



Tech Talk

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VR/AR in Aerospace and Energy



Who am I ?



- Human Computer Interaction Researcher at IIIT Hyderabad
- Associate Research Staff - Nvidia Research
- Global Co- Chair for (WebXR) Industry Committee at VRAR Association
- OSS Developer for WebVR API and WebVR 2.0 at Mozilla Research at 16.



Talk Rules 101:

No rules though (duh!)

PS: For questions

Wait till the end

OR

Tweet @pandastichuman

Use #Skillwise and #VRpanda

Intro Module

Overview

Realities

Hardware

Engineering
Design

VR/AR/MR

Learning Curves

XR Spectrum

VR/AR Across
Industries:
Aerospace and
Energy



What I am excited about in 2019 ?

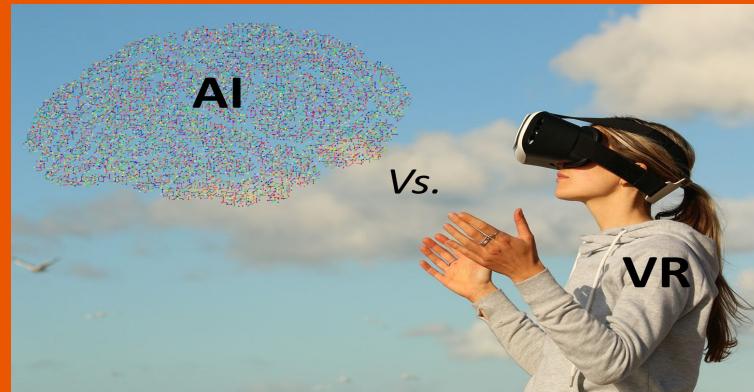


XR Projects



Data Visualisation

Artificial Intelligence in VR



Augmented Reality



Understanding Reality Spectrum



Realities, like literally!



The state of things as they "actually exist" through our human senses without any technology.



Artificially created sensory experiences of people, environments and objects, which can include sight, touch, hearing, and smell.

The Immersive Spectrum

The Fallacy:



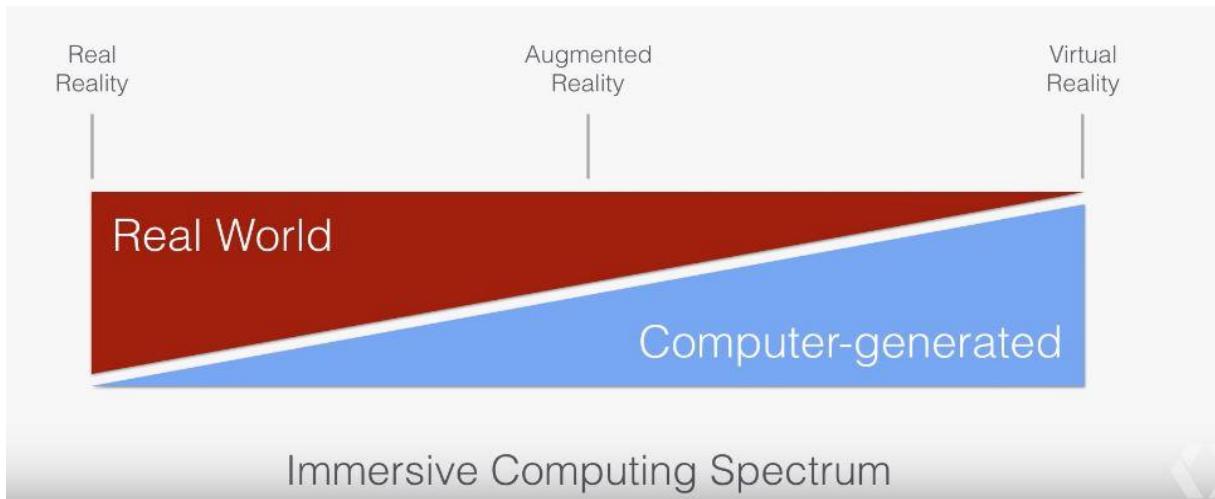
The Truth:

Real experiences

Augmented Reality

Virtual Reality

The VR/AR Spectrum



Virtual Reality:

- Immersion into another world
- Usually uses a headset and mobile device
- Does not interact with the real world
- Experiential Information

Augmented Reality:

- Overlay of objects in world around you
- Use of a phone or viewing device
- Usually uses target image

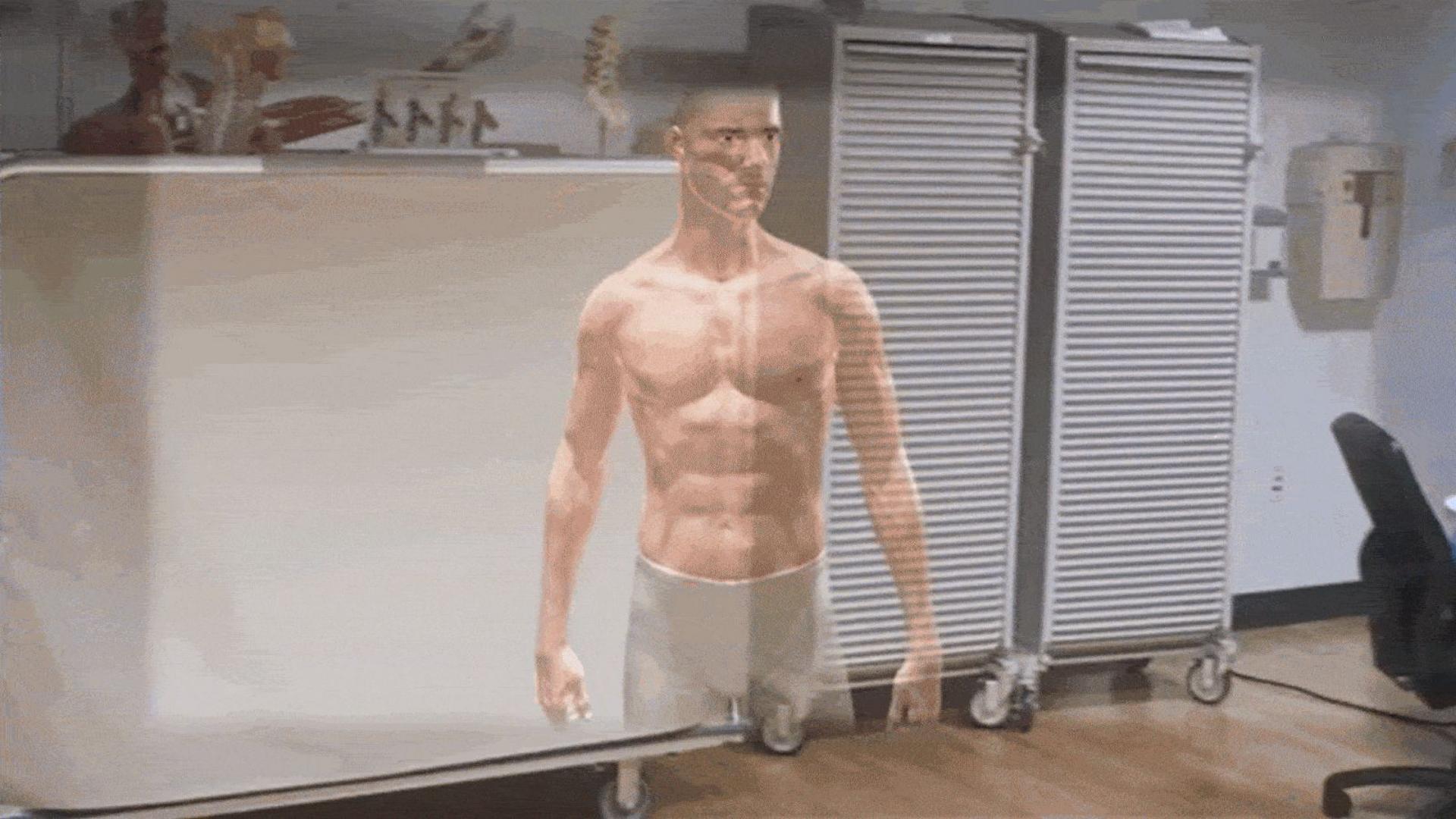


**Task: Which among the upcoming slides
contains an example of VR/AR/MR?**





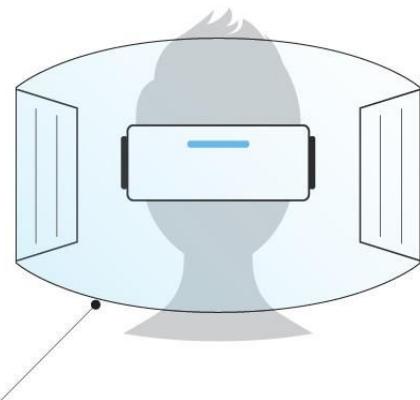
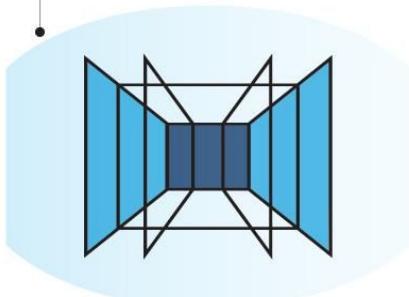






VIRTUAL REALITY (VR)

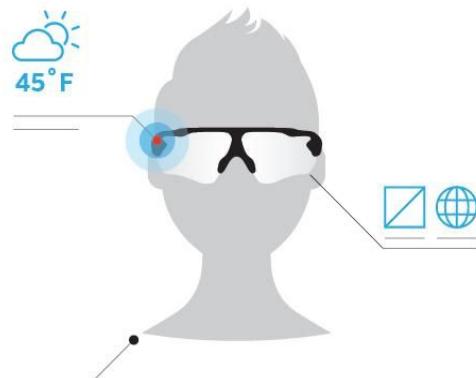
Completely digital environment



Fully enclosed, synthetic experience with no sense of the real world.

