

# Virtual and Augmented reality

Zuzana Berger Haladová



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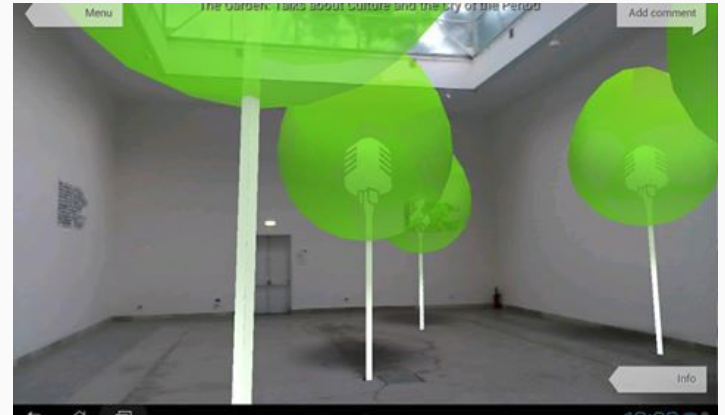
PhD. Augmented reality in Cultural heritage applications

Computer vision: features extraction, object instance detection, deep learning, visual inspection for industry

Augmented reality: Cultural heritage presentation, Art and New media

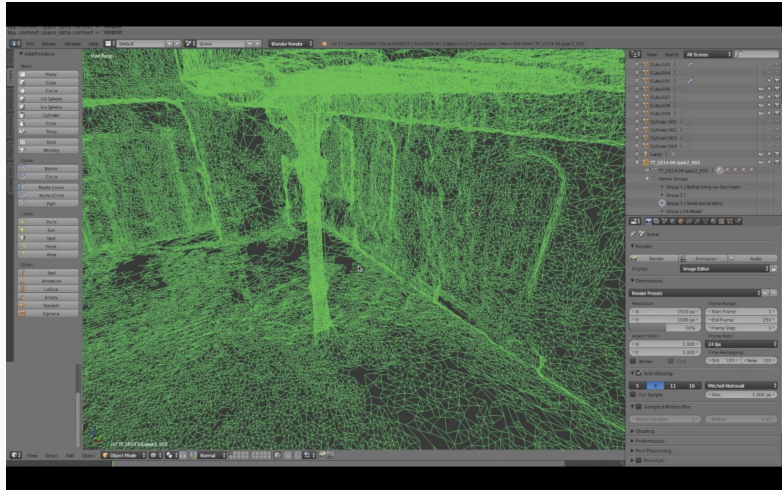
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## Asking Architecture



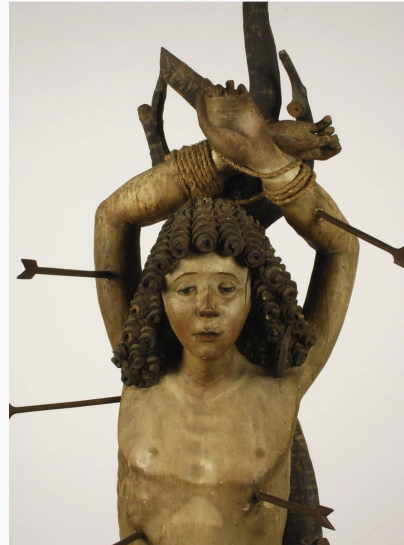
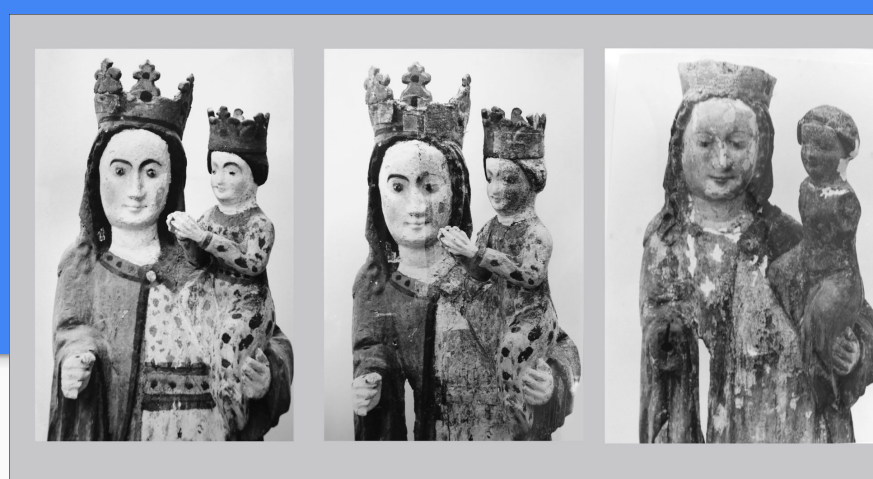
# Zuzana Berger Haladová

