



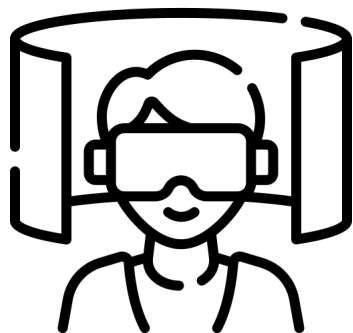
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The Metaverse: challenges and opportunities

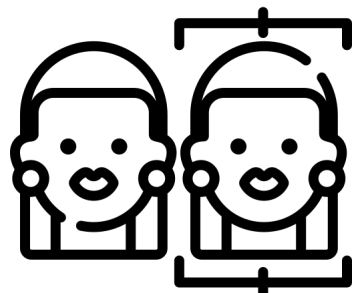
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Università degli Studi di Padova

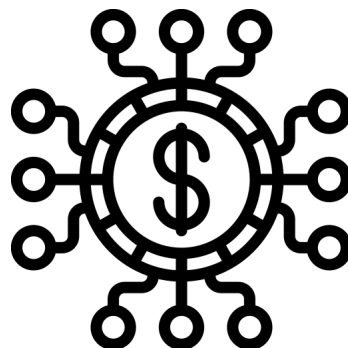
Enabling technologies



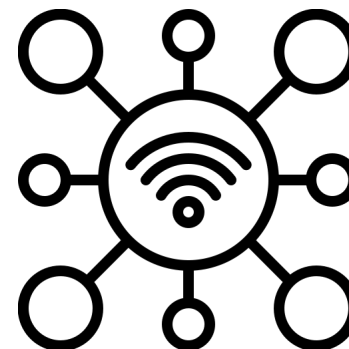
AR and VR



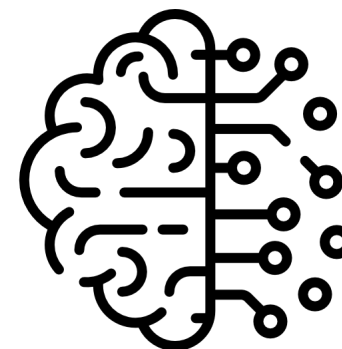
Digital Twin



Blockchain



Internet of
Things



Artificial
Intelligence

Virtual and Augmented Reality



www.engadget.com

Virtual Reality



Microsoft.com

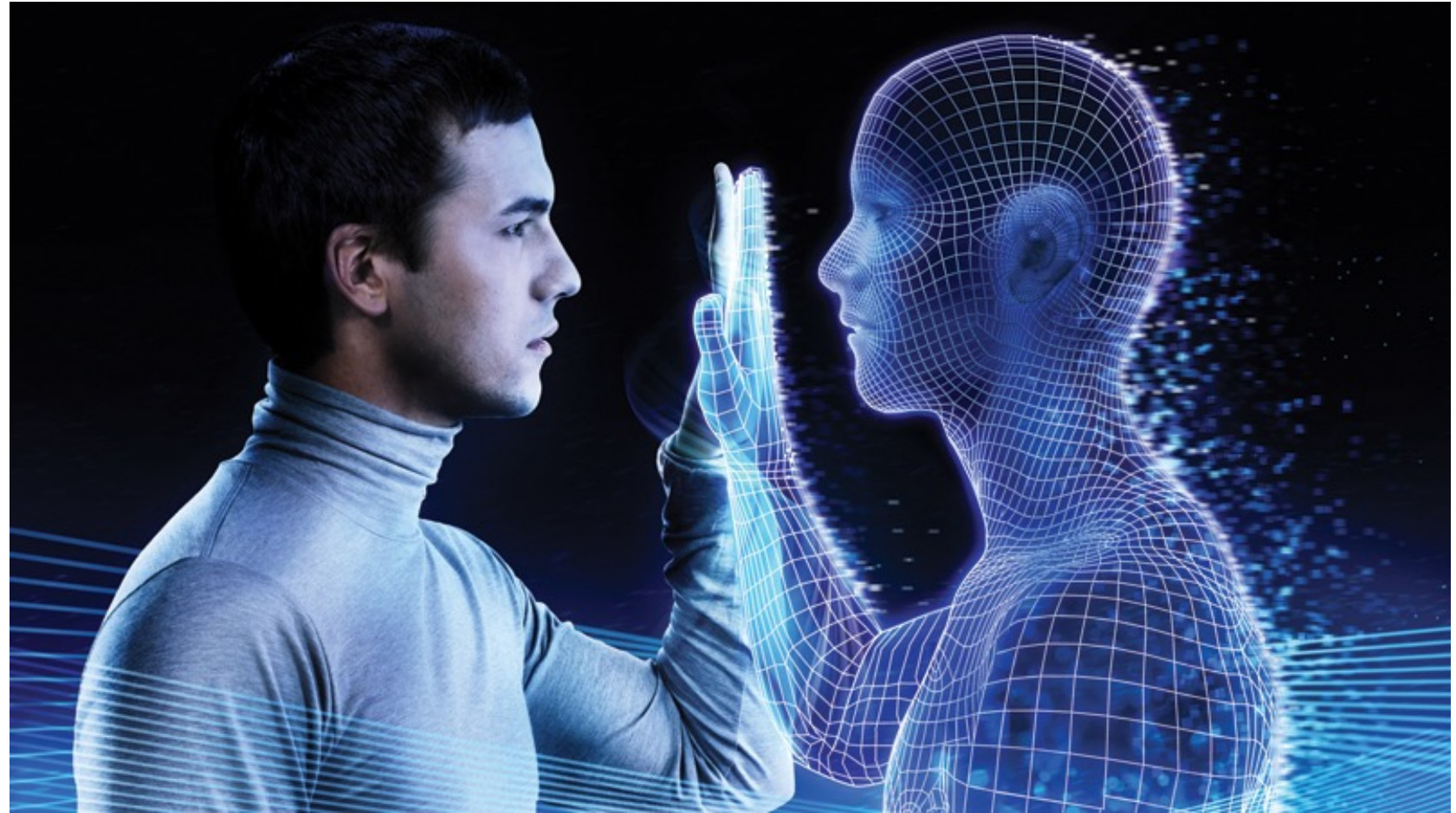
Augmented Reality

Mixed Reality

Digital Twin

A **virtual model**, or simulation, of any object, process, or system, generated using real-world data, for the purpose of **learning** more about its real-world counterpart.

In the metaverse, the digital twin could be of the patient themselves.



Blockchain

- Blockchain guarantees the **authenticity** and **security** of a record of data and generates trust without the need for a trusted third party.
- Blockchain technology could be involved in the **certification**, **authentication** of rights, distribution, trade, use, and **authentication** of virtual identities in digital medical resources and realize the intelligent management of digital rights.



www.statnews.com

Internet of (Medical) Things

- Any device that uses an internet connection to send or collect data, operate a process, or communicate information with other devices is considered an IoT device.