AUGMENTED REALITY (AR)

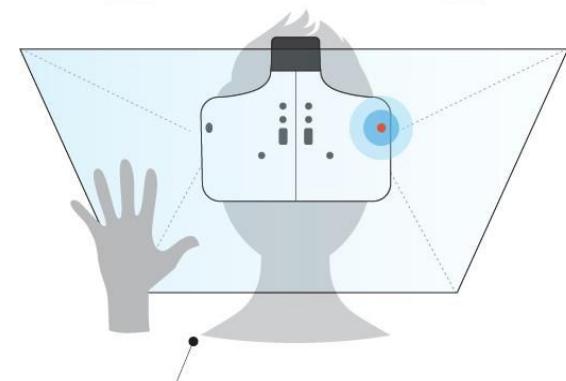
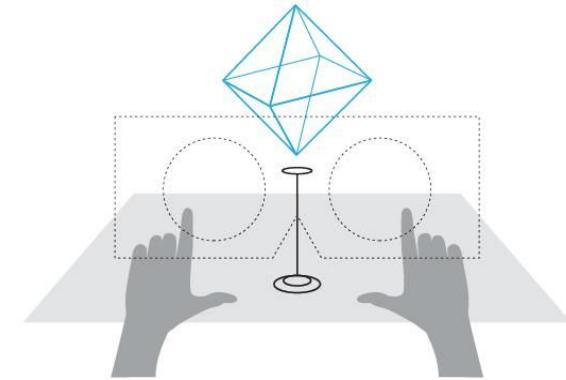
Real world with digital information overlay



Real world remains central to the experience, enhanced by virtual details.

MERGED REALITY (MR)

Real and the virtual are intertwined



Interaction with and manipulation of both the physical and virtual environment.

DIFFERENCES

AR

(AUGMENTED REALITY)

Features

AR stands for augmented reality which is a way in which you can get an indirect view of a real life scenario or environment in a supplemented way by use of digital technology. Sound graphics and other sensory input can help to make the experience more realistic.

Platform

It can be used to interact with the real world to help make suggestions of improvement, such as recipe ideas based on real ingredients laid out before the camera.

Headset

A headset is able to enhance the experience further, for example by adding characters in a game that are able to talk and make suggestions, immersing you only partially, to give you the feel of realism. Augmented reality can be best described as a real life overlay rather than a thorough digital and sensory experience that takes you away from it.

MR

(MIXED REALITY)

Features

MR stands for mixed reality which brings the digital world and the real world together to provide you with a totally new experience. Rather than just being added to the real world, the experiences are interactive to a point where they can be used in many applications. Characters and scenarios can be mixed with the real world surroundings.

Platform

Mixed reality allows you to get a better sense of realism, as the digital scenarios take place in the real world surroundings. This can be used in training and in gaming technology.

Headset

Using a headset allows for a better sense of realism, however, in mixed reality not all scenarios would be suitable for headset use, e.g. if you still wish to interact with others who are physically present. It can, however, allow other people using the mixed reality to interact on a shared level.

VR

(VIRTUAL REALITY)

Features

To enhance the experience and make virtual reality exciting, headsets and cameras are often used to block out the real world. It's a totally immersive experience allowing you to interact with a totally different world.

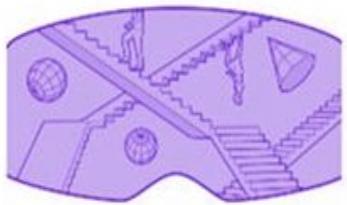
Platform

VR has already been used to help with training medical staff and military as well as in gaming, to give an experience on a totally different level. Recently, virtual reality has stepped up to the next level offering users a more realistic experience allowing for a complete immersion.

Headset

By using a headset people are able to walk around their own surroundings and yet feel as if they were in a totally different reality. They can interact with other users in games and digital characters without an interruption from the outside world.

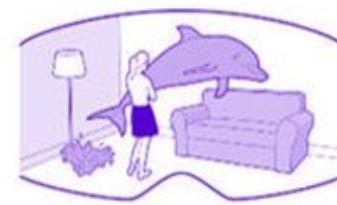
DIFFERENCES



Virtual Reality isn't the real world but instead a simulation that draws the user into the virtual reality.



Augmented Reality is parts of the real world being overlapped so that you are able to use parts of both unlike MR which is mixed reality rather than an overlap.



Mixed Reality uses the technology of the digital world to enable it to coincide with the real world.

Hardware in Market



Google
Daydream

Samsung
Gear VR

Oculus
Rift

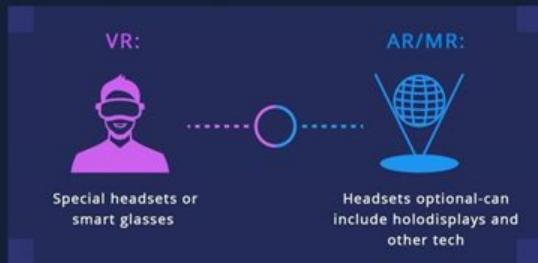
Sony
Playstation VR

HTC / Valve
Vive

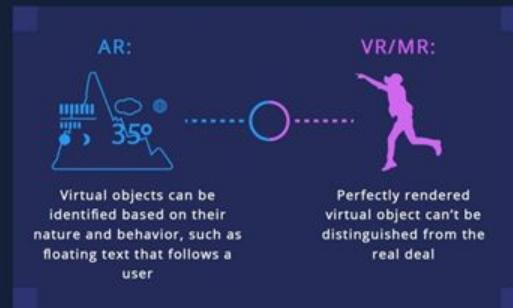
VR & AR IN LEARNING

SOME INTERESTING FACTS

DISPLAY DEVICES



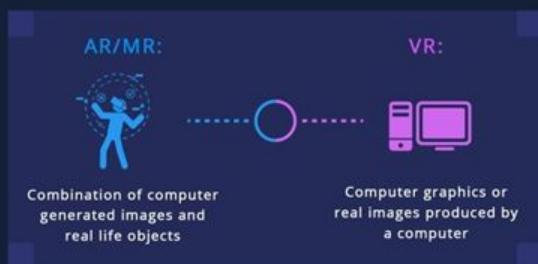
AWARENESS



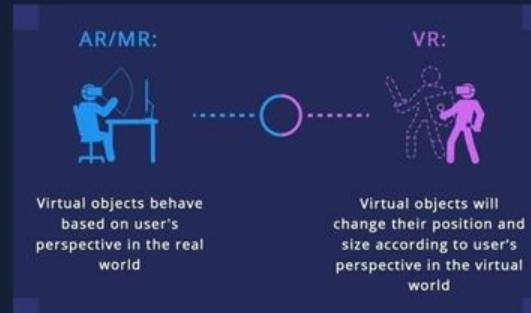
ENVIRONMENT



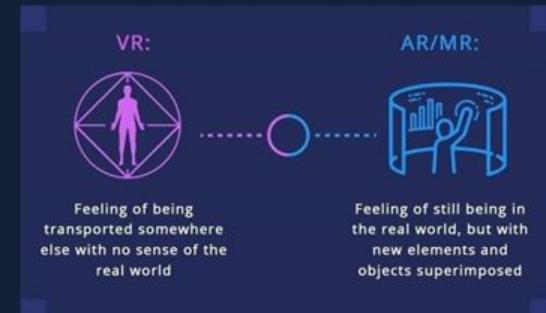
IMAGE SOURCE



PERSPECTIVE



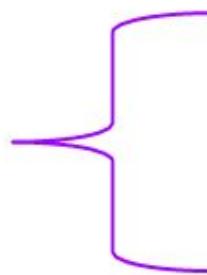
PRESENCE



AR/ VR ACROSS INDUSTRIES

VR ADOPTION

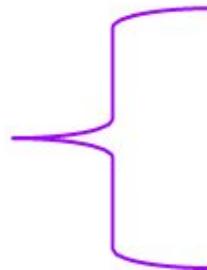
In the industries that benefit from **immersive experiences and rich storytelling**.



Automobiles, Hospitality Services, Mass Media, Telecommunication, Energy, Aerospace, Defense

AR ADOPTION

In the industries that thrive on **direct interactions with consumers**.



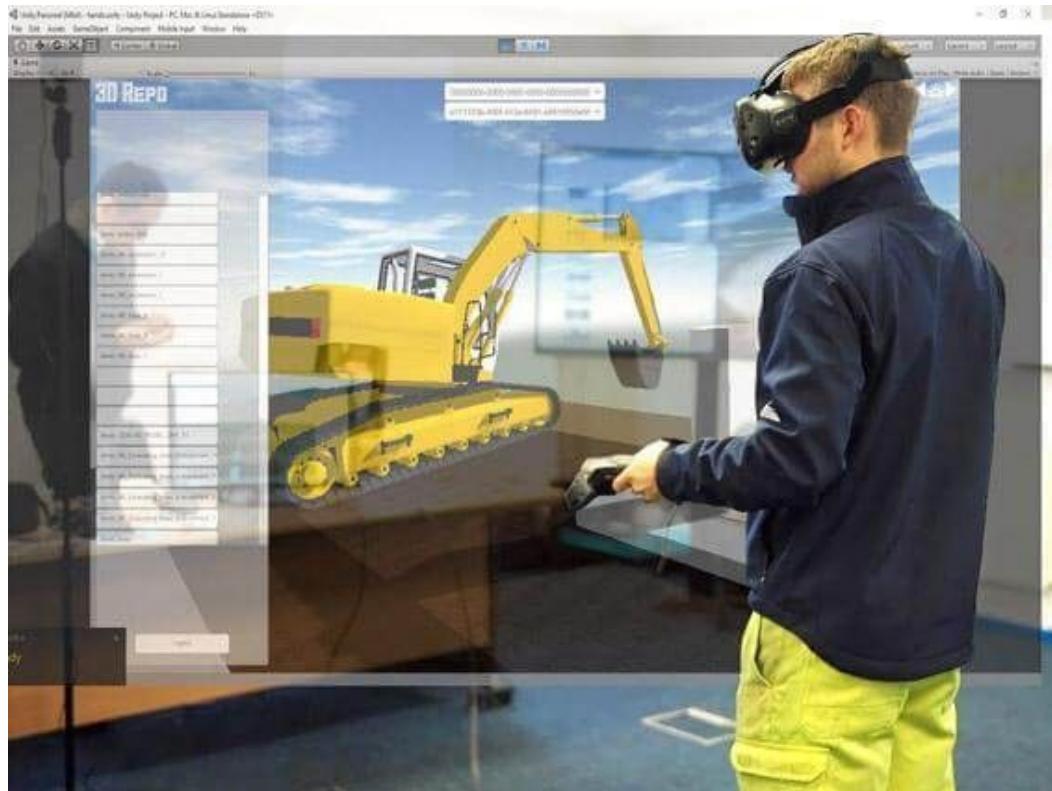
Retail, Consumer Goods, Banking, Consumer Electronics