Kunsthalle



# Zuzana Berger Haladová

AREST



# Bakalarky diplomovky

Vitrina

SlovakAR

Oclusion in AR

Visual Theremin

VR vs AR?

# Virtual and Augmented reality

**Augmented reality-** Rozšířená realita, Augmentovaná realita, Zmiešaná realita, Obohatená realita

**Virtual reality-** Virtuálna realita

**Applications (not only games...)?**

- **Medicine (AR/VR)**
- **Army(AR/VR)**
- **Cultural heritage (AR/VR)**
- **Industry (mostly AR)**



# Virtual and Augmented reality

AR concept was first introduced in 80's, why is it interesting now?

- **Hardware:** available and fast
- **Application:** authoring is easier than ever
- **Users:** (almost) broad public instead of few nerds

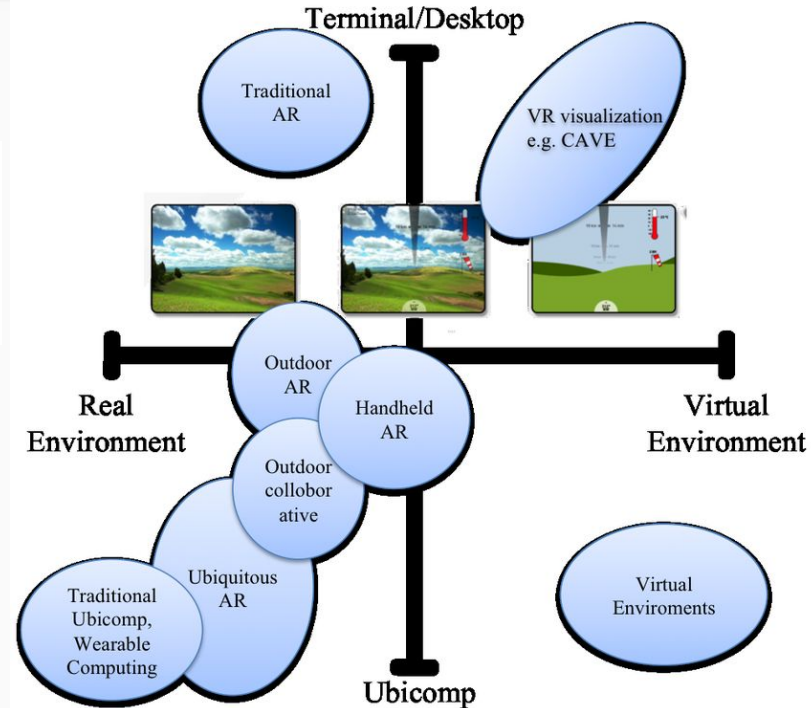


# Virtual and Augmented reality

Milgram continuum (1994)



Milgram Weiser continuum (2016)



# Virtual and Augmented reality

AR desktop

<https://www.youtube.com/watch?v=wXLwYchMIPA>

AR mobile

[https://www.youtube.com/watch?v=JvE\\_7filGsY](https://www.youtube.com/watch?v=JvE_7filGsY)

