EEDUSIM
training in hEalthcare EDUcation with SIMulation

Erasmus+

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MetaMedics VR

SESAM Society for Simulation in Europe

cps Centro Professionale Sociosanitario Lugano

AR / VR and screen based technology

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Erasmus+

Screen based technology

Screen Based Simulations

- A simulation performed with the use of a computer
- No "real" manikin / simulator involved

Aspects:

- How to interact with the patient?
- How does the scenario evolve?
- How to prepare the simulation?

Augmented / Virtual reality

AR / VR / XR / MR

MR: Mixed Reality

XR: Extended Reality

AR: Augmented Reality

VR: Virtual Reality

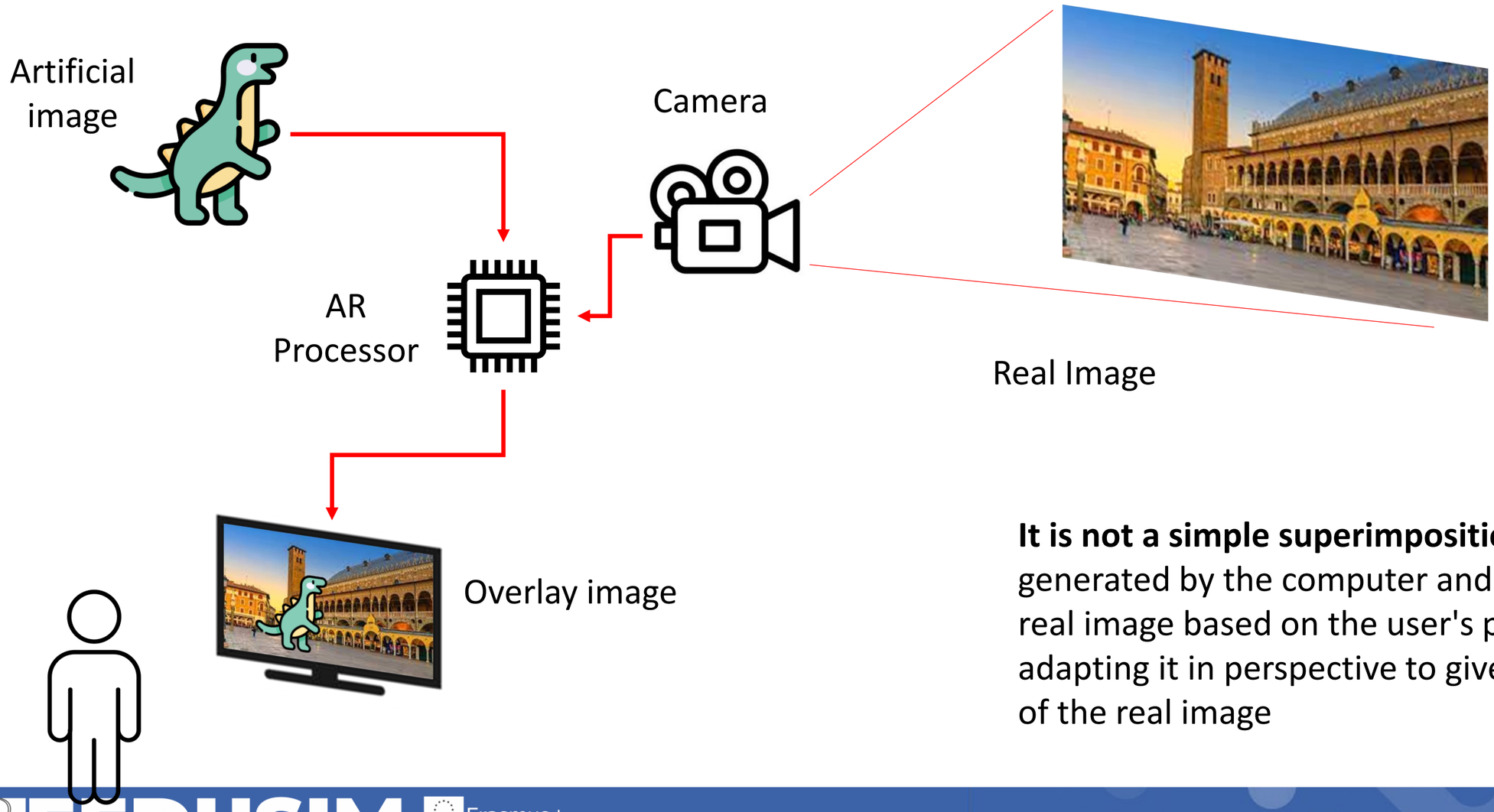
Generato con intelligenza artificiale · 25 settembre 2023 alle ore 7:22 PM