VR for Design

Tools popularly used to design for VR:

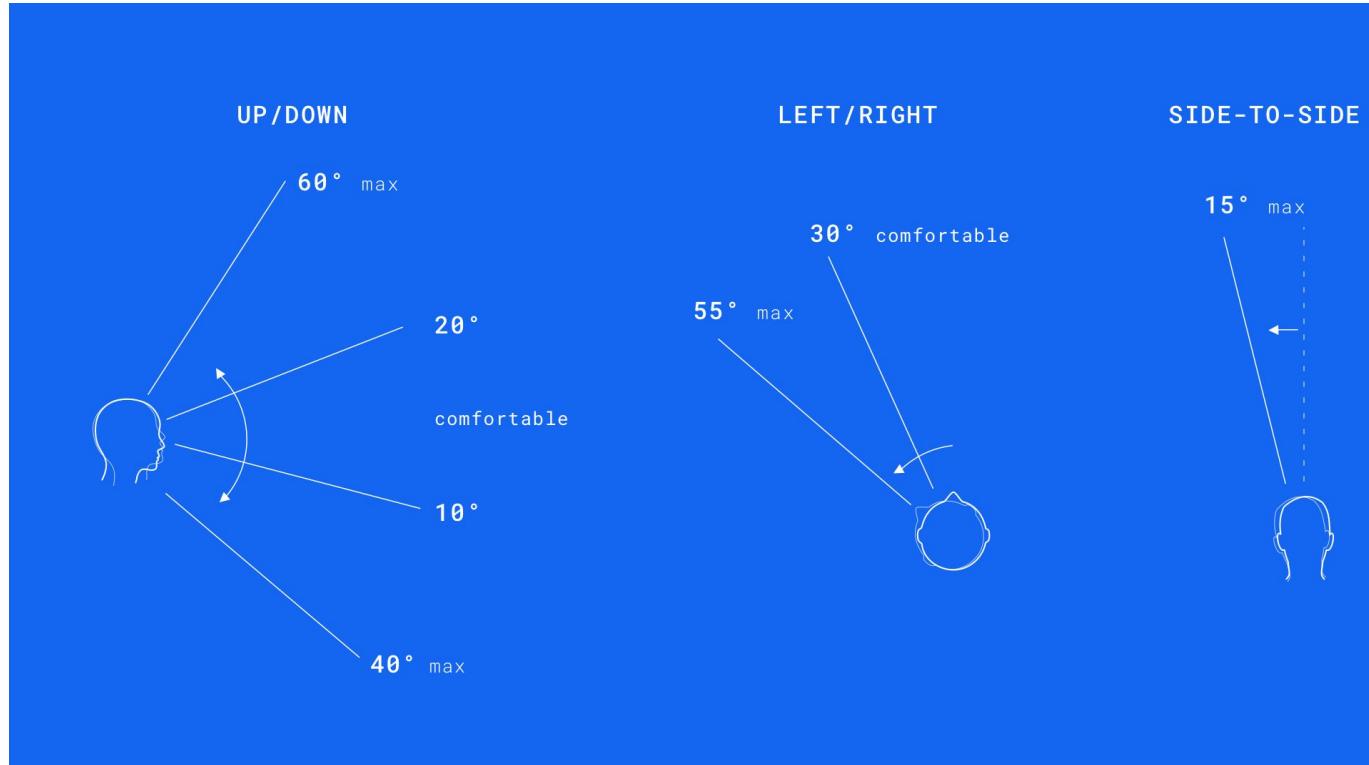
1. Gravity Sketch
2. Unbound Alpha
3. Tilt Brush
4. Mozilla A-Painter



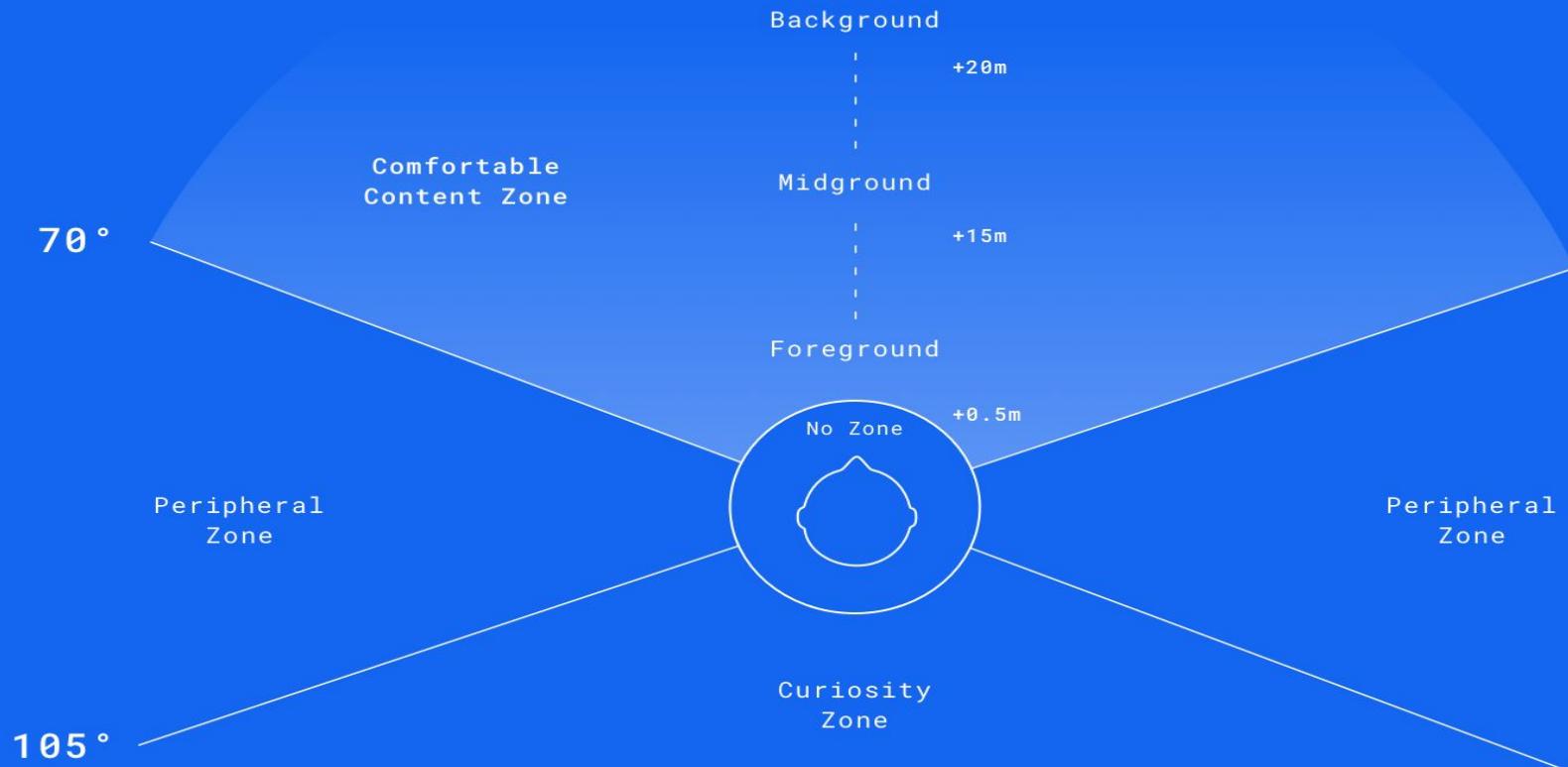
UX of Design: Ergonomics



Range of Motion:



VIEWING ZONES



Technical Module



Design Cycle of VR/AR

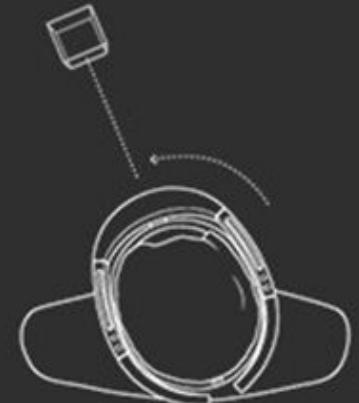


Features XR devices have?

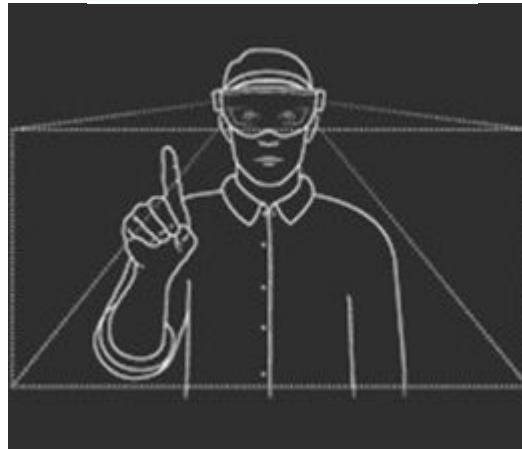




Gaze



Gesture



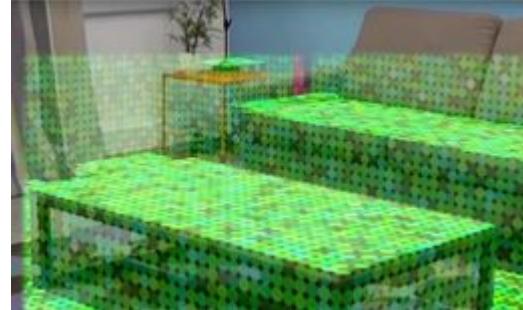
Voice commands



Spatial sound



Spatial mapping



World coordinates





Web Realities Infrastructure



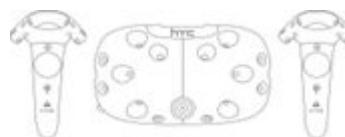
Why WebVR?



