GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

Application Areas of Augmented and Virtual Reality

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Seminar: Technologies and Design of Graphical and Virtual User Interfaces
Date: 09.01.2020

Outline

1. General information about AR and VR
2. History of AR and VR
3. Application Areas of AR and VR
4. Current issues with AR
5. Current issues with VR
6. Conclusion
7. References

What are AR & VR ?

Augmented Reality

- Augmenting the existing world
- No special equipment (smartphone)
- AR is 25% Virtual + 75% Real
- Allows user to see the real world around
- Partially immerses user into the action

Virtual Reality

- Creating a new virtual world
- Special equipment (VR Headset)
- VR is 75% Virtual + 25% Real
- User cannot see the real world around
- Fully immerses user into the action

[1]

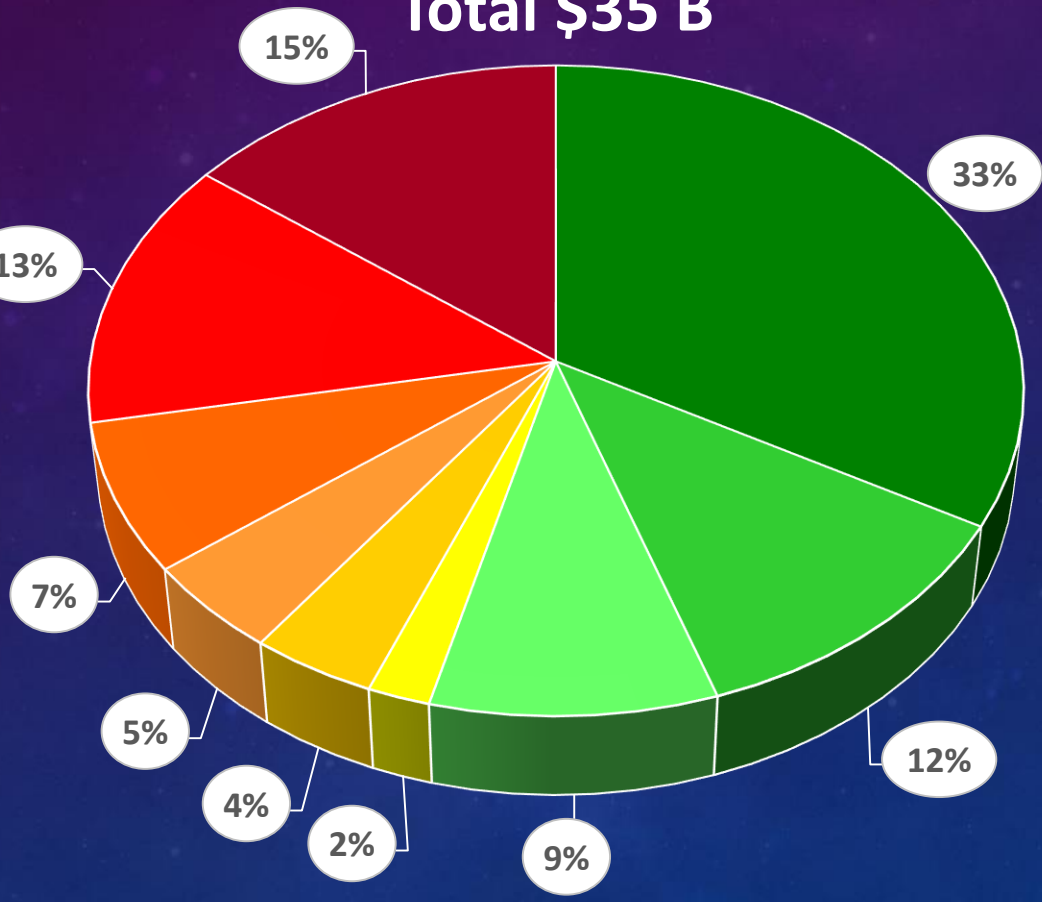
Diverse Potential in 2025

Predicted market size of AR/VR software

Enterprise and Public Sector $16,1 B

Total $35 B

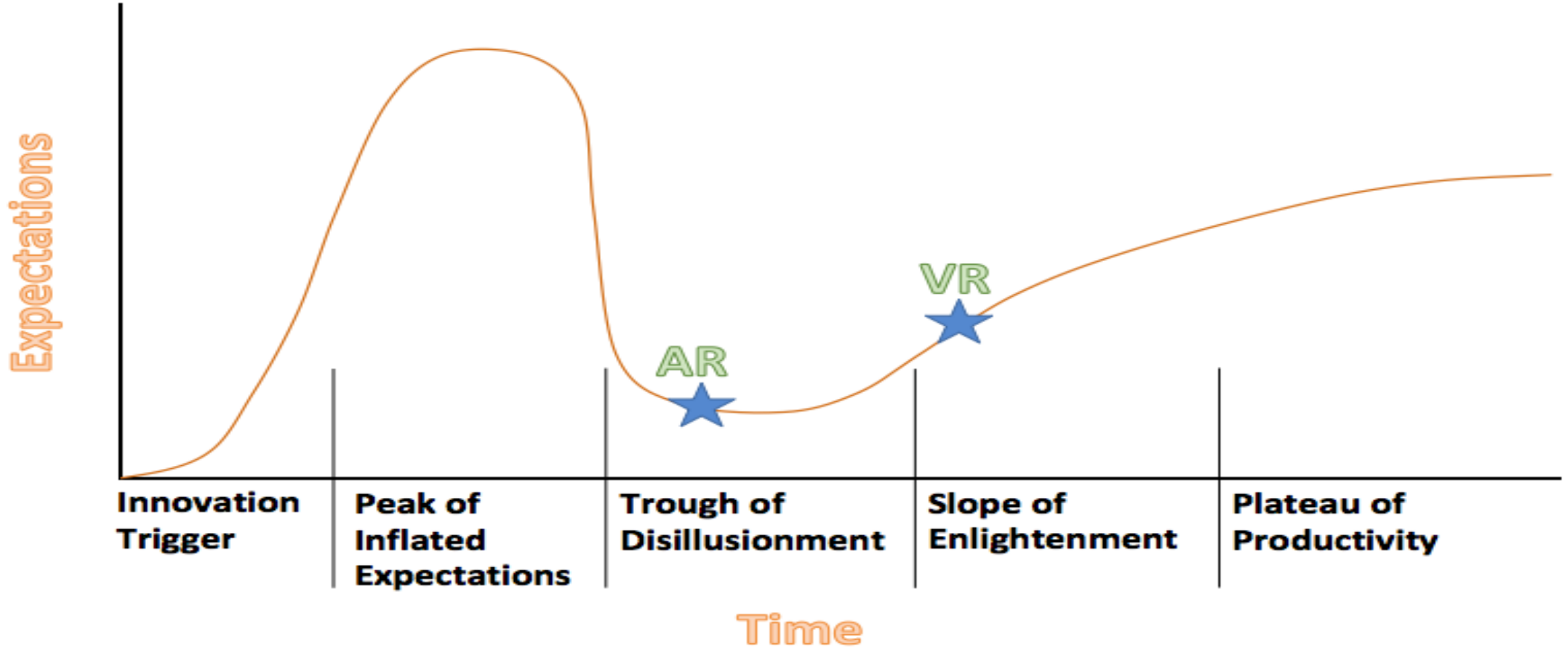
Consumer $18,9 B



[2]

2017

Gartner Hype Cycle for Emerging Technologies



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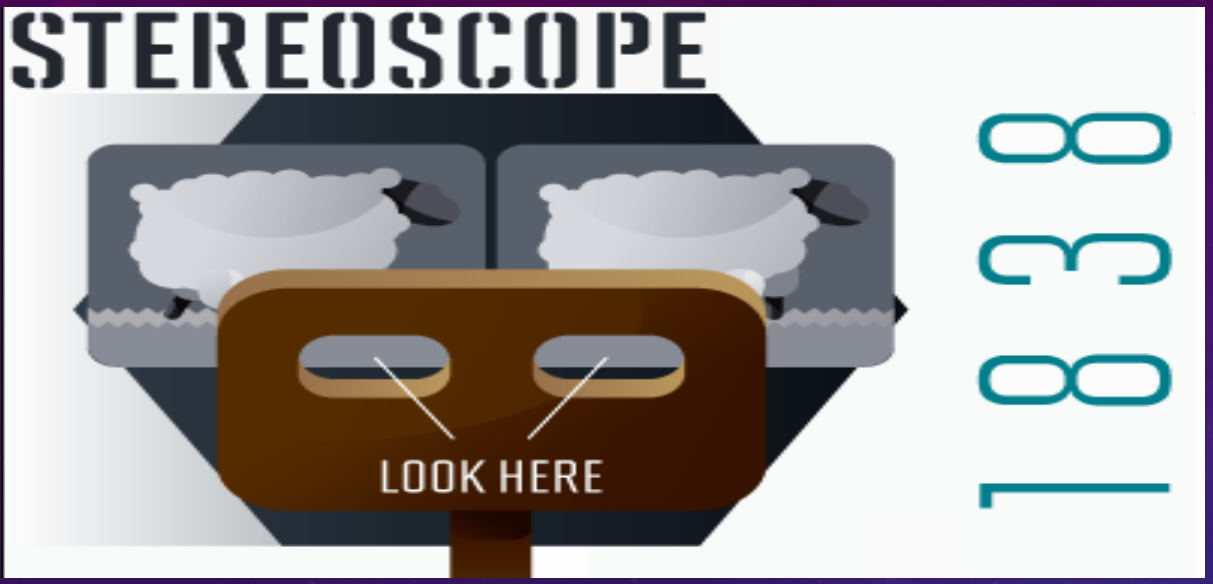
2. History of AR and VR – 19th Century