AR – Augmented Reality

AR: Augmented Reality

Superimposes artificially generated images on top of live images

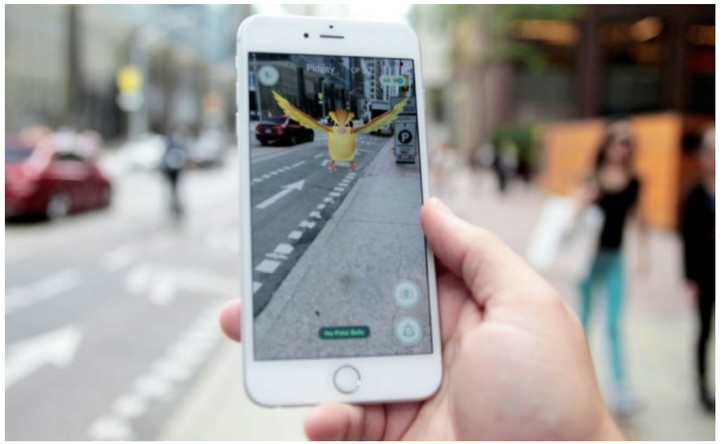
AR: how does it work? (type 1)



It is not a simple superimposition: the artificial image is generated by the computer and superimposed on the real image based on the user's position and direction, adapting it in perspective to give the illusion that it is part of the real image

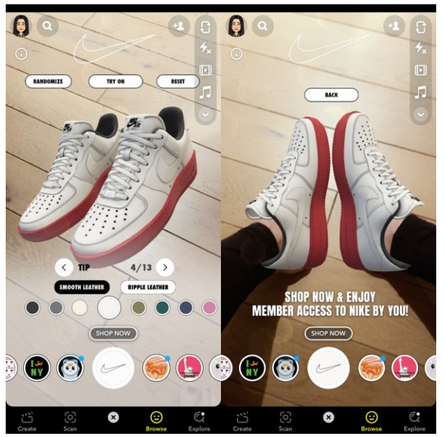
AR: tablet/smartphone technology

- A tablet/smartphone has everything you need to become an augmented reality tool
- There are various apps (e.g. shopping apps) that use this technology
- The result is not immersive



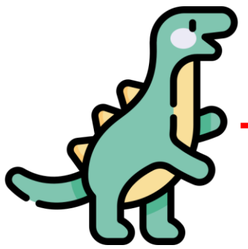
Pokemon Go
https://www.newyorker.com/tech/annals-of-technology/pokemon-go-will-make-you-crave-augmented-reality

Amazon's Room Decorator
https://www.cnet.com/tech/mobile/amazon-now-lets-you-design-a-whole-room-of-augmented-reality-furniture/

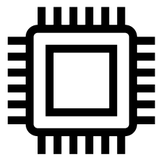


Nike's AR shopping lens
https://time.com/6138147/augmented-reality-shopping/

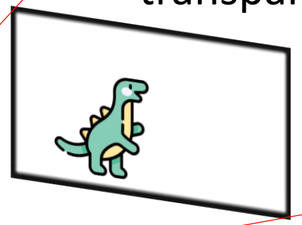
AR: How does it work? (type 2)



Artificial image

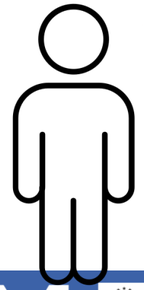


AR
Processor



Projection on a
transparent screen

Real
Image



It is not a simple superimposition: the artificial image is generated by the computer and superimposed on the real image based on the user's position and direction, adapting it in perspective to give the illusion that it is part of the real image

AR: glasses technology

- Expensive instruments, with applications that are currently industrial
- The result is partially immersive: wherever the user looks (inside the glasses) he will be able to see the virtual world