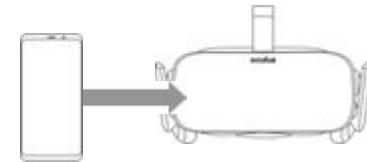
Google VR SDK
(iOS/Android/Unity)



Oculus Mobile SDK



Viveport SDK
(Android/Windows)



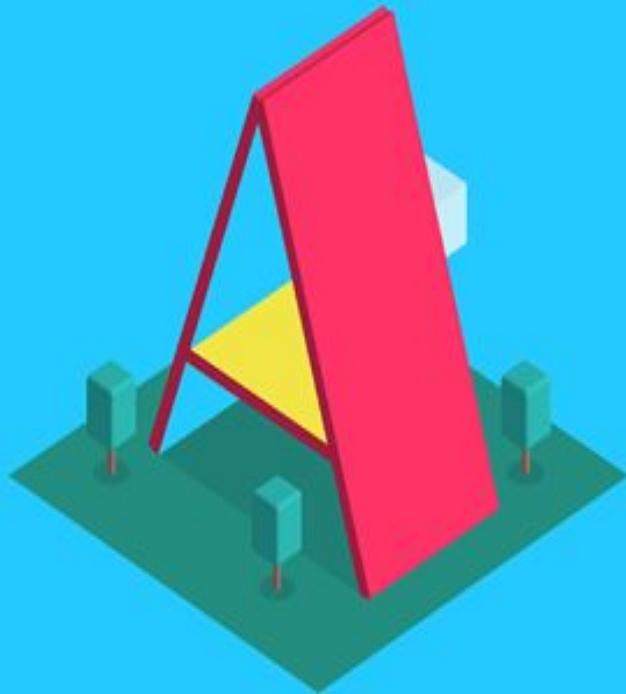
WebVR

Widest **delivery** network in existence: the **Web**

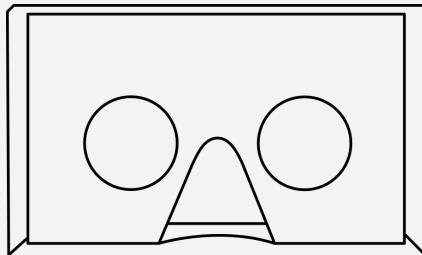
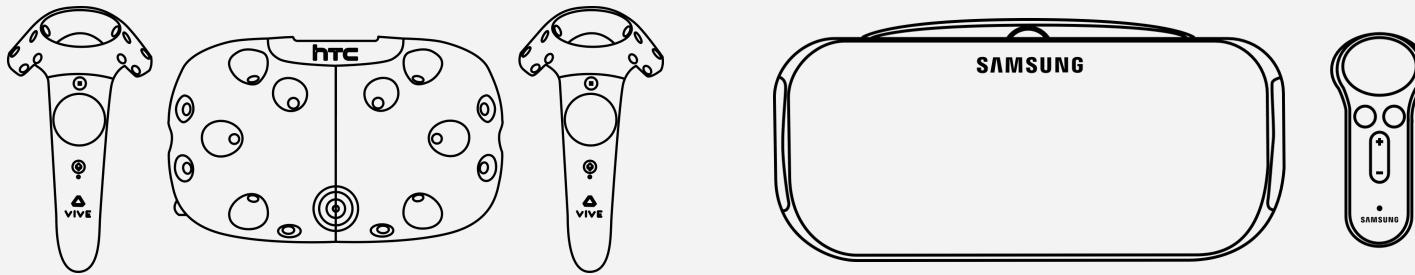


Cost of entry for simple experiences for consumers translates to access to a browser in a device.

Aframe : The Top-Dog of WebVR



Cross Device Support for VR/AR/MR

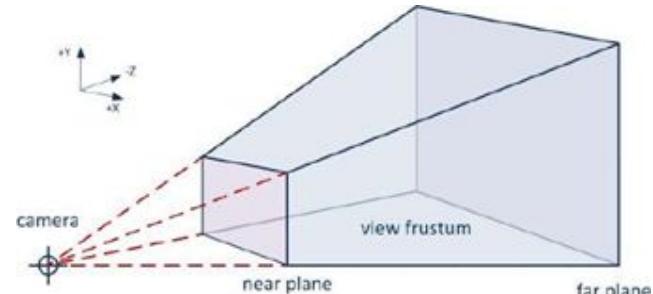




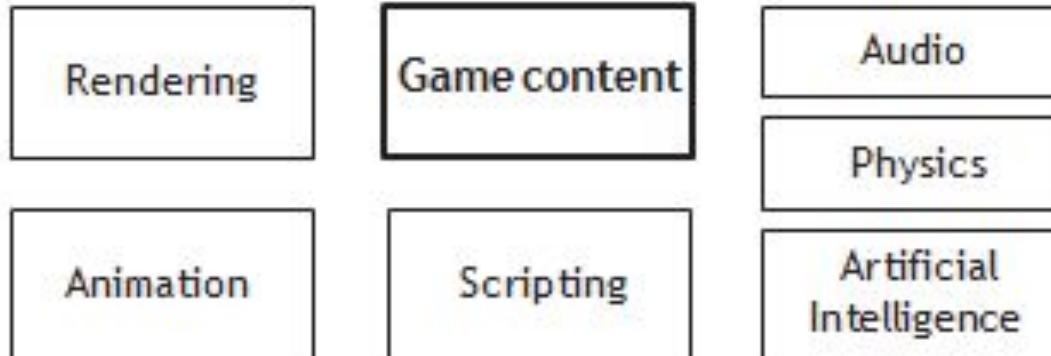
Standalone VR : Unity vs Unreal



Why a Game Engine?



Viewing Frustum of Camera



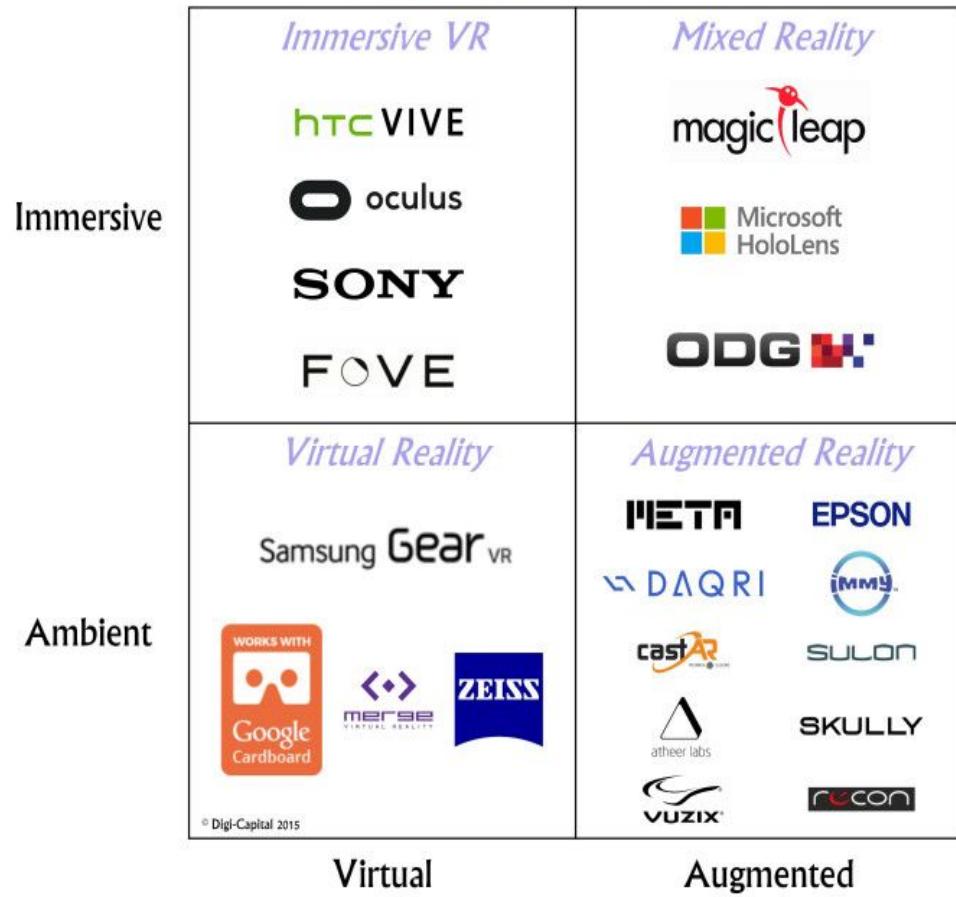


Starter Kit: VR/AR Design and Production?



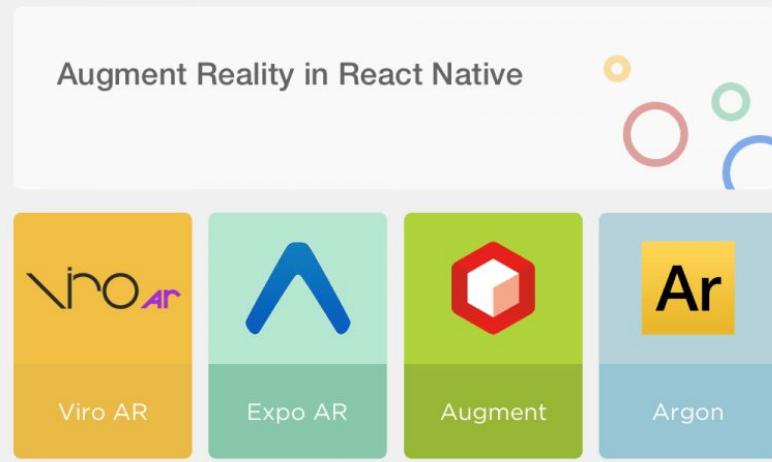
Vs.

