



THE CYPRUS
INSTITUTE

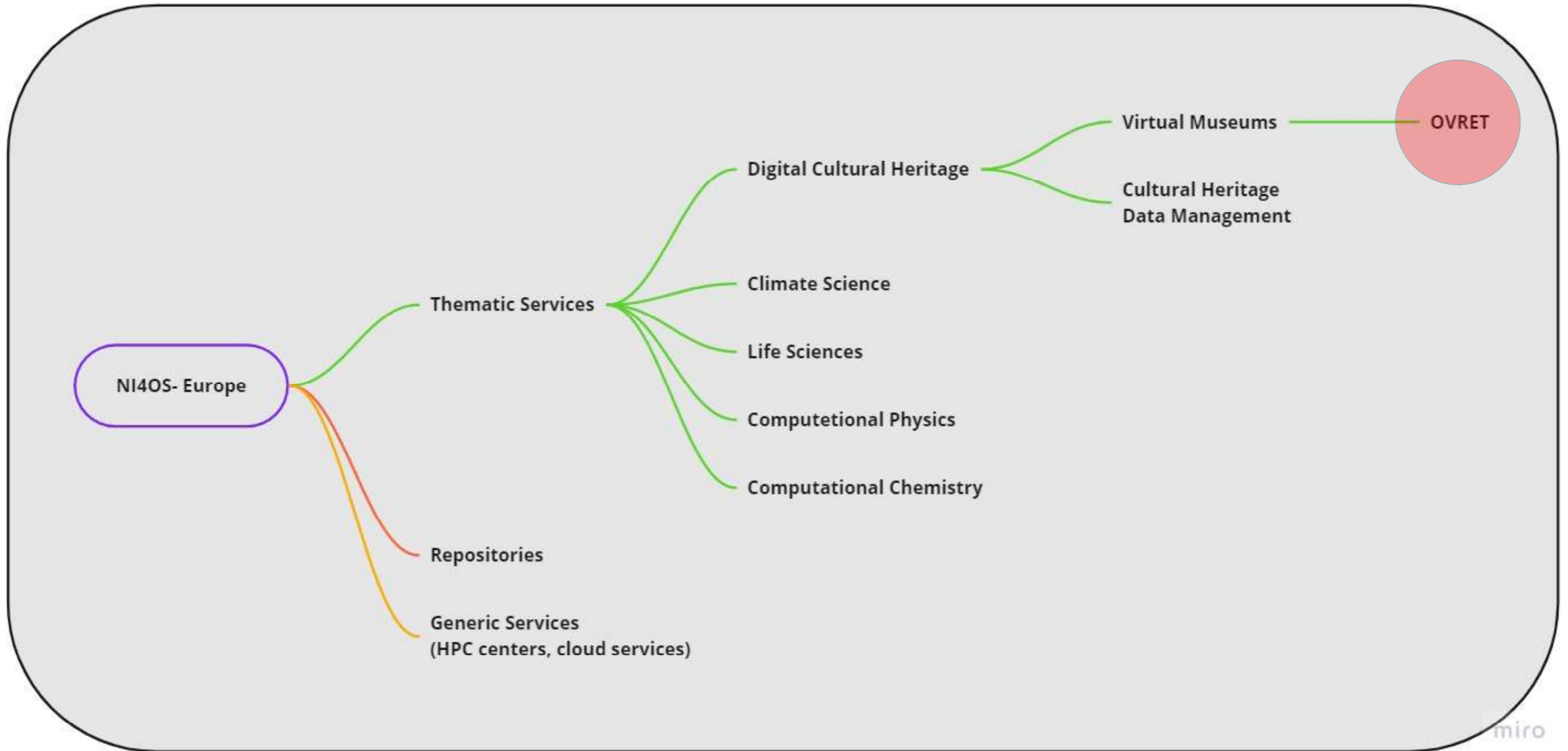
RESEARCH • TECHNOLOGY • INNOVATION



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PostGrad Dip IAAC/UPC, PhD Cand. CaSToRC, CYI