Microsoft Hololens 2
3.500 $

Magic Leap 2
3.299 $

Lenovo ThinkReality A3
1.500 $

Smart Glasses (e.g. Google Glass) are not really augmented reality glasses because they provide information overlay that don't give the impression of being real (Perspective Correction)

AR: technical difficulties / challenges for the future

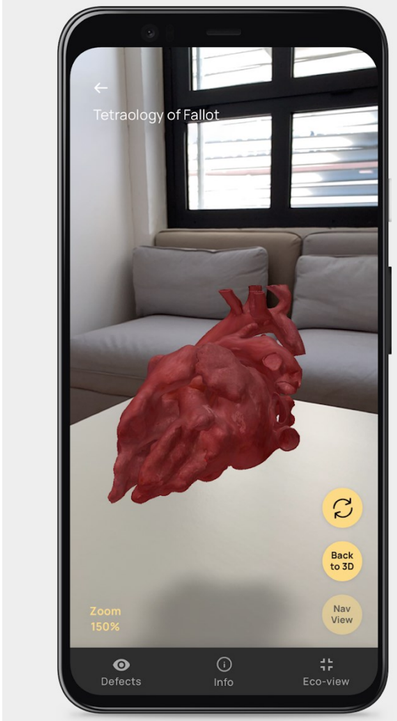
- Hopping: to create a realistic image, the processor must adapt the artificial image to the real one; To do this, it must constantly evaluate the position of the user and the device by making many calculations; Small variations in the results of the calculations can lead to small shifts in the artificial image, which does not stand still but "jumps" (registration errors)
- Brightness: The superimposed image is sometimes "washed out" if it is superimposed on very bright real scenes (for glasses)
- Cost (for glasses)

AR for Healthcare Training

- Smartphone app

https://play.google.com/store/apps/details?id=it.unipd.cardiologyar

- CAE LucinaAR https://www.youtube.com/watch?v=0pb0kLK9218
- Gaumard Noelle https://www.youtube.com/watch?v=TvLu28TSpLc



VR – Virtual Reality

VR: Virtual Reality

The user is completely immersed in a computer-calculated three-dimensional world (virtual world)

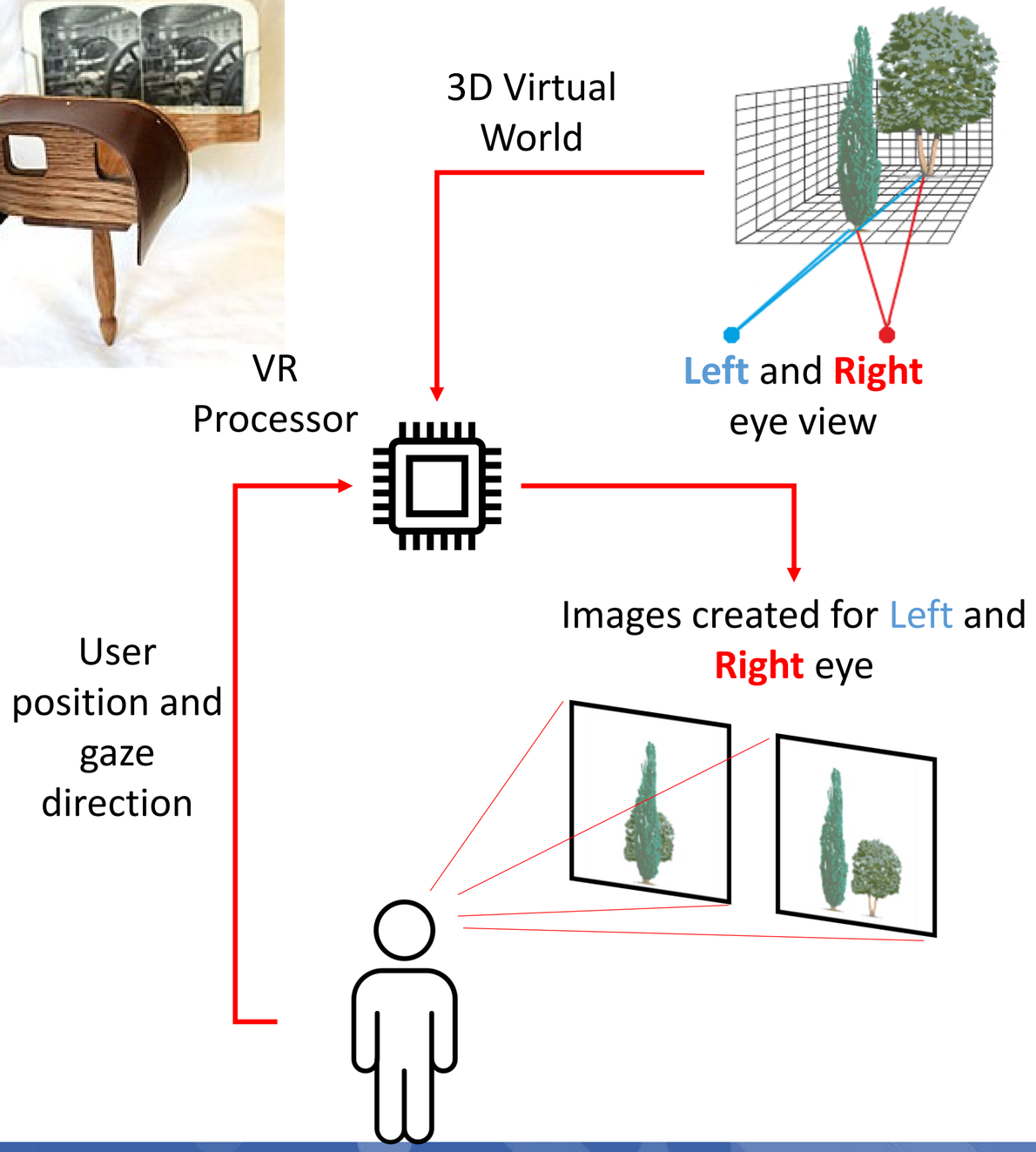
The user wears a headset that isolates him from the outside world

