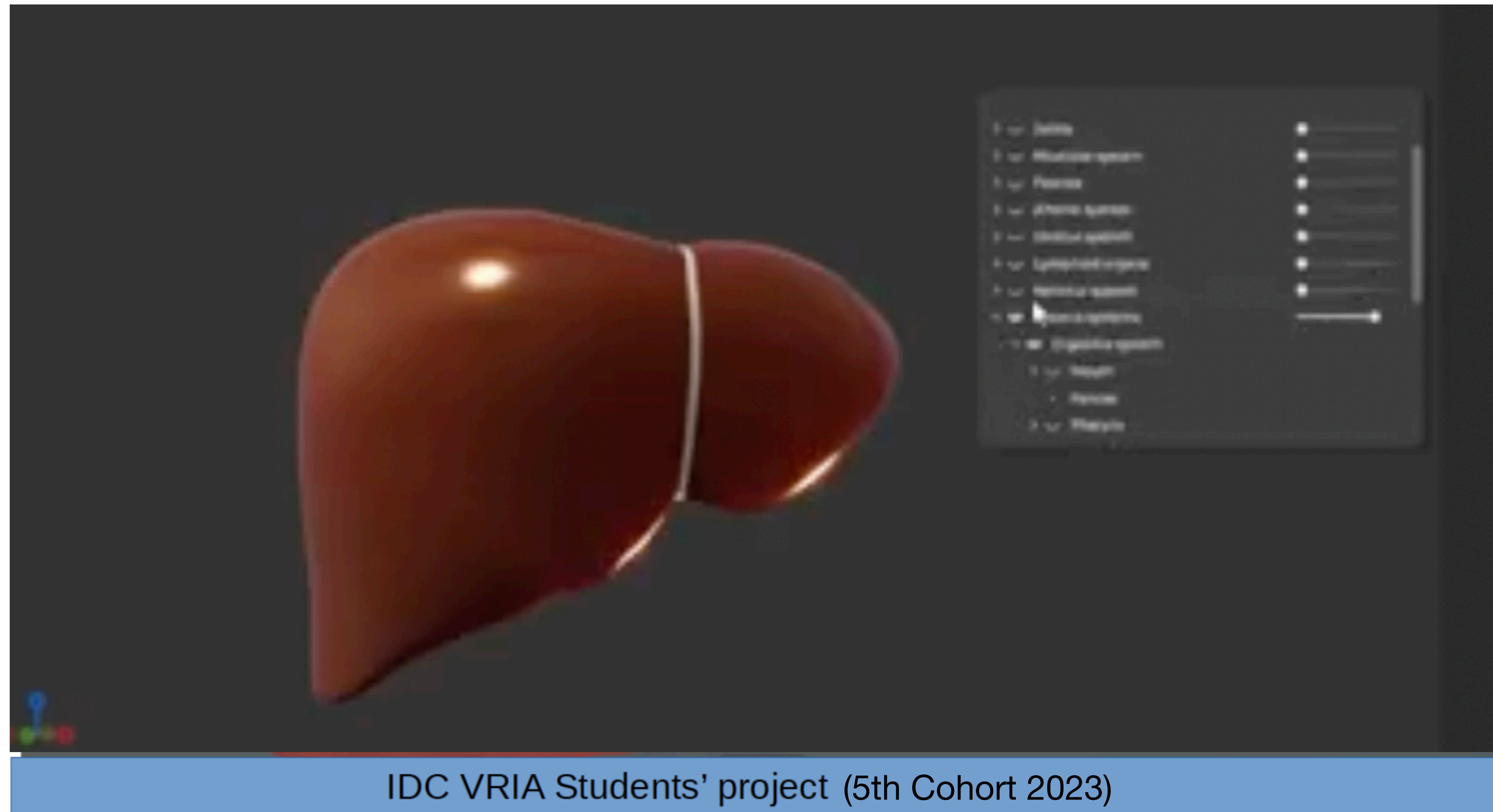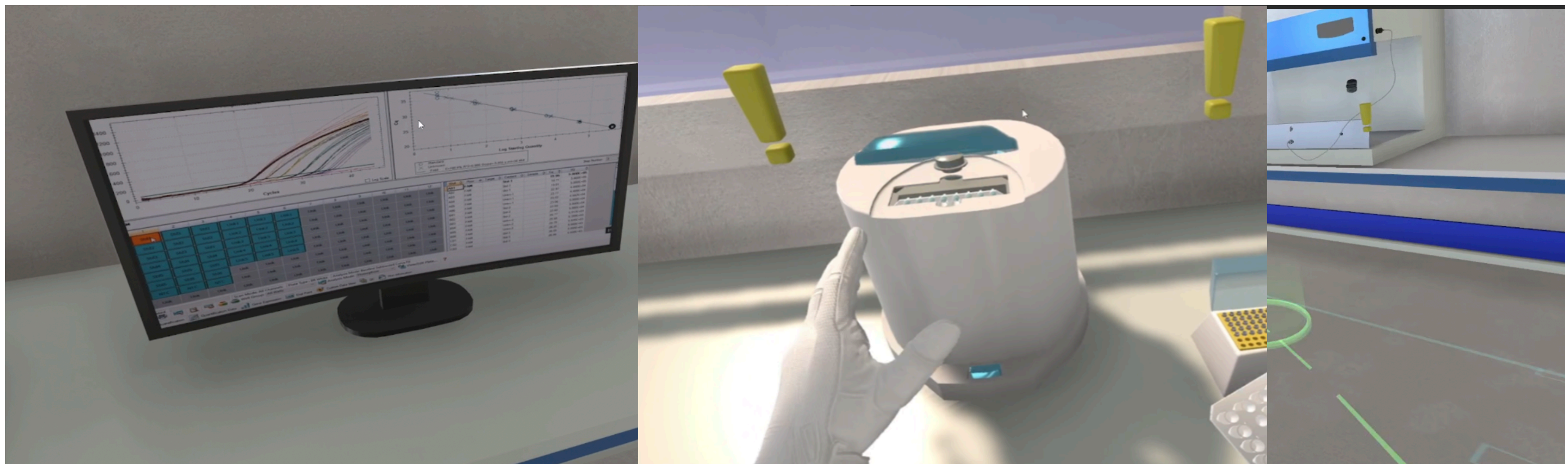
UM6P, Benguerir

VR Orthodontie simulator

IDC VRIA Students' project (2nd Cohort, 2021)

Clinique Dentaire, Univ. Abou Alqassis, Rabat

VR Liver Model

IDC VRIA Students' project (5th Cohort 2023)

INO, Rabat

PCR Test

IDC VRIA Students' project (5th Cohort 2023)

Institut Pasteur, Casablanca

Thanks for your attention !