AR ubiquitous

<https://www.youtube.com/watch?v=jZkHpNnXLBO>

VR visualisation:

<https://www.youtube.com/watch?v=IYLJ6lwK3Bk>

VR environment:

<https://www.youtube.com/watch?v=fbu8OUq1CUE>

VR combination

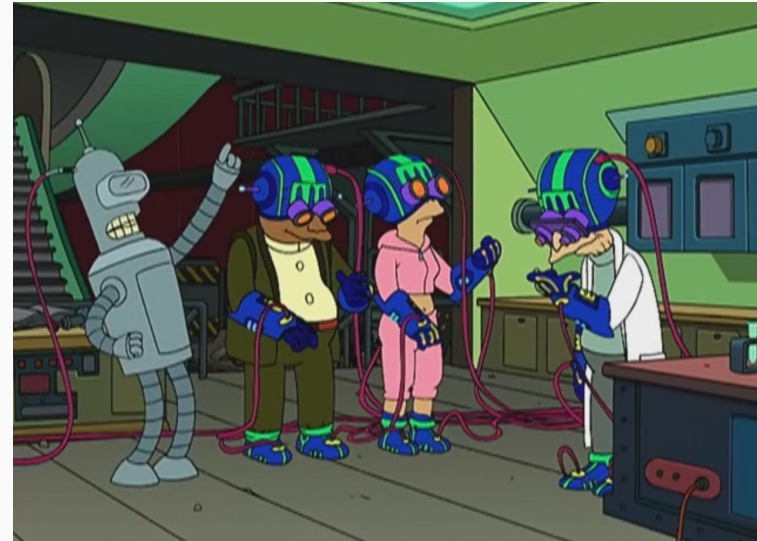
[https://www.youtube.com/watch?v=-\\_5pzbw3YvM](https://www.youtube.com/watch?v=-_5pzbw3YvM)

# Virtual and Augmented reality

Ultimate Immersion VR/AR ?

Hardware- what is AR what is VR

- HMD-Oculus
- Omnidirectional walking board
- Camera
- Haptic feedback gloves
- GPS
- Beam splitter



# Virtual and Augmented reality

## 5 senses?

- Sight
- Hearing
- Touch
- Smell
- Taste

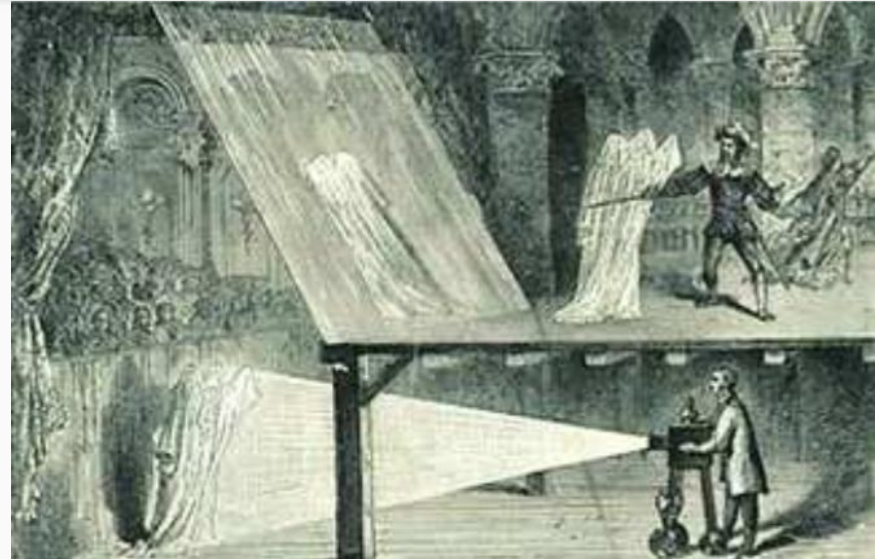


# History of VR and AR

# Prehistory of AR

## Pepper's ghost 1863

The core of the Pepper's Ghost was the actor (dressed like a ghost) whose image was projected through the 45-degree angled semi transparent mirror (beam splitter) upward and on to the stage. The projectionist operated from beneath the stage along with the actor(s).