ARCore

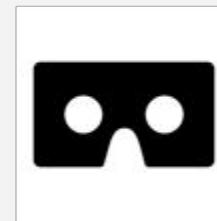




React based WebAR



React-Web-AR

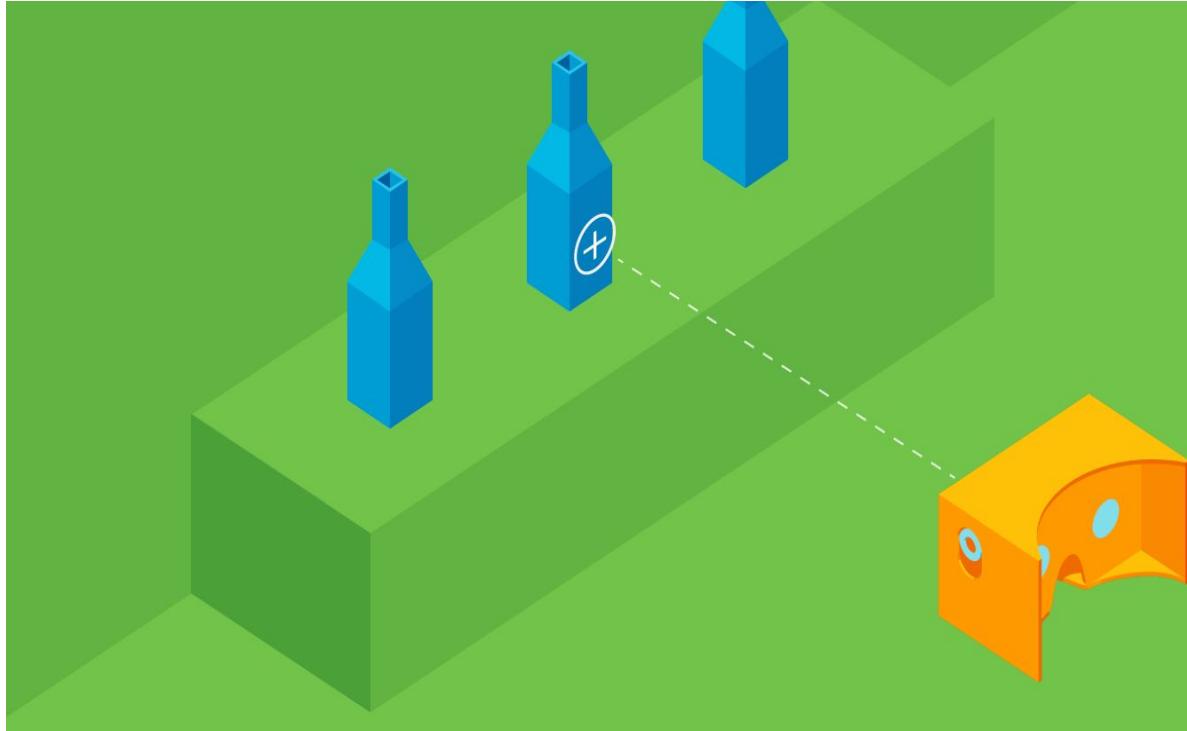


Augmented Reality on web with React

For all the Non-coders



Entry Point :



Prototyping:

1. Unity VR
2. Unreal
3. Vuforia
4. WebVR:
Aframe, React
etc





Frameworks

There are three major frameworks to choose from when designing for VR: Mozilla A-Frame, Daydream VR, and Unity VR/Unreal SDK.

1. Mozilla A-Frame is for Web VR and can be used platforms such as Google Cardboard, Samsung Gear, and Oculus Rift.
2. Daydream VR is for mid range VR and works with mobile phones only.
3. Unity VR/Unreal SDK are for high end headsets including Oculus Rift, HTC Vive, HoloLens (AR) and LeapMotion (MR)

Input Methods



VIVE



oculus





Sound

3D Sound – aka Holophonic sound – is still in its infancy, but will be transformative in how we experience VR.

We are all used to stereophonic sound, which provides sound coming from two channels (left/right), but holophonic sound allows us to tell if sound is coming from above, below, or behind us. Think of when you are outside and hear an airplane. You intuitively look up, right? Having this sound experience in VR is what will make it truly immersive.



Exit Notes:

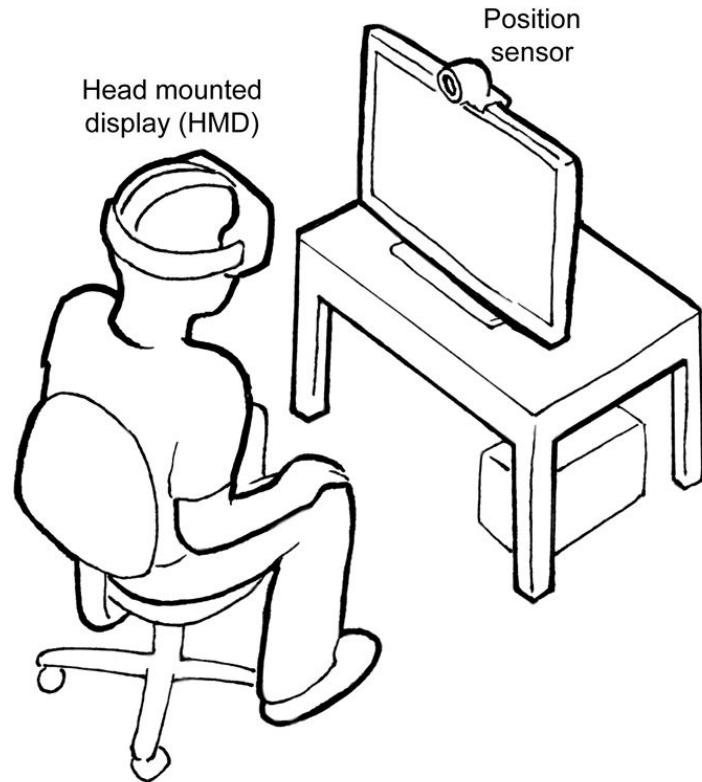
There are some fundamental design steps to be followed when designing for any immersive surface.

These are :

1. 3D and Visual Design
2. Understanding Scale and Positioning
3. Tracking and Movement
4. Animation and Transition Principles.

How any VR works?

1. [`Navigator.getVRDisplays\(\)`](#) is used to get a reference to your VR display.
2. [`VRDisplay.requestPresent\(\)`](#) is used to start presenting to the VR display.
3. WebVR's dedicated [`VRDisplay.requestAnimationFrame\(\)`](#) method is used to run the app's rendering loop at the correct refresh rate for the display.
4. Inside the rendering loop, you grab the data required to display the current frame ([`VRDisplay.getFrameData\(\)`](#)), draw the displayed scene twice — once for the view in each eye, then submit the rendered view to the display to show to the user ([`VRDisplay.submitFrame\(\)`](#)).



Augmented Reality



Augmented Reality in Aerospace



Key Innovations and applications to look for

These are :

1. Pratt and Whitney's : AR engine Maintenance
2. AeroGlass : AR Data Visualisation
3. AirFrance: Immersive Entertainment
4. Bell Helicopters: FCX-001





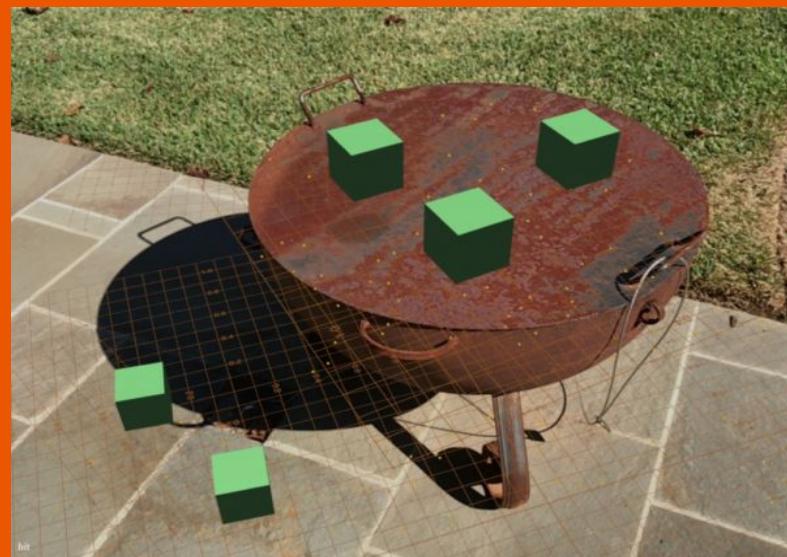
The XR Spectrum



What is XR?

Extended Reality (XR) refers to all real-and-virtual environments generated by computer graphics and wearables. The 'X' in XR is simply a variable that can stand for any letter. XR is the umbrella category that covers all the various forms of computer-altered reality, including: Augmented Reality (AR), Mixed Reality (MR), and Virtual Reality (VR).

WebXR: A combined framework



Proposing a WebXR API

We have created a [draft WebXR API proposal](#) for providing access to both augmented and virtual reality devices.

The WebXR API formalizes the different ways these technologies expose views of reality around the user, and it exposes concepts common in AR platforms such as the Anchors found in Hololens, ARKit, and ARCore.



and who is supporting us?



Human Factors and Challenges

1. Aircraft MRO
2. General aviation maintenance organizations
3. Use of Technical Publications,
4. Fatigue/Alertness,
5. Safety Culture,
6. Event Data,
7. Return on Investment for Human Factors,
8. Prioritization of Human Factors
9. Professionalism and Generational Issues
10. Attention to Required Inspection Items.



Business Module



How does VR/AR tech makes a difference in Aerospace and Energy?



Customer Journey: A Bell Product

An HTC Vive collaboration.

The team decided to build their mock-ups in VR, and it had a profound effect on their entire concept process. Bell worked with S5D, an innovative 3D design and production agency, to help design and sketch the initial model, then create the aircraft in 3D using Computer Aided Design (CAD) software. The model was then transferred into Unity (a real-time game engine) so the design could be experienced and modified in VR on HTC VIVE.



Customer Journey: A Bell Product

An HTC Vive collaboration.

Lets see how they did this?



How AR can improve Safety Standards for Commercial Aviation



How AR can help?

1. AR navigation in commercial flying.
2. AR in air traffic visualization
3. AR in aircraft maintenance



Applications in Energy Industry:

Applications of VR in energy space can be classified as:

- a. Direct Applications
- b. Passive Applications

Direct Application

VR primarily being a training and familiarization tool is ideal for helping professionals in the energy sector understand their craft better.