- Invented by Charles Wheatstone
- Allowed users to view a pair of separate images for each eye, creating a seemingly distant and larger 3D image

- Invented by Thomas Edison and William Dickson
- Sent a piece of film between a lens and a bulb while the user peered through a peephole showing images at 46 FPS

[4]

2. History of AR and VR – 20th Century

- Developed by Morton Heilig, cinematographer and VR pioneer
- First ever head-mounted display (HMD), which used stereoscopic technology, 3D imagery, widescreen vision, and stereo sound

[4]

- Developed by Philco Corporation engineers
- First motion-tracking HMD that took pictures and was designed to allow remote viewing of dangerous situations by the military

2. History of AR and VR – 20th Century

- Developed by Morton Heilig
- 3D-equipped booth that produced sensations to stimulate real experiences, such as a vibrating seat and the smell of hot dog stalls to stimulate riding a motorcycle through New York

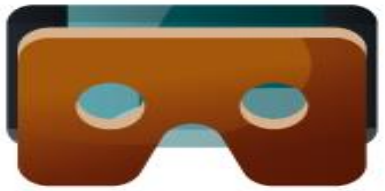
- Created by scientists at the Electronic Visualization Laboratory at the University of Illinois
- The first wired glove, which turned finger movement into electrical signals

[4]