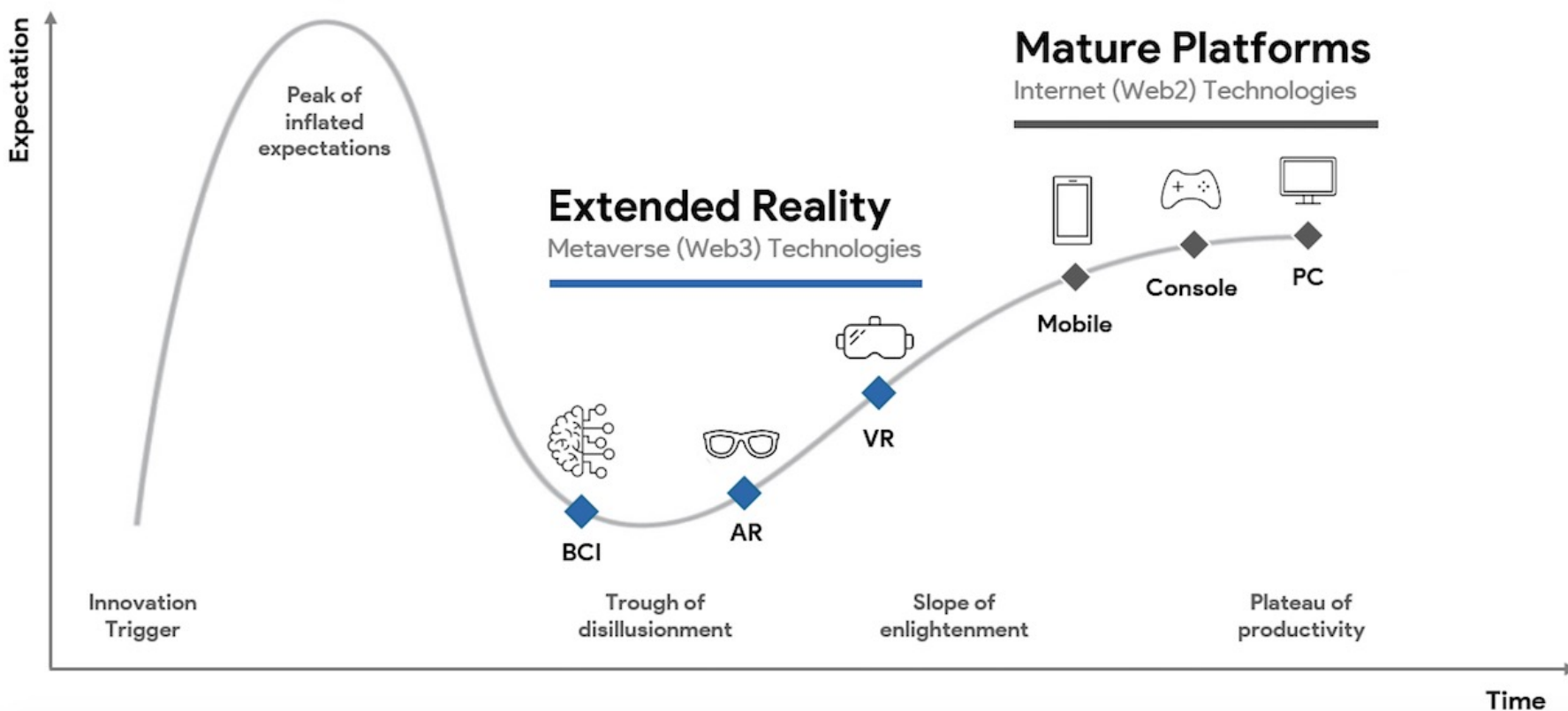
Artificial intelligence

- The theory and development of computer systems able to perform **tasks** normally requiring **human intelligence**.
- Early diagnosis, management of chronic diseases, intelligent auxiliary diagnosis...