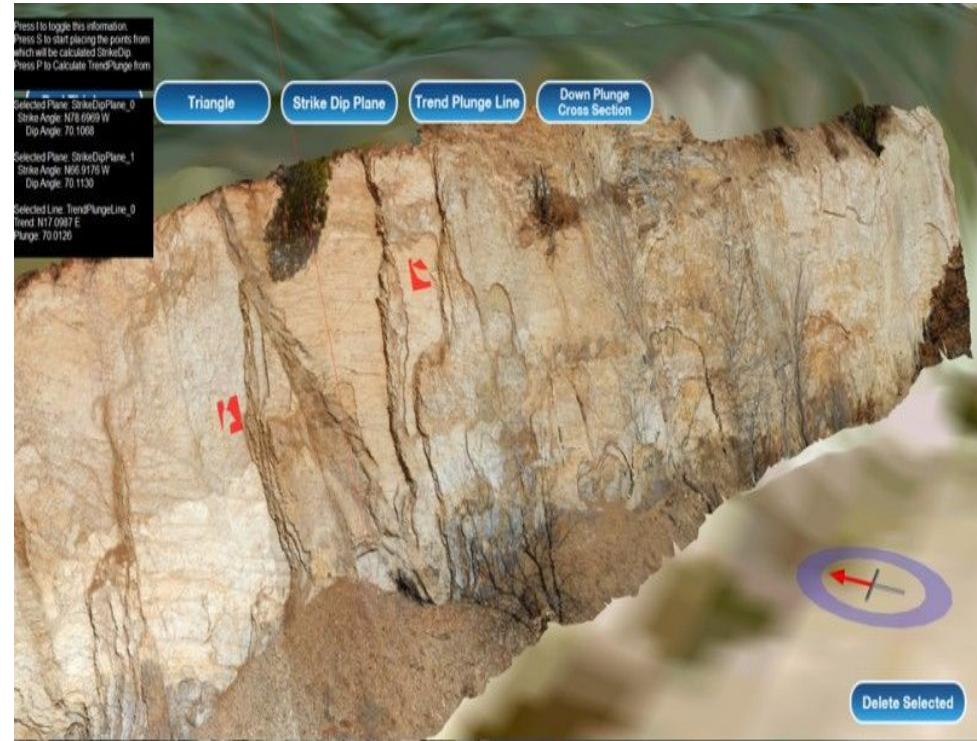
VR based Training and Field trips
Immersive Oil Rig Training

Passive Application

VR has also proven to be an invaluable tool for helping energy companies run their design process faster, safer and cheaper, too .

VR Compressor Design.
Oil Rig Visualisation Tools.
Operator Essentials Toolkit

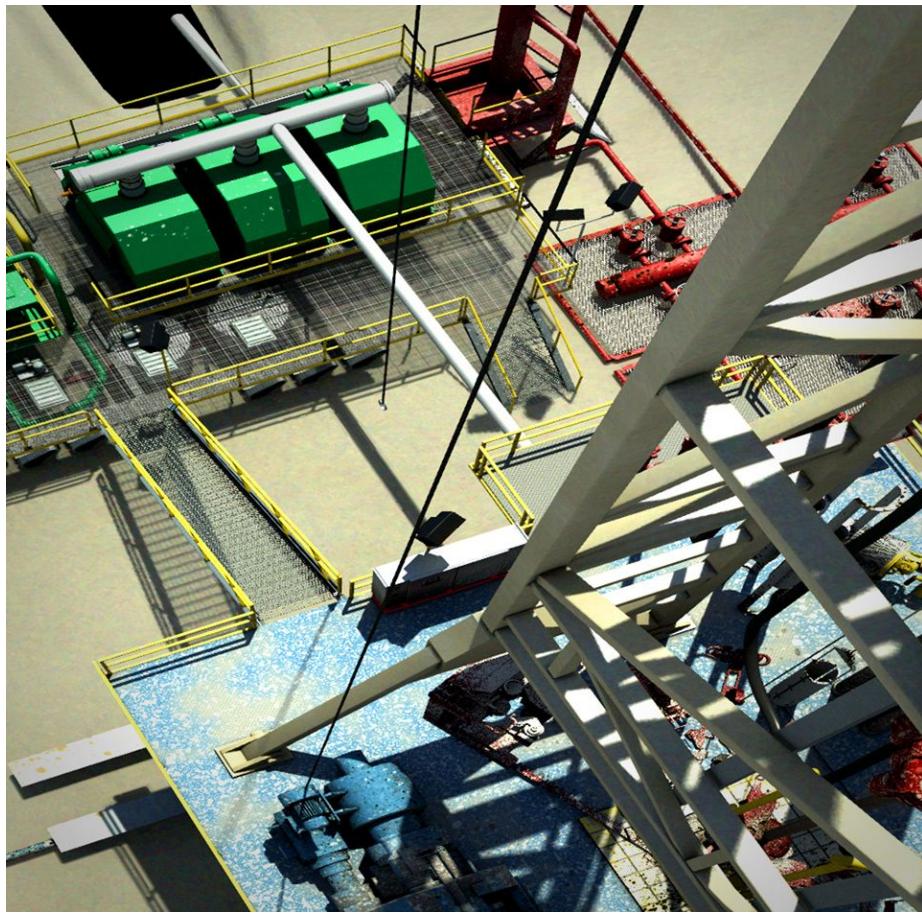
Field trip VR Simulations



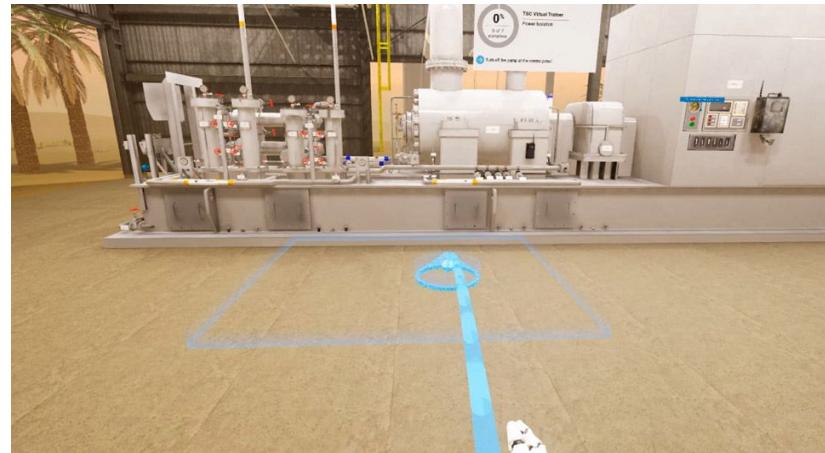
Competence Assessment of Oil Rig Workforce



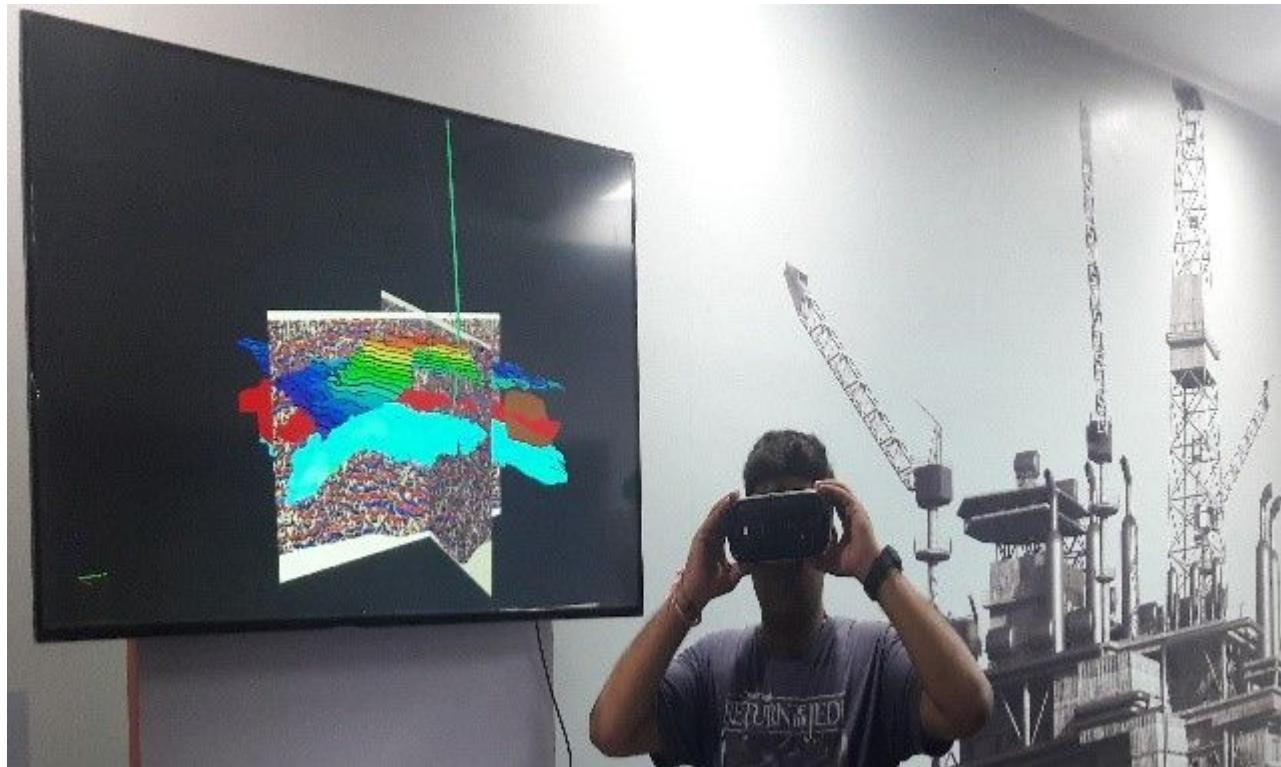
Oil Rig Training



Compressor Design



VR Simulations for Drilling Operations



Application Journey: EPRI, Palo Alto

Lets see how they did this?





More business applications of VR

VR can enhance passenger flying experience

VR can help train pilots better

VR can help treat passengers suffering with aviophobia



VR reduces turnaround time



Most Impactful application (Market-wise)

Virtual Training and Simulation Market is expected to garner **\$329 billion** by 2022, registering a **CAGR of 16.8%** during the forecast period 2016 - 2022. The Market is a method in which a simulated virtual environment is created to test certain abilities of a trainee that can contribute to the learning process.