2. History of AR and VR

2000s-PRESENT

THE AR AND VR MARKET



Google Cardboard

$15.00

Samsung Gear

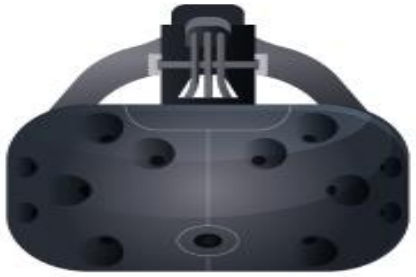
$129.99

Sony's Playstation VR

$299.00

Oculus Rift

$399.00



HTC VIVE

$499.99

Magic Leap One

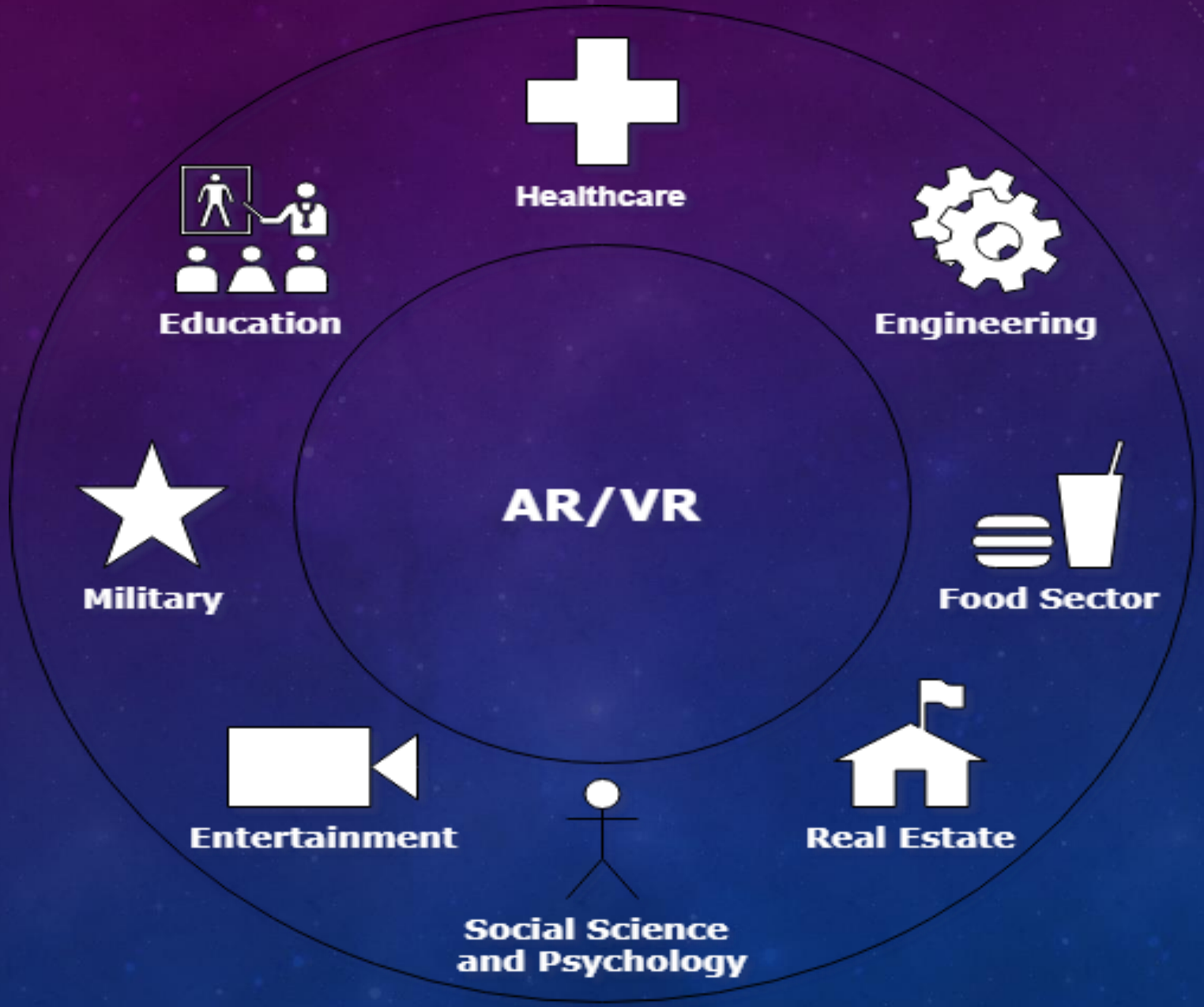
$2,295

Microsoft HoloLens for Developers

$3,000

[4]

3. Application Areas of AR and VR



3.1. Healthcare

- **Reducing risks of errors**
- **Early detection of Alzheimer's disease**
- **Studying cancer in 3D**
- **Healthcare from distance**
- **Pain Management & Physical Therapy**

[7]

AccuVein [5]

VR is being used for physical therapy [6]

3.2. Education

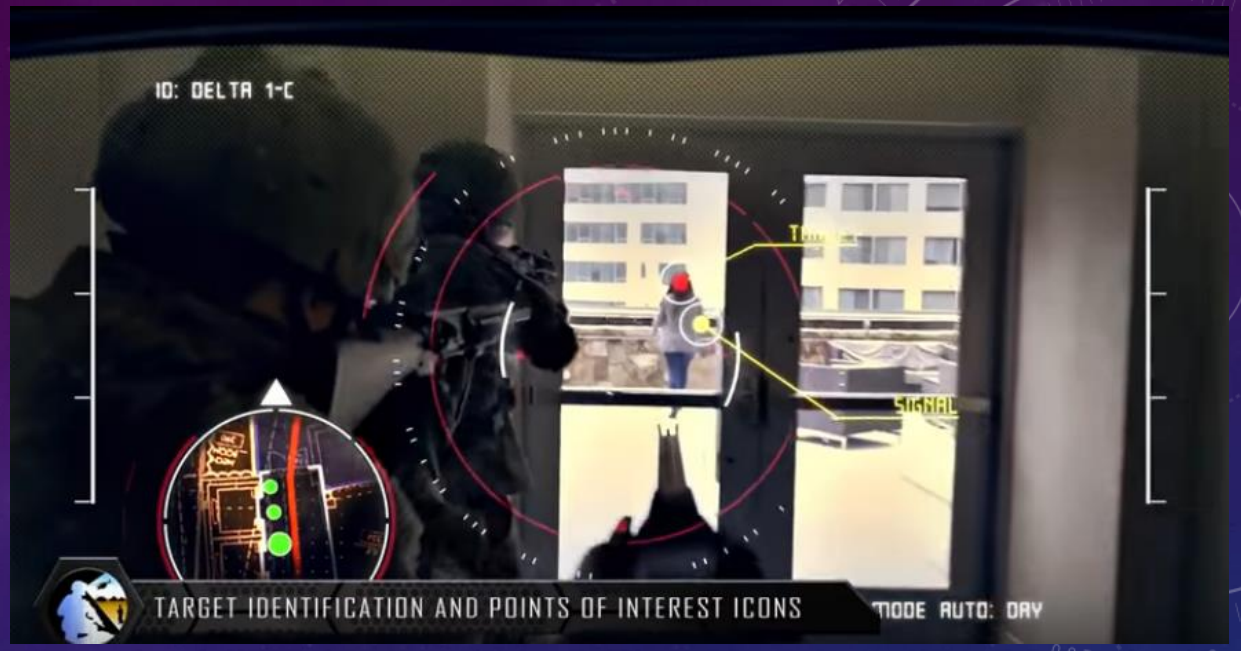
- **Getting learners excited about learning**
- **Enhancing learning experience for learners having various learning challenges**
- **Helping learners develop skills without the real-world consequences of failing (especially useful in situations of life-or-death)**