Technology readiness

Computing Platforms over Time



Towards a more complete experience



www.xsens.com



www.caesarvr.com



www.trendhunter.com

Towards a more complete experience

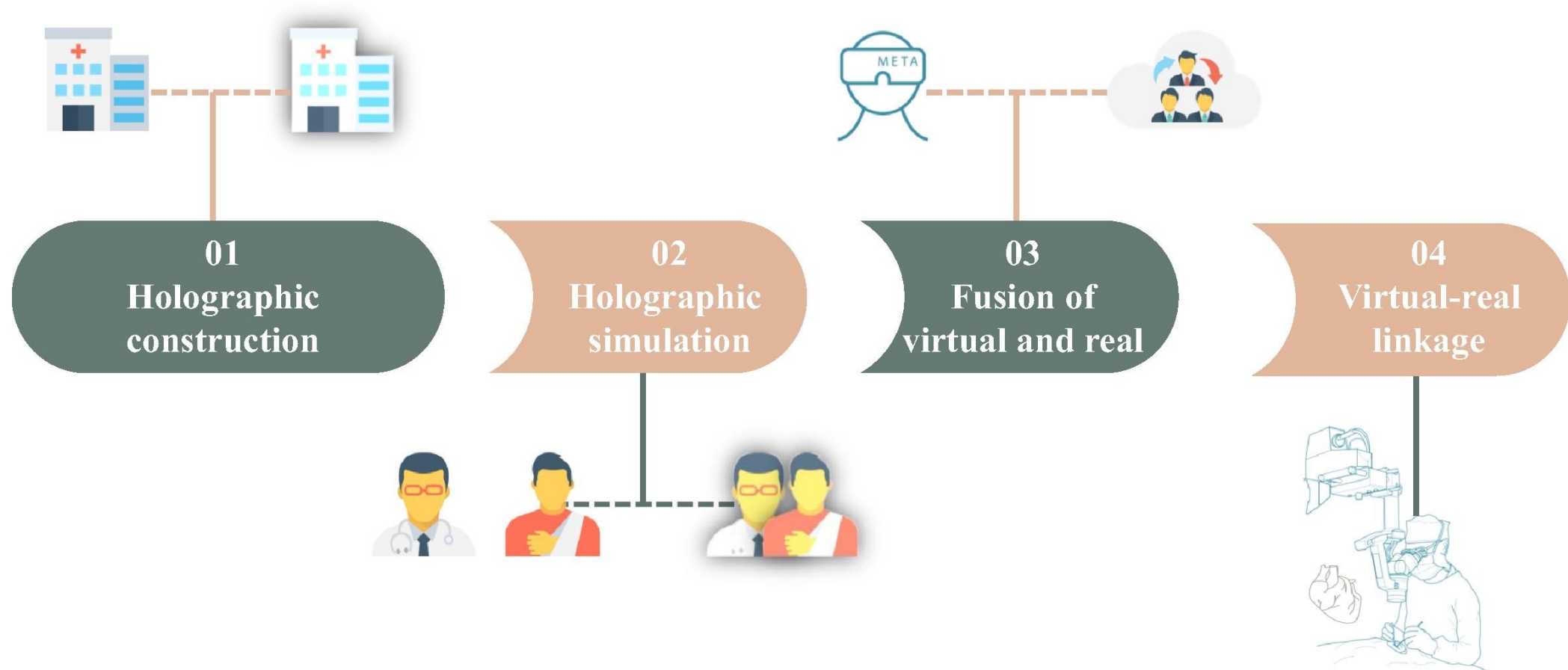


ovrtechnology.com



bioengineer.org

The medical Metaverse



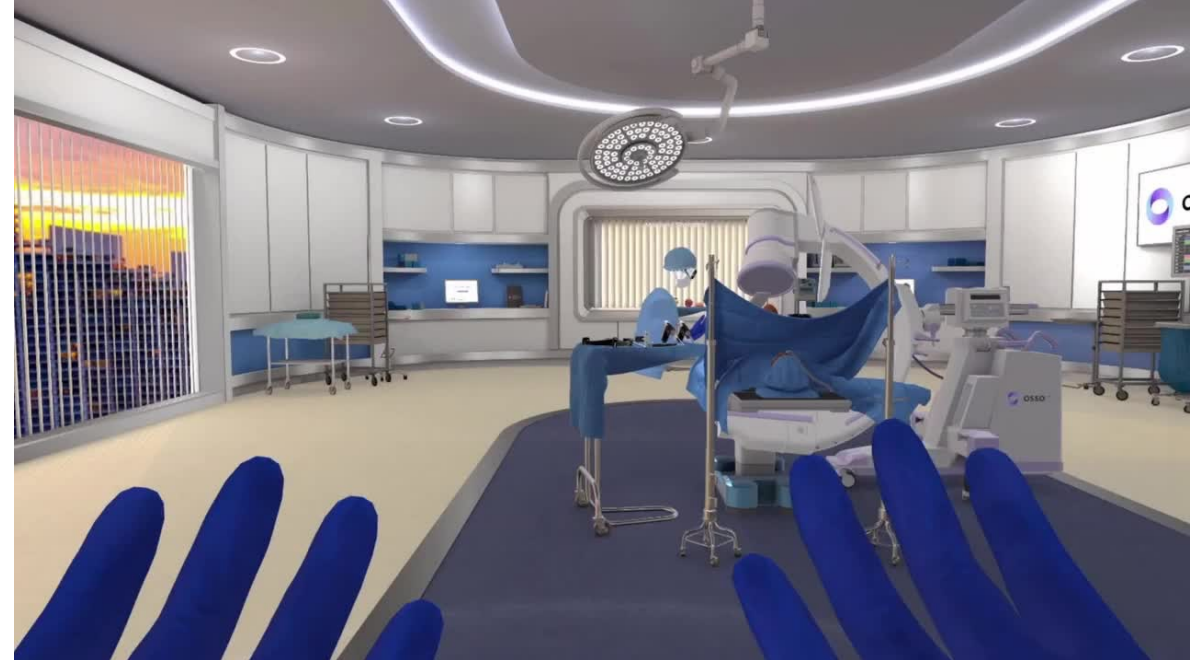
Holographic construction

- Creation of a static geometric model of the entire virtual world, including hospitals, medical equipment, and other objects.
- Three main elements: events, scenes, and people.