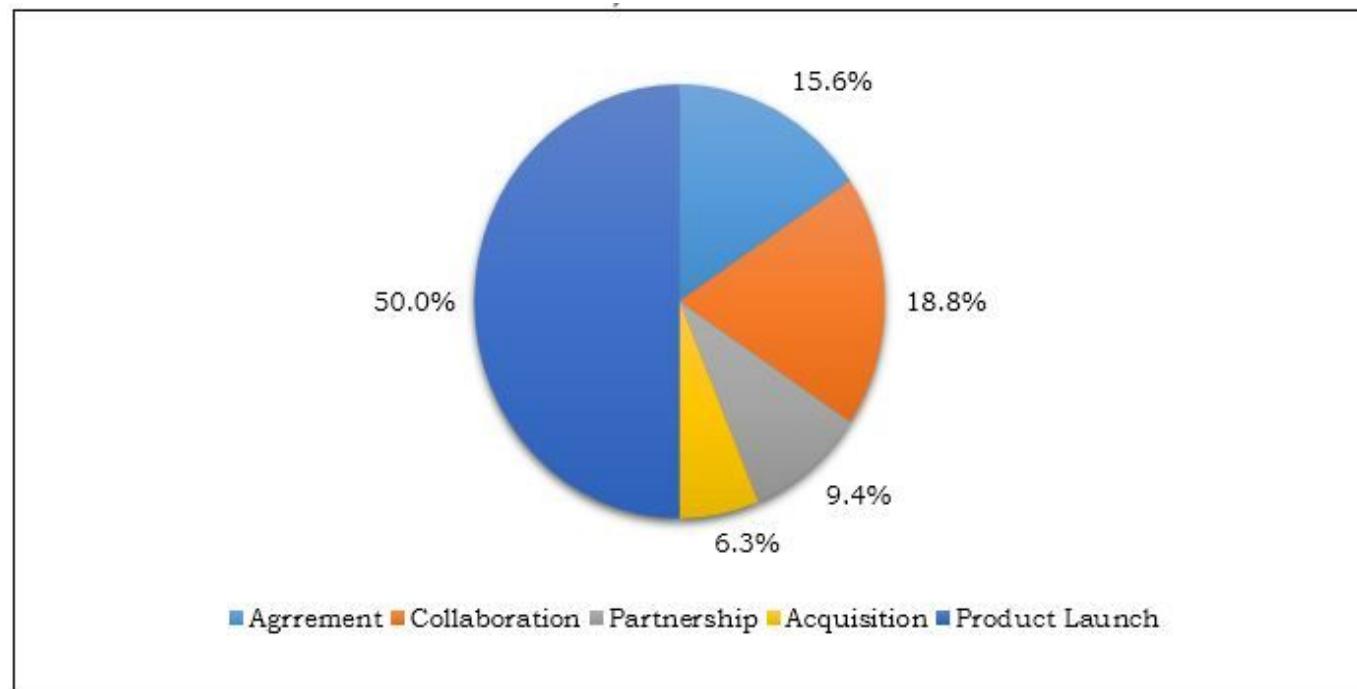
It is used in the wide area of applications, including in flight simulation, simulation-based gaming, serious games, healthcare training, energy, transportation training, e-learning, military & navy, digital manufacturing, and others. Virtual training and simulation tools comprise hardware and software.



Ground Truth: Adoption Rates

The pie chart shows the percentage share of **adoption of strategies by various players in the virtual reality training and simulation market.**

Key players operating in the market use numerous strategies to strengthen their market presence, including partnerships, collaborations, product launches, agreements, and acquisitions.



Source : Allied Market Research



Areas where VR affects Energy Industry



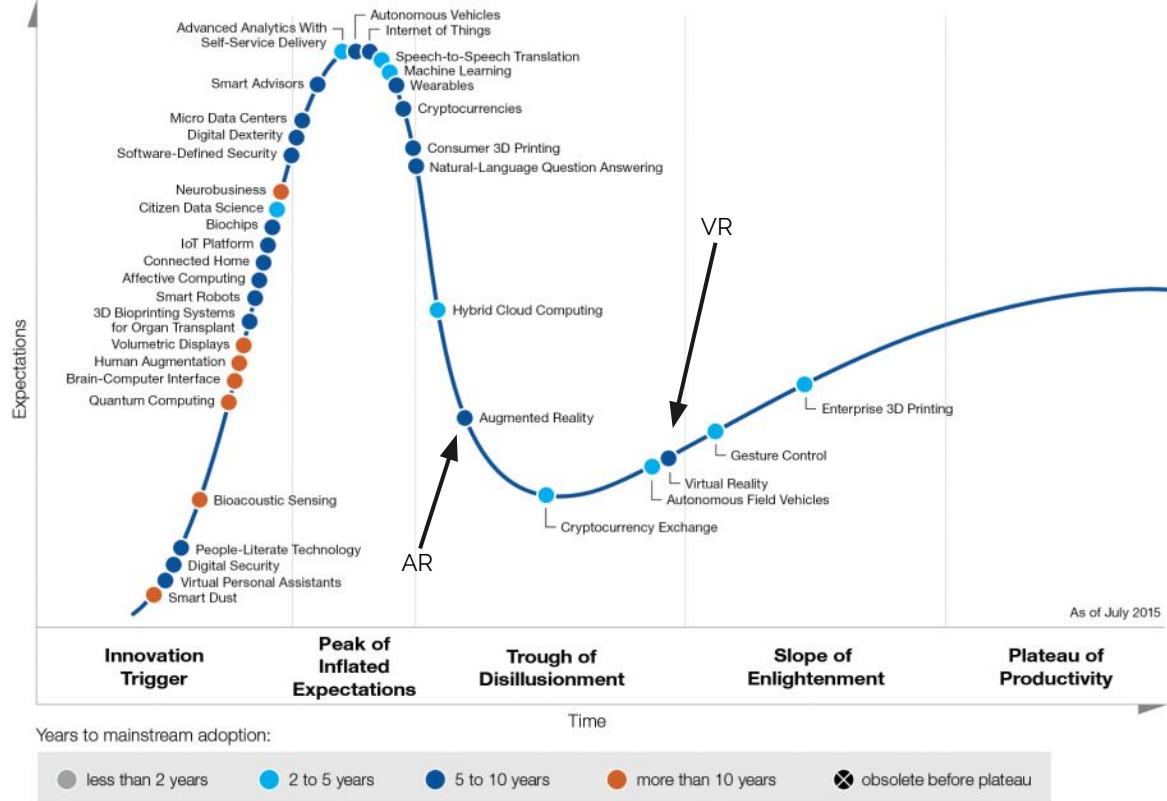
Real Time application of AR-VR technologies to revolutionize Energy Industry

Application areas :

1. E&P Companies specifically cater Drilling and Completions Operations.
2. Rig Monitoring Systems
3. Maintenance Activities
4. Anomaly Detection systems with AR lenses to remotely monitor
5. Virtual Reservoir Explorations.



Emerging Technology Hype Cycle



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Gartner

Ending Notes:



How does VR/AR affect your aerospace business and why its necessary to upgrade.?

Overall Benefits for Aerospace:

- a. Reducing risk in high stake conditions.
- b. Design timecycle is massively cut.
- c. Recruiting and onboarding
- d. Speeding up the whole assembly.

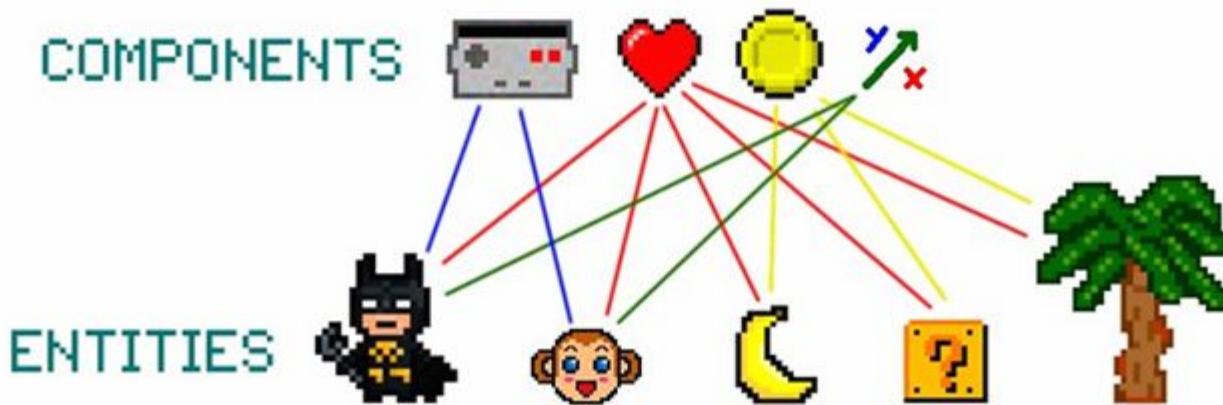
Overall Benefits for Energy :

- a. Disaster planning: assess risks and safety,
- b. Detect and measure features,
- c. Validate new equipment design,
- d. Path planning validation for dwell drilling,
- e. Big-data visualization,
- f. Training sessions: familiarize with vessels and task to be performed later on site.

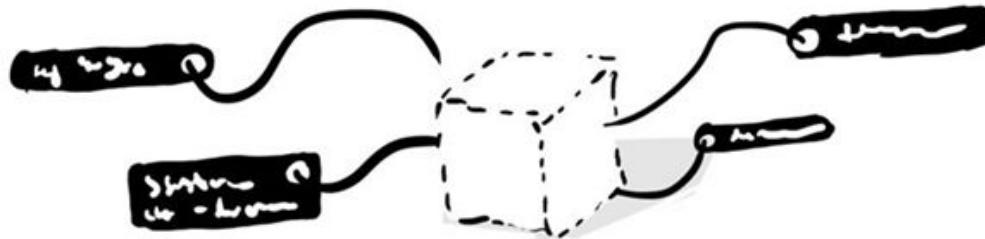


Questions?