Titans of Space 2.0 for Oculus Rift [8]

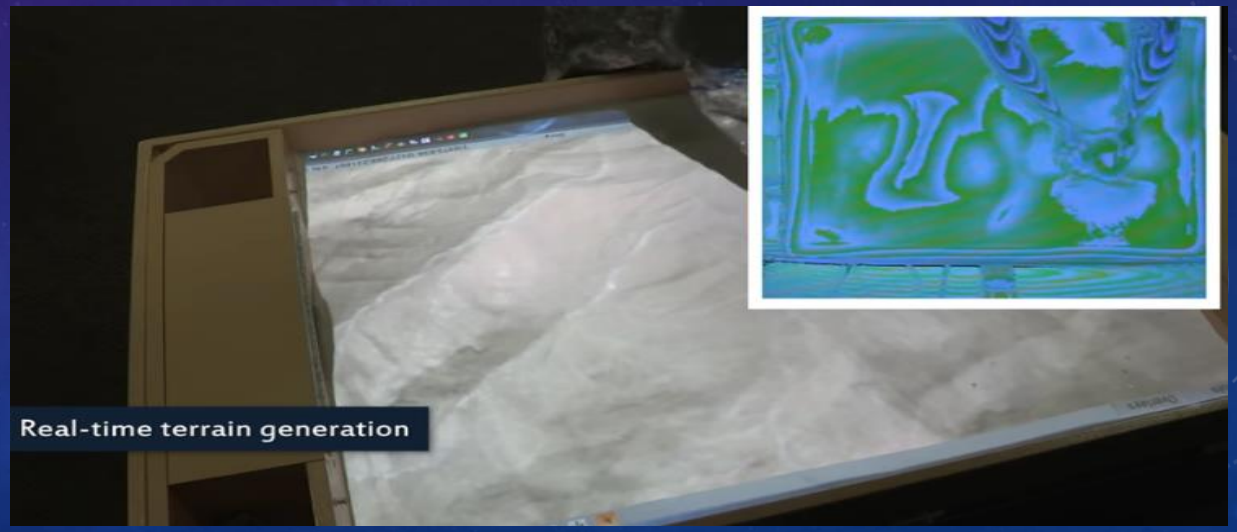
VR Medical Procedure for Envision EMI [9]

3.3. Military

- **Useful for training soldiers for combat situations or other dangerous settings without any risks**
- **Helping for making right decisions faster**
- **Lowering costs for combat training**



Tactical Augmented Reality [10]

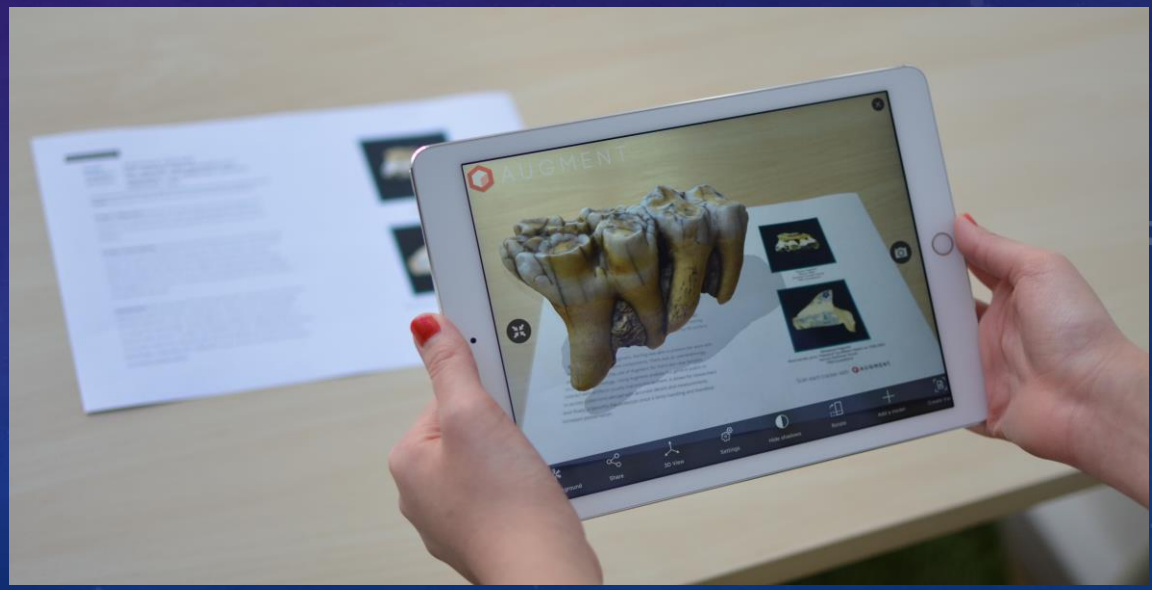


Augmented reality sand table [10]