# Pre history of VR

1838





# Sensorama

1960's

Inventor Morton Heilig developed the Sensorama which was the first machine to provide users with an immersive feel through the use of almost all of our five senses.

<https://www.youtube.com/watch?v=vSINEBZN Cks>



# Ivan Sutherland

1968

Head mounted display

<https://www.youtube.com/watch?v=NtwZXGprxag#>

Sketchpad

<https://www.youtube.com/watch?v=495nCzxM9PI>

Concept of Ultimate display



# Future world

1976- first 3D CG in the film

<https://www.youtube.com/watch?v=QfRAfsK5cvU>



# Pixar- *The Adventures of André & Wally B.*

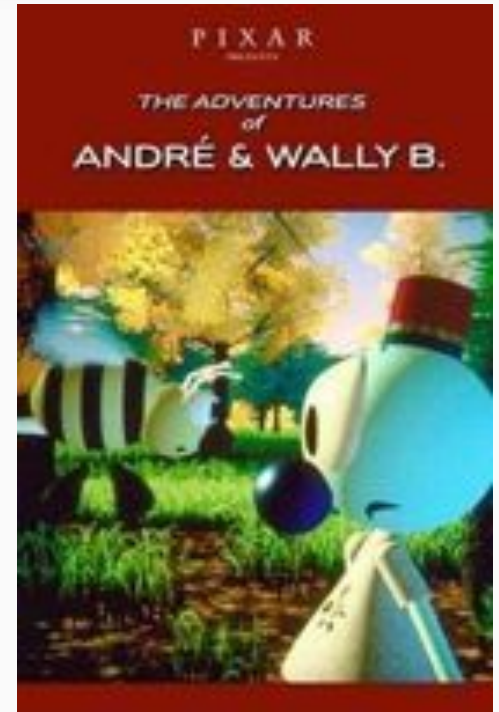
1984

Motion blur

3D environment

Particle systems

[https://www.youtube.com/watch?v=a\\_9Tsbduk9E](https://www.youtube.com/watch?v=a_9Tsbduk9E)



# NASA VR

1985

<https://www.youtube.com/watch?v=NAuytnYU6JQ>

Virtual Lab  
Continuous research



# VPL- Jaron Lanier

1987

Visual Programming Lab

Data suit, data glove- bending of fiber optics

EyePhone

Coining of “Virtual Reality” term

VR evangelist, media coverage

(Timothy Leary)



# Pixar- Tin Toy

1988

First Oscar for short animated CGI film

<https://www.youtube.com/watch?v=ffIZSAZRzDA>



# Virtuality

1990's

<https://www.youtube.com/watch?v=1Qe4suqGZmU>





# Lawnmower Man

1992

Stephen King

<https://www.youtube.com/watch?v=YCxFGxqLsHE>



# Sport 1998

Sport's augmentation starts in the television broadcasting.