Holographic simulation

- The virtual world has to be created to approach the natural world in infinite detail:
 - Technology development
 - Improvement of fidelity of interaction
 - Connection with medical information and data systems
 - Digital avatars of patients and doctors



Fusion of virtual and real

- Creation of a mixed medical reality world
 - the boundary between the virtual and real worlds will be broken



www.envisionexperience.com

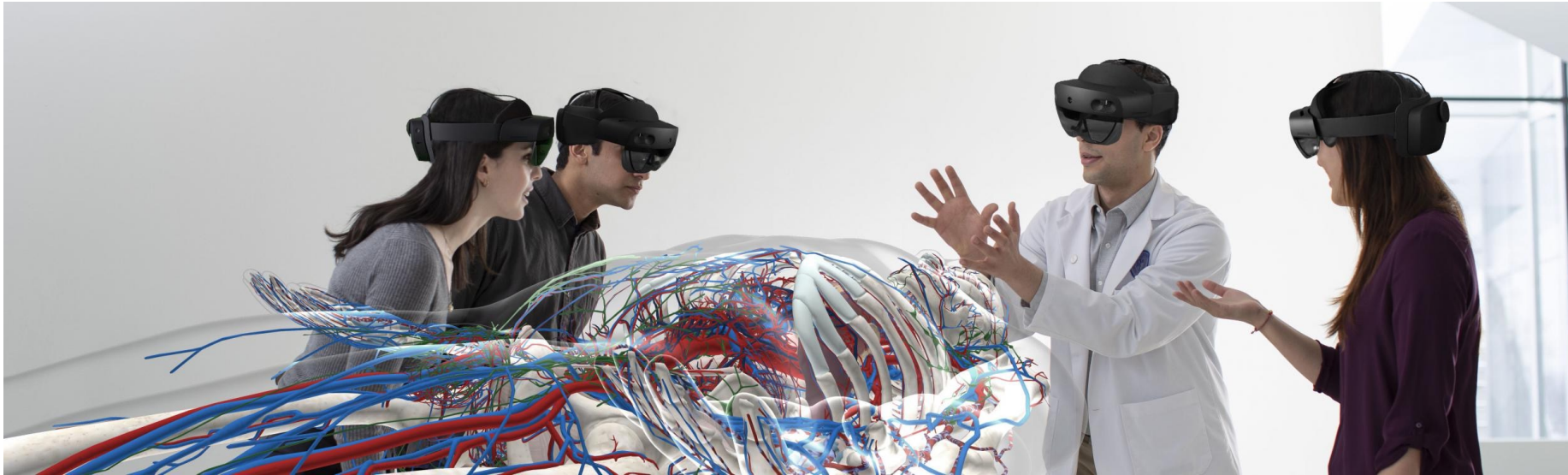
Virtual-real linkage

- New concepts and methods in the era of meta-medicine



What we have now..