3.4. Entertainment

- **Games**
- **Theaters**
- **Museums**
- **Galleries**
- **Music concerts**

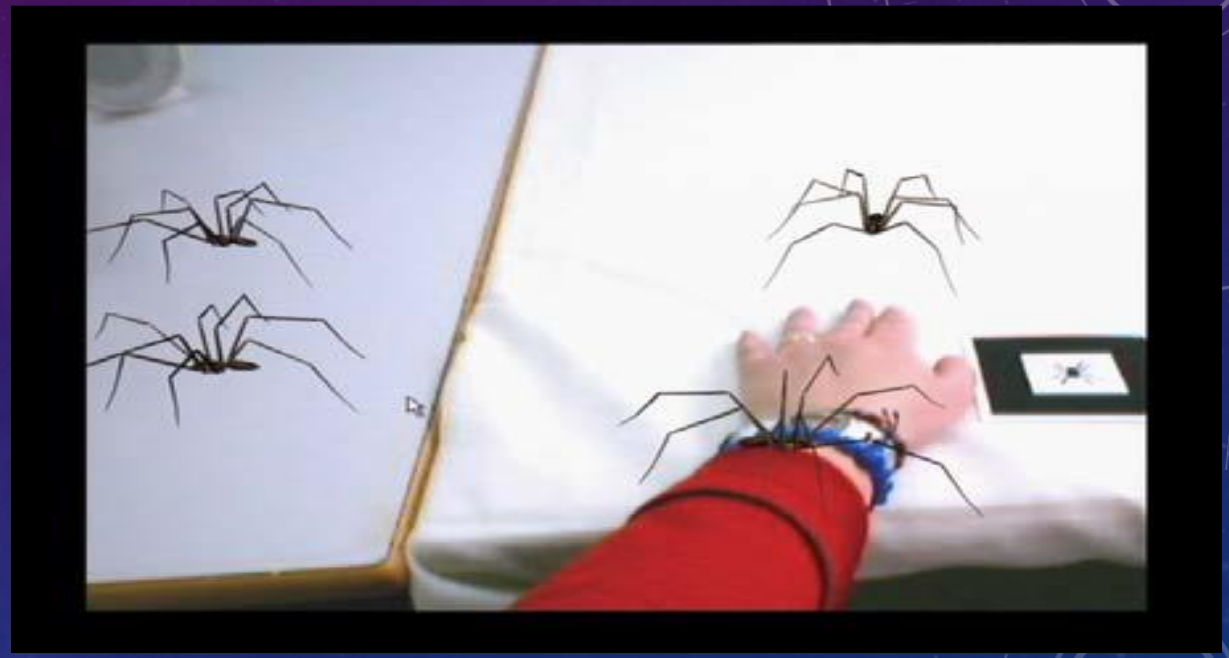
Scene from the “Borderline Procession” [11]



Visualizing the Past [12]

3.5. Psychology

- **Helping for overcoming different phobias**
- **Reducing symptoms of depression**
- **Identifying the early signs of schizophrenia**

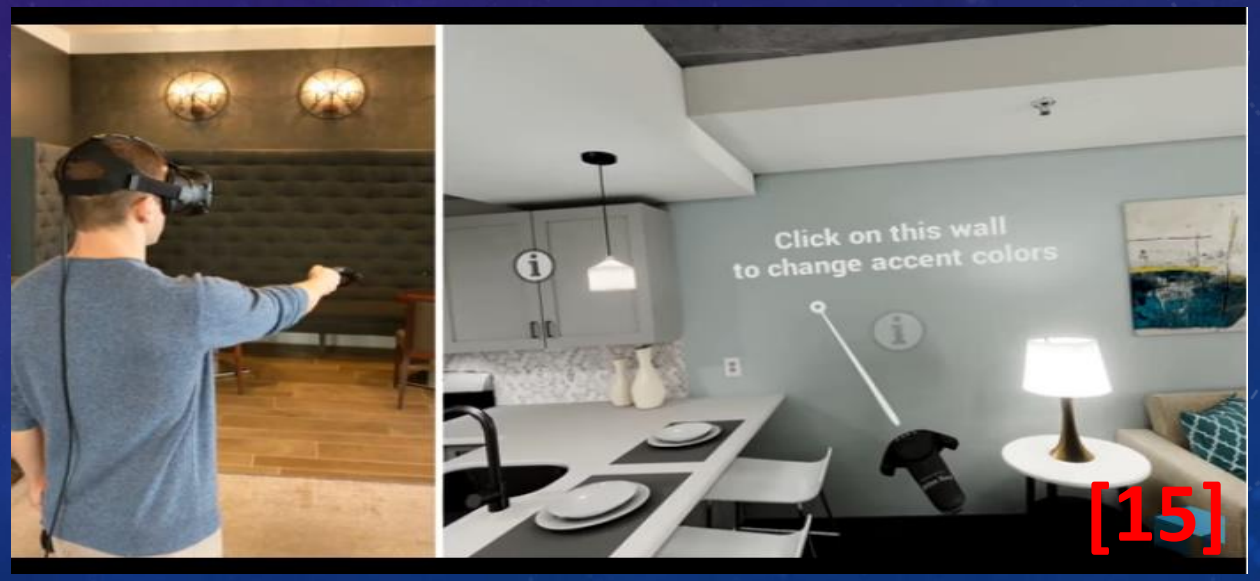


Phobia Treatment AR Application [13]