For Slides follow
Twitter: **@pandastichuman**

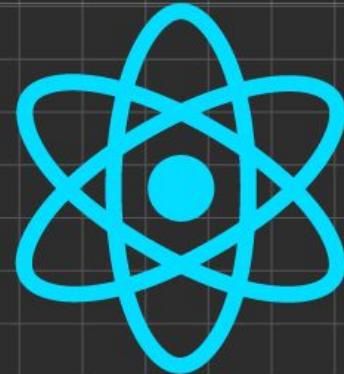


Entity-Component System





React Ecosystem for VR/AR



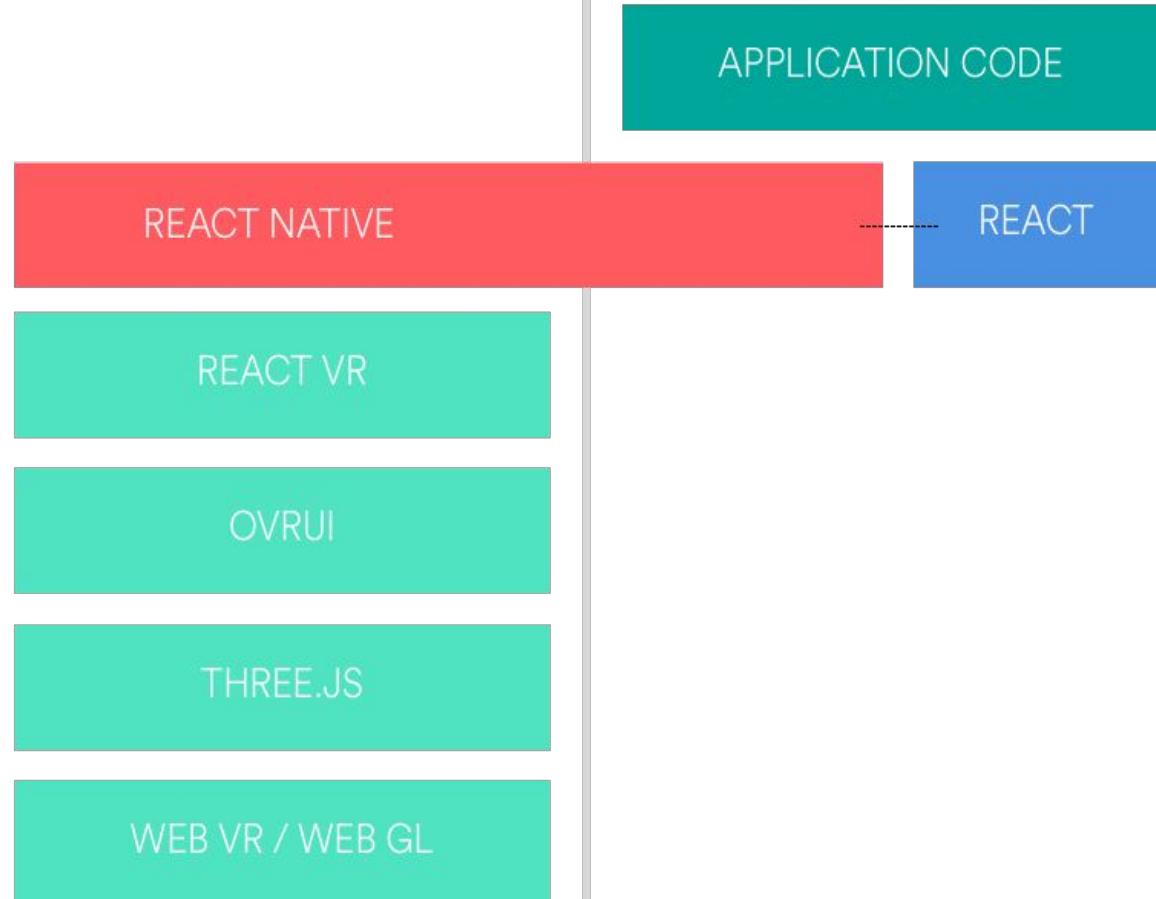
React 360 : Facebook's own WebVR Framework

How ReactVR?

- Based on Three.js library
- OVRUI : Oculus VR UI
- React Native Elements:
View, Image, Text, etc
- React VR adds : **Pano, Mesh, Pointlight & others**
- Getting started is easy-peasy.

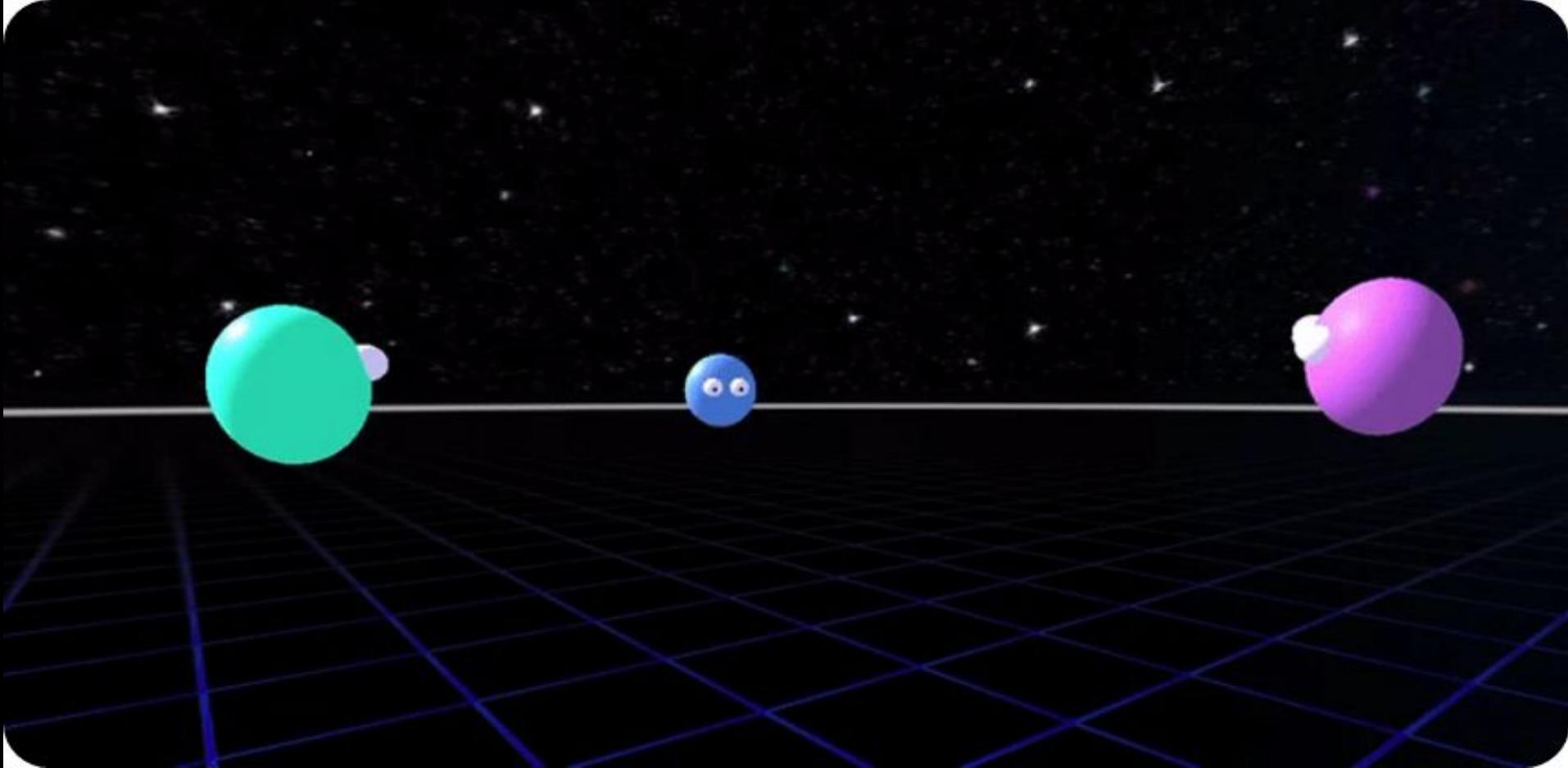
BROWSER MAIN THREAD

WEB WORKER

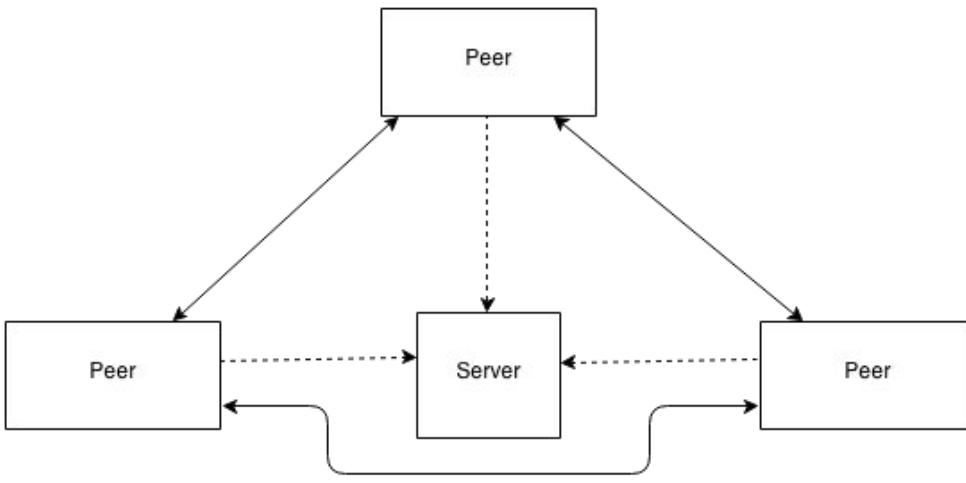




Social VR with ReactVR



How does it work?



Uses a 'networked-scene' system for the scene identifying sessions by 'app' and 'room'.

Uses a 'networked' component on entities to sync them.

Utilizes templates to represent the networked entity.

It can broadcast messages to connected peers.

Based in WebRTC / WebSockets and PEER.js



Prototyping Tools

ViroReact / ViroAR



Features

Cross Platform Development

Write once, run anywhere across all mobile AR (ARKit, ARCore) and VR (Cardboard iOS/Android, GearVR, Daydream)



React Native Framework

Create apps using React Native, making it easy for web developers to get started.



Powerful Renderer

Create stunning scenes with PBR, HDR, Realtime Lighting, Physics, Particles, and more.



Rapid Iteration

Use the free Viro Testbed app to view your app and see your changes quickly. No need to wait for recompile. It's like refreshing a browser.



Documentation

We provide you with extensive developer support and documentation.



Questions?

Connect with me:

www.particlepanda.xyz

Twitter: @shivank1995