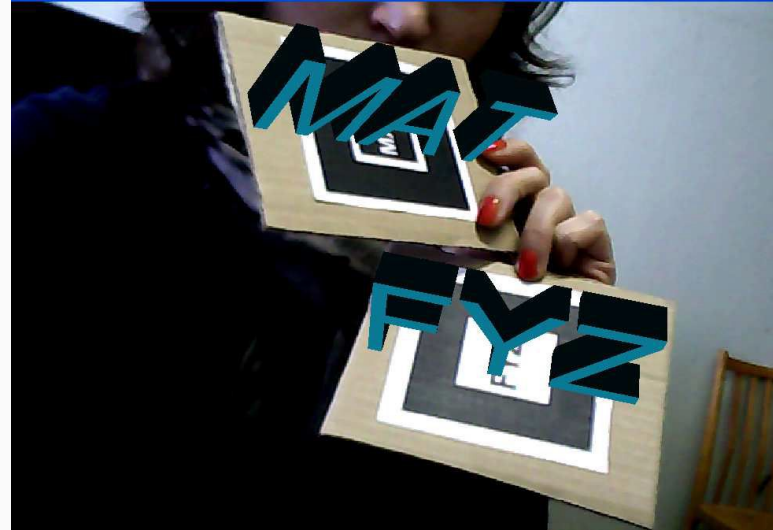
1996 Foxtrax

1998 The "1st and Ten" line



# ARToolkit 1999

ARToolkit was developed by H. Kato in the Nara Institute of Science and Technology  
ARToolkit is a computer library for the tracking of the visual markers and their registration in the camera space.



# Game Engines

1998- Unreal engine  
2005- Unity



# 3D movies 3D TVs

2009 Avatar

3D television 41.45 million units in 2012 ended in 2016



# Oculus Rift

2012 Kickstarter

Palmer Luckey- collected 50 HMD  
Construct first prototype at the age of 17 in garage :)  
Facebook spend 2 billion dollars to buy Oculus

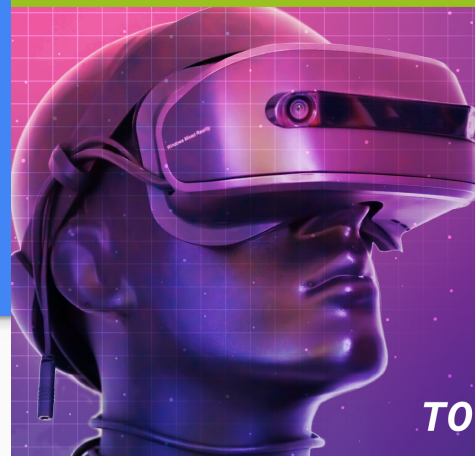


# 2021

Distant learning, distant working, virtual culture

Cool AR glasses coming  
VR glasses (can be better)

Metaverse, Digital twin, Omniverse



***ARE WE HEADED  
TO THE METAVERSE?***

# Hodnotenie?

All basic components of VR/AR system:

- Display device (stereo) B-
- Image (rendering) A+
- Head tracking B+
- Interaction (camera pistol grip) B+
- Model generation B-



Accessibility

# Accessibility



# Accessibility

Creating Accessible environments (real-virtual) will enrich all of us.

= Everyone will get the disability (if lucky)

= Technologies made originally for disabled

- = 1932 Audiobooks

- = 1954 Electric tooth brush (Broxodent)

- = 1983 Internet (Vint Cerf TCP-IP)

- = 1992 SMS (Matti Makonen)

# Accessibility

Who are we consciously excluding?

Who are we unconsciously excluding?

Cultural Bias (electricity, internet...)

# Displays/Projectors

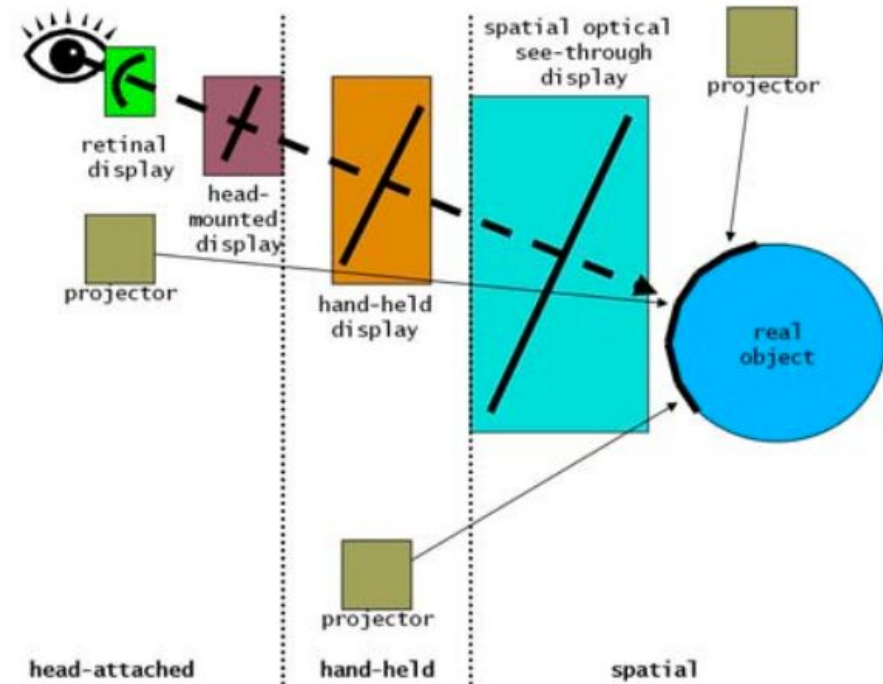
Classification based on Bimber and Raskar:

Head attached

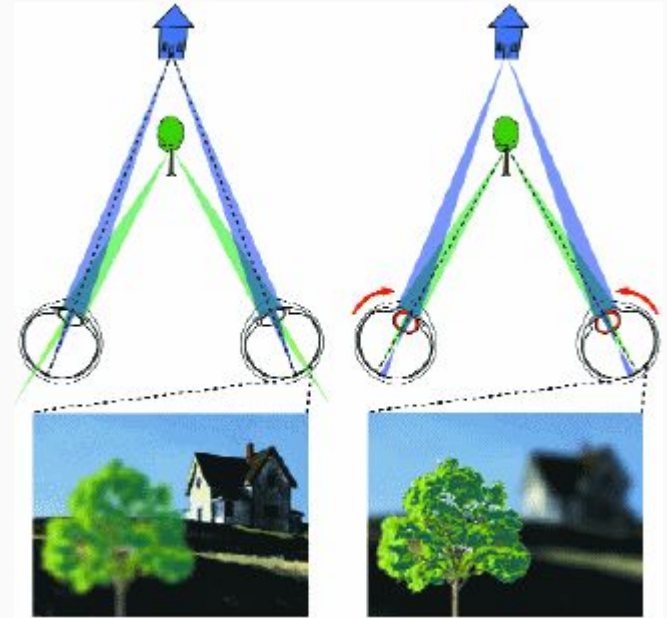
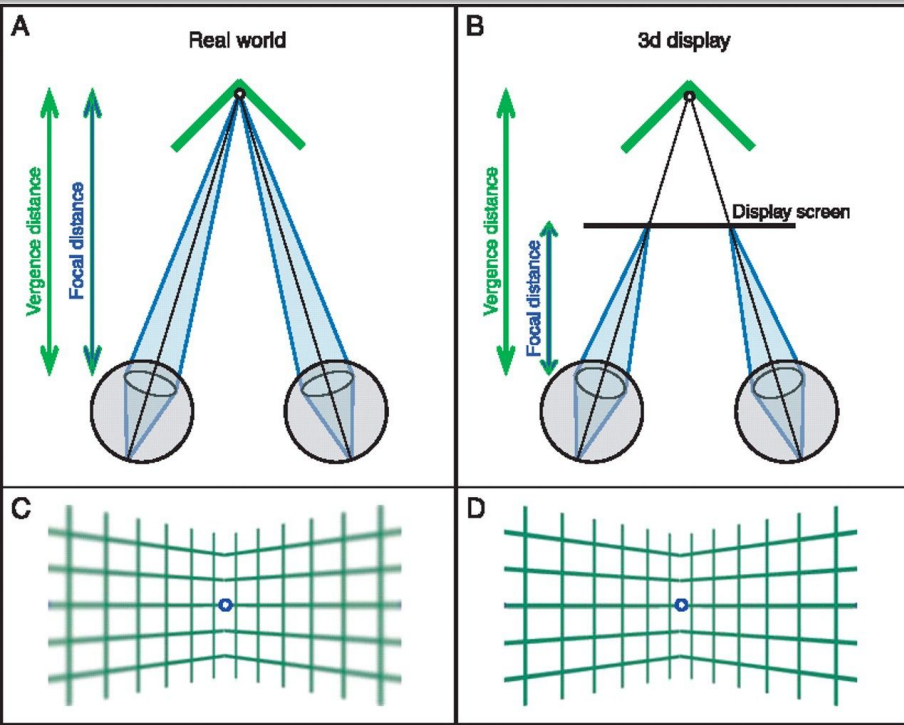
Hand held