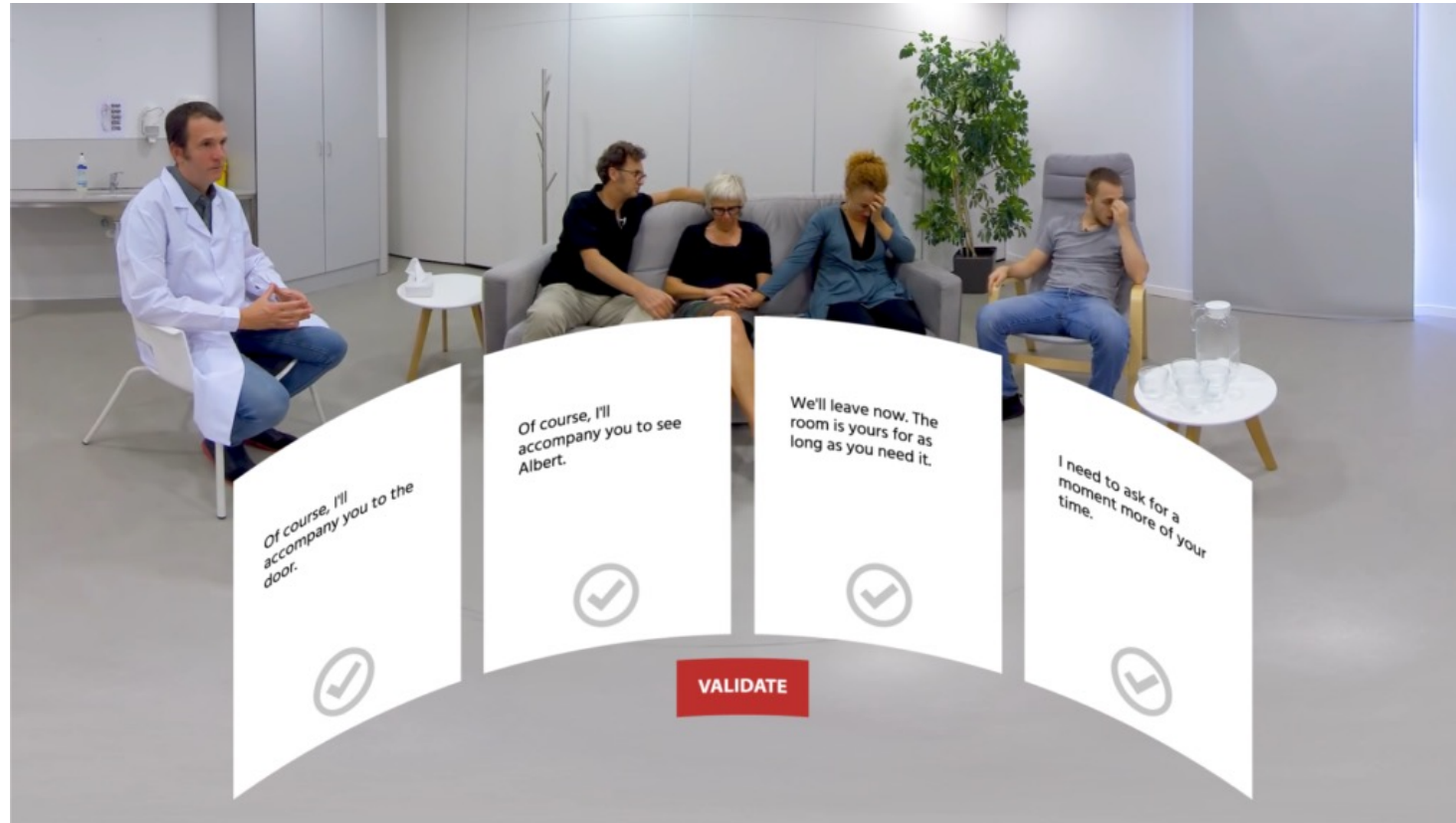
- April 2020: HoloAnatomy



case.edu

What we have now..

- December 2020: Family Approach VR



What we have now..

- April 2022: A comparison between learning in mixed-reality and real dissection:
 - medical students may prefer mixed-reality as it may be an effective modality for learning breast anatomy while facilitating teamwork.
 - supplementing cadaveric dissection with mixed-reality may improve long-term retention for at least one anatomical topic.

International Journal of Medical Education. 2022;13:107-114

ISSN: 2042-6372

DOI: 10.5116/ijme.6250.0af8

Comparing learning retention in medical students using mixed-reality to supplement dissection: a preliminary study

**Guy Baratz¹, Preethy S. Sridharan², Valeda Yong³, Curtis Tatsuoka⁴, Mark A. Griswold⁵,
Susanne Wish-Baratz⁶**

What we have now..

- August 2022: conjoined twins separated with the help of virtual reality
- The teams spent months trialling techniques using virtual reality projections of the twins, based on CT and MRI scans.
- Surgeons in separate countries wore headsets and operated in the same "virtual reality room" together.



www.bbc.com

Is it going to happen?

- Missing body and poor quality avatars.
- User interfaces that consumers can access easily and comfortably.
- The services must be immersive and informative.
- No physical discomfort (dizziness, nausea, ...)
- Training professionals to treat and diagnose patients as effectively as in the real world.



Instant Codec Avatar



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