The feeling of immersion is VERY immersive

Image credit: Great.gov.uk

VR: how does it work

- The processor calculates two different images, one per eye
- The images are "photos" of a virtual world, taken from two slightly offset points (the distance between the pupils is about the distance between the pupils)
- The two images create a stereoscopic vision that tricks the brain into believing that it is inside the virtual world
- The user's position and the direction in which they are looking are constantly calculated and used to update the generated images



VR: technology

Current technology differs between:

the headset must be/can be connected to a PC

Number and type of controllers

External sensors must be installed to detect the user's position

Oculus Quest 2
349 $

Oculus Quest 3
549 $

Apple Vision Pro
3.499 $

HTC Vive XR Elite
1.099 $

Valve Index
999 $

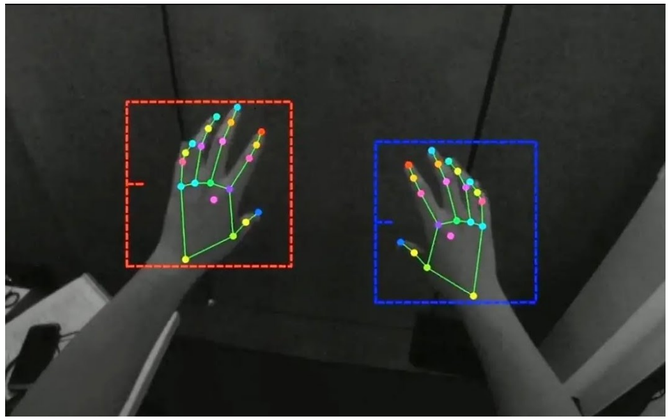
VR: technology

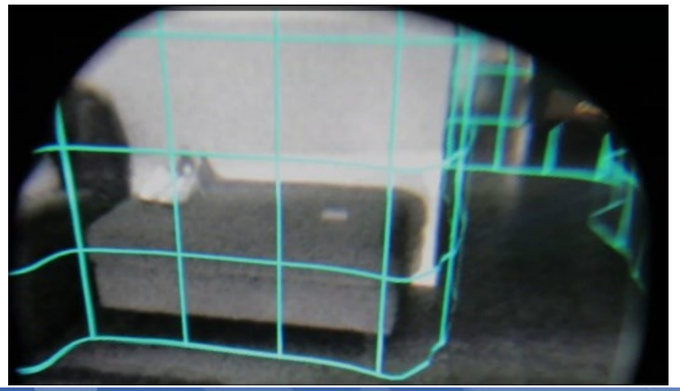
The user interacts:

using one or two wireless joysticks

using your hands

Latest models have cameras that allow the user to see "through" the helmet (pass-through)





Why don't we come up with a new name?
Let's invent Mixed Reality!