[7]

3.6. Real Estate

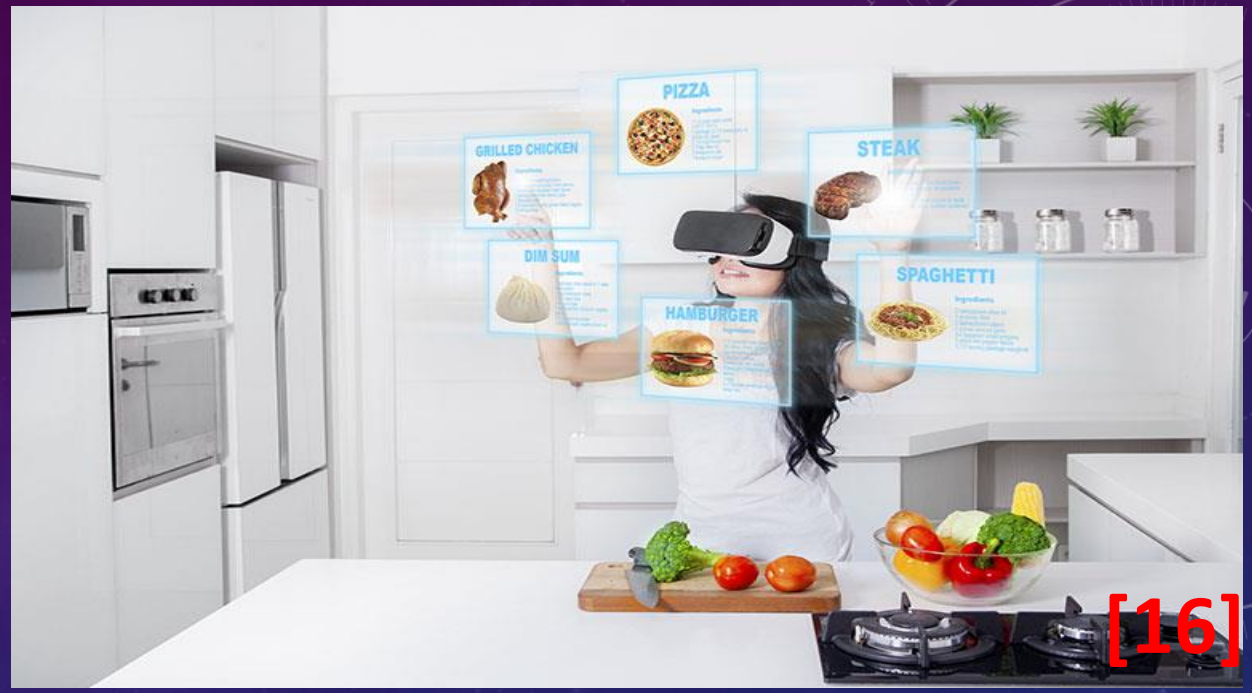
- **Creating interactive walk-throughs of properties**
- **Architectural visualization is possible**
- **Helping for faster choose of interior decorations and furnishing even before the property is built**



[14]

3.7. Food Sector

- **Helping with employee training**
- **Enhancing customer experience, satisfaction, and loyalty**
- **Helping to add interactivity to products**
- **Accurate estimation of food portions**



[16]

[17]

[16]

3.8. Engineering & Industry

- **Real-time employee instruction**
- **No downtime or disruptions**
- **Better time-to-market**

AR in Automotive industry (BMW) [18]

[18, 19]

4. Current issues with AR – (1/2)

- Form Factors & First impressions – AR is limited to what a mobile device can deliver;
- Cost and availability – most AR headsets are currently targeting mostly enterprise or in general still not ready for public consumption;
- Perceived usefulness – many people aren't sure what they would use it for;

[20]

4. Current issues with AR – (2/2)

- Tracking – many AR devices suffer from some amount of tracking latency (delay);
- Field of view (FOV) – limited to the smartphone screen or small area withing the AR glasses, not the entire viewable area;
- Visuals - poor *occlusion* (the effect of an object blocking another object) + not enough high-resolution

