

## Comparison: Display

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	Display
Virtual reality	The camera is in the user's position. You can watch from any point in any direction. stereo vision.
Augmented reality from a fixed precalculated position. Mixed reality	The camera is in the user's position. You can watch from any point in any direction.
Graphical interactive co	The camera amending input devices.
video 360	You can only change the direction in which you look

# Comparison: Display Devices

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Display Devices	
Virtual reality	Helmet (HMD) / stereo projection *
Augmented Reality	Smartphone / Tablet Mixed Reality
Graphical interactive co	Helmet see-through / Projection *
video 360	Screen / Casco (HMD)

\* It requires tracking devices

## Comparison: Interaction

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Interaction	
Virtual reality	Surf $\leftarrow \rightarrow$ Select and interact
No interaction Augmented Reality	$\leftarrow \rightarrow$ select and interact
Mixed reality	Surf $\leftarrow \rightarrow$ Select and interact
Graphical interactive co	Surf $\leftarrow \rightarrow$ Select and interact
video 360	Change viewing direction

## Comparison: interaction devices

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Interaction devices	
Virtual reality	Tracking + Drivers
Augmented Reality Mixed Reality	touch screen device
Graphical interactive co	Tracking + Drivers / Tracking
video 360	Mouse / joystick
	Head orientation / Mouse / Touch Screen

## Comparison: Navigation

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	Navigation
Virtual reality	physically / move special devices and techniques
Augmented reality	-
Mixed reality	physically move
Graphical interactive co	Input devices (mouse, joystick, ..)
video 360	-

# Comparison: Positioning Devices

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	Dispositives
Virtual reality	tracker
Augmented reality	-
Mixed reality	tracker
Graphical interactive co	-
video 360	-

## Comparison: Representation Model

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	Representation
Virtual reality	3D model
Augmented Reality Text Labels	3D model
Mixed Reality	
Graphical interactive co	3D model
video 360	Frame sequence 360

## Comparison: Rendering

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	render
Virtual reality	Camera in the user's position. Stereo. 120 FPS.
Augmented Reality Visualization located in the image  real world *: If no 3D model is rendered in fi ja position relative to the device.	
Mixed reality	Camera user's position. Stereo. 120 FPS.  Model located in the real world *
Graphical interactive co	Camera controlled with mouse / joystick. 60 FPS
video 360	Cropping and frame reprojection

\* Mechanisms need to match the virtual information with the real world.

## Comparison: Immersion

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	render
Virtual reality	Yes
No Augmented Reality Mixed	
Reality	Yes
Graphical interactive co	Do not
video 360	Do not

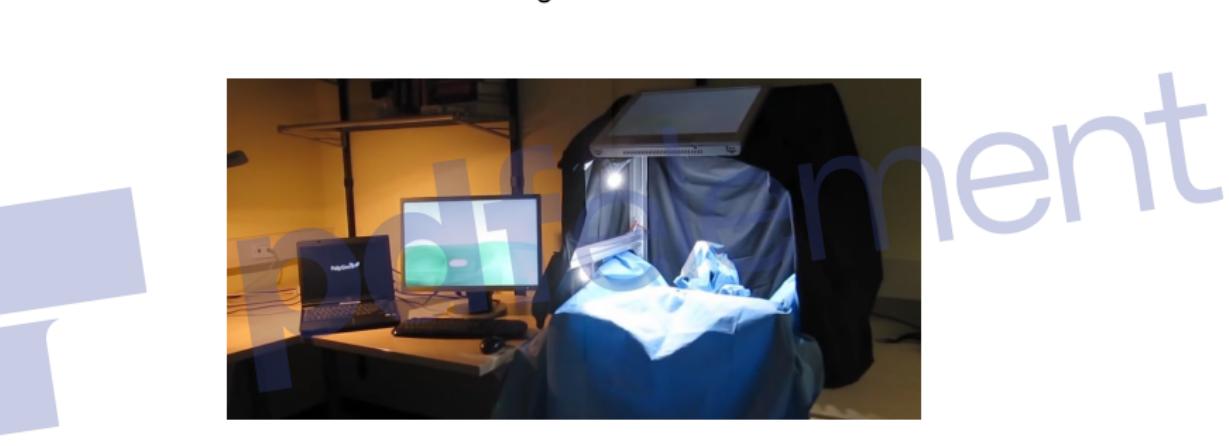
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## 2. Virtual Environments

"**TO virtual environment ( VE)** can be defined as a **computer-generated environment used to simulate the real world.** Many different types of virtual environments are possible. On the one hand, can be These environments as simply as a **semi-immersive** computer-based environment. On the other hand, can be completely These environments **Immersive**, hardware-based, three-dimensional interactive experiences utilizing sound and force feedback to simulate, as Accurately as possible, real environment "January 1 Gupta SK, DK Anand, J. Brough, M. Schwartz, and R. Kavetsky "Training in Virtual Environments. A safe, cost effective, and Engaging approach to training ". University of Maryland. 2008.

## Example virtual environment

PalpSim is a mixed reality system for training in palpating the femoral artery and inserting punción<sup>1</sup>. It combines three haptics with a video camera to generate tactile and visual feedback. interactive rendering.



<https://www.youtube.com/watch?v=aFafx7m-Xxs>

1 TR Coles, NW John, D. Gould, and DG Caldwell, "Integrating With Augmented Reality Haptics in a Femoral Palpation Needle Insertion Training and Simulation," IEEE Transactions on Haptics, vol. 4, no. 3, pp. 199-209, Jul. 2011



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- stereo projection
- surround projection
- positioning
- 3D model rendering  
interactively

## Example: Flight Simulator

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- inertial feedback
- 3D model rendering interactively
- Replica cabin actual control



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Turing's test of a virtual intone can be formulated as to whether we are in a real or virtual environment.



Photography



Viewing a model

3D