VR: technical difficulties / challenges for the future

- The user is isolated: he does not perceive the external environment
- The risk of impact is very high in narrow environments
- Movement in virtual space can lead to nausea, especially if it is not performed by moving in real space
- Interaction with objects is purely virtual: the user lacks haptic feedback
- Haptic feedback technologies (capable of stimulating touch) are being studied
- Interaction with other people is made complex by the presence of the headset
- There are multiplayer apps with avatars

VR: technical difficulties / challenges for the future

- To allow the user to move around while standing in place, multidirectional treadmills have been invented

https://youtu.be/M52lD0I0zlw?si=hQDiE9oQql33wMJ4&t=8

VR for Healthcare Training

- Simx https://www.simxvr.com/
- Clinical Scenario Simulators
- Laparoscopy / Robotic Surgery Simulators
- Hybrid simulation with skill trainers

Lap Mentor VR, Surgical Science

I3 Simulations

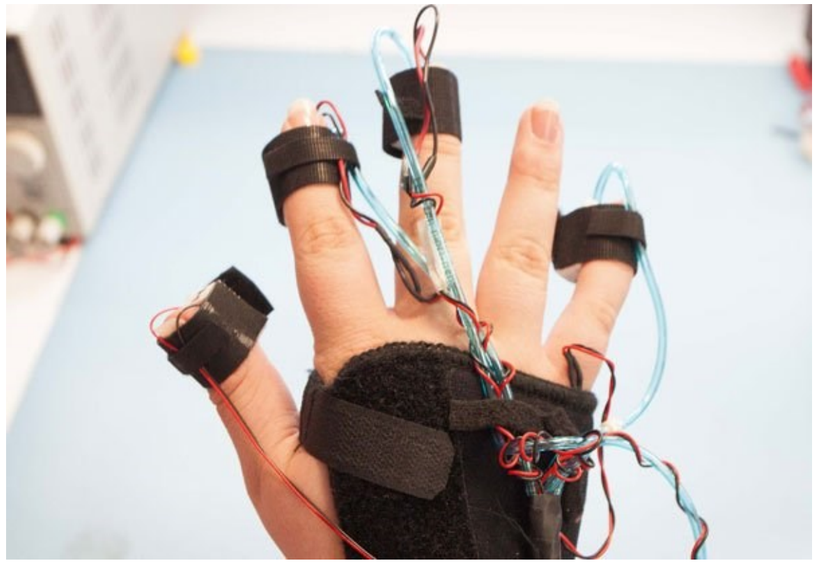
Looking to the future

AR and VR in the next years

- Graphics: the headsets have not very powerful processors but in the future they will be able to display very realistic virtual worlds

  https://youtu.be/qC5KtatMcUw?si=3ozOarJxyP_Gn3ze&t=173

- Haptic feedback: In the future, for example, using special gloves, it will be possible to simulate physical interaction with virtual objects



Conclusions

Questions

Which is preferable between AR or VR in the following cases?

To do an intubation simulation?

To do an outpatient simulation of anamnesis collection?

To simulate a train wreck?

…let's discuss!

VR vs AR

	VR	AR glasses	AR smartphone
Immersion	Yes, high	Yes	No
Isolation	Yes	No	No
Cost	Medium	High	Low
Nausea	Possible	No	No
Ease of use	Media	High	High

What you need to get started

- Identify the technology
- Locate your software
- Extensions
- Tables where you can place the visors
- An environment with room to move your arms
- Labels so as not to confuse headsets and controllers
- Tutorials to introduce the technology to users

Take home message

- In Augmented Reality (AR), artificial images are superimposed on live images
- In Virtual Reality (VR) the user is completely immersed (and isolated) in a virtual world
- AR and VR are technologies that must be used where and how they are needed
- Once we have bought the hardware (viewer) **we need to find the right software for our needs**

The End

Questions?