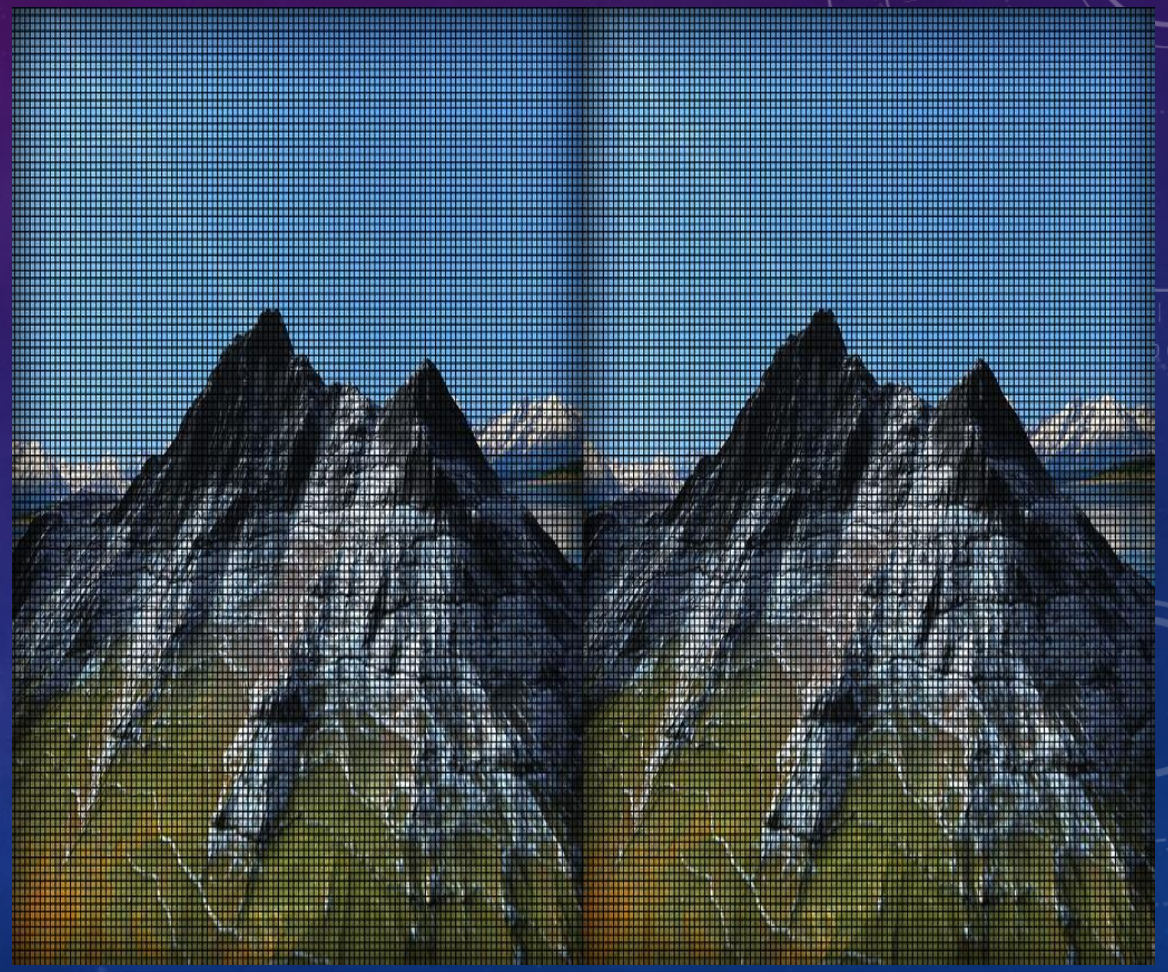
Photo by Breather on Unsplash (https://unsplash.com/photos/bjhrzvz3eq4)

[20]

5. Current issues with VR – (1/2)

- Simulator (motion) sickness – It's an issue that modern headset manufacturers still grapple with;

- The screen-door effect – Although solved for televisions of today with usage of extremely high resolutions, it's still a problem in some VR headsets.



Example of the screen-door effect

[21]

5. Current issues with VR – (2/2)

- Movement in VR – Moving through the digital environment of VR is still an issue, users could be tracked throughout a room, but not much farther.

- Health effects – the largest unknown on this list. Currently only short-term problems are known, but long-term problems might occur when users start using VR more and more

[21]

6. Conclusion - What is the future of AR and VR ?

- They both have positive and negative potential.
- Some other possible issues in the future might be:
  - addiction and time lose
  - desensitization to actions
- Some further concerns regarding AR:
  - distinction of real world ?
  - rights to the digital world ?
  - anyone and anywhere ?
- However, the positive potential of these technologies are a lot greater than the possible future issues and concerns.

Thanks for your attention! Any questions ?

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