Spatial

Figure 2.1 illustrates the different possibilities of where the image can be formed, where the displays are located with respect to the observer and the real object, and what type of image is produced (i.e., planar or curved).



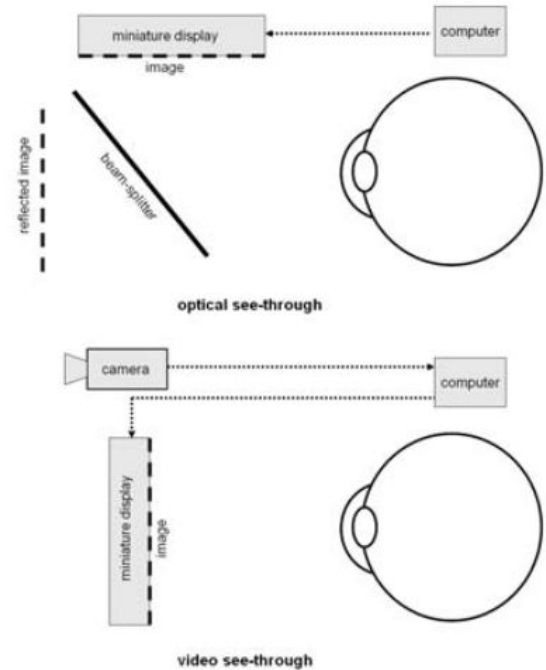
# Vergence-Accommodation conflict in HMD



# OST vs VST

Optical see-through

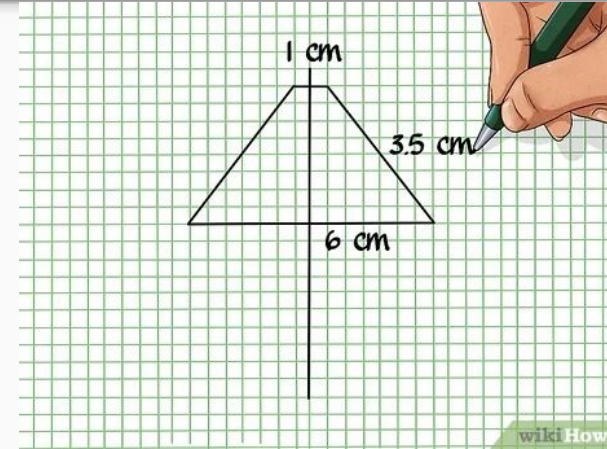
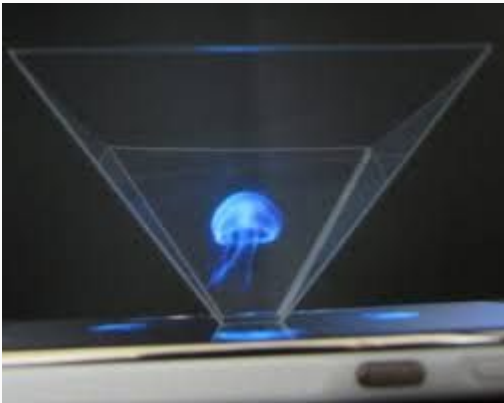
Video see-through



# Lets make Pseudo hologram

Optical see-through

<https://www.youtube.com/watch?v=nQs6gmY286k>





# UNITY+VUFORIA