OVRET- Online Virtual Reality Toolkit

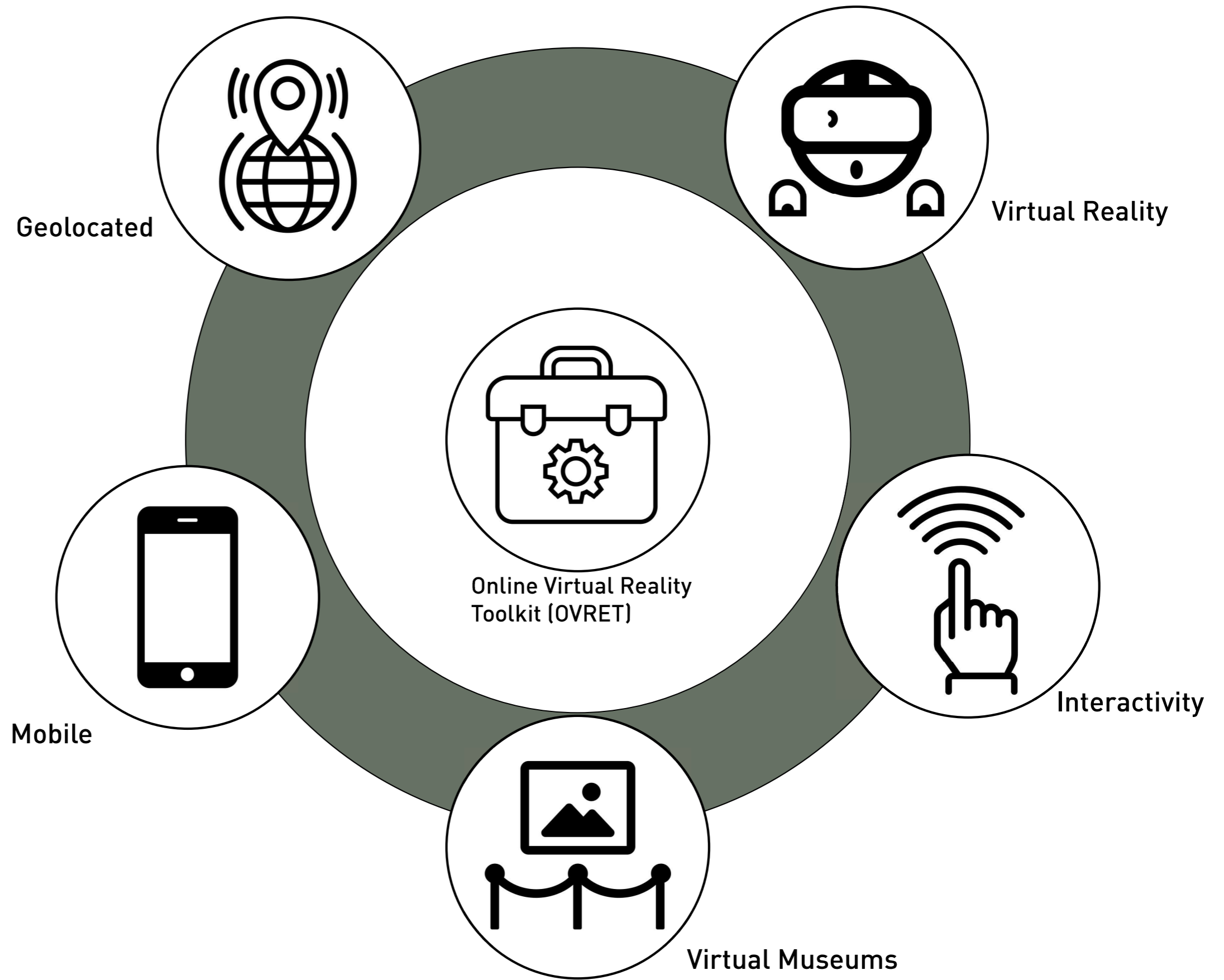
Service Map



OVRET- Online Virtual Reality Toolkit

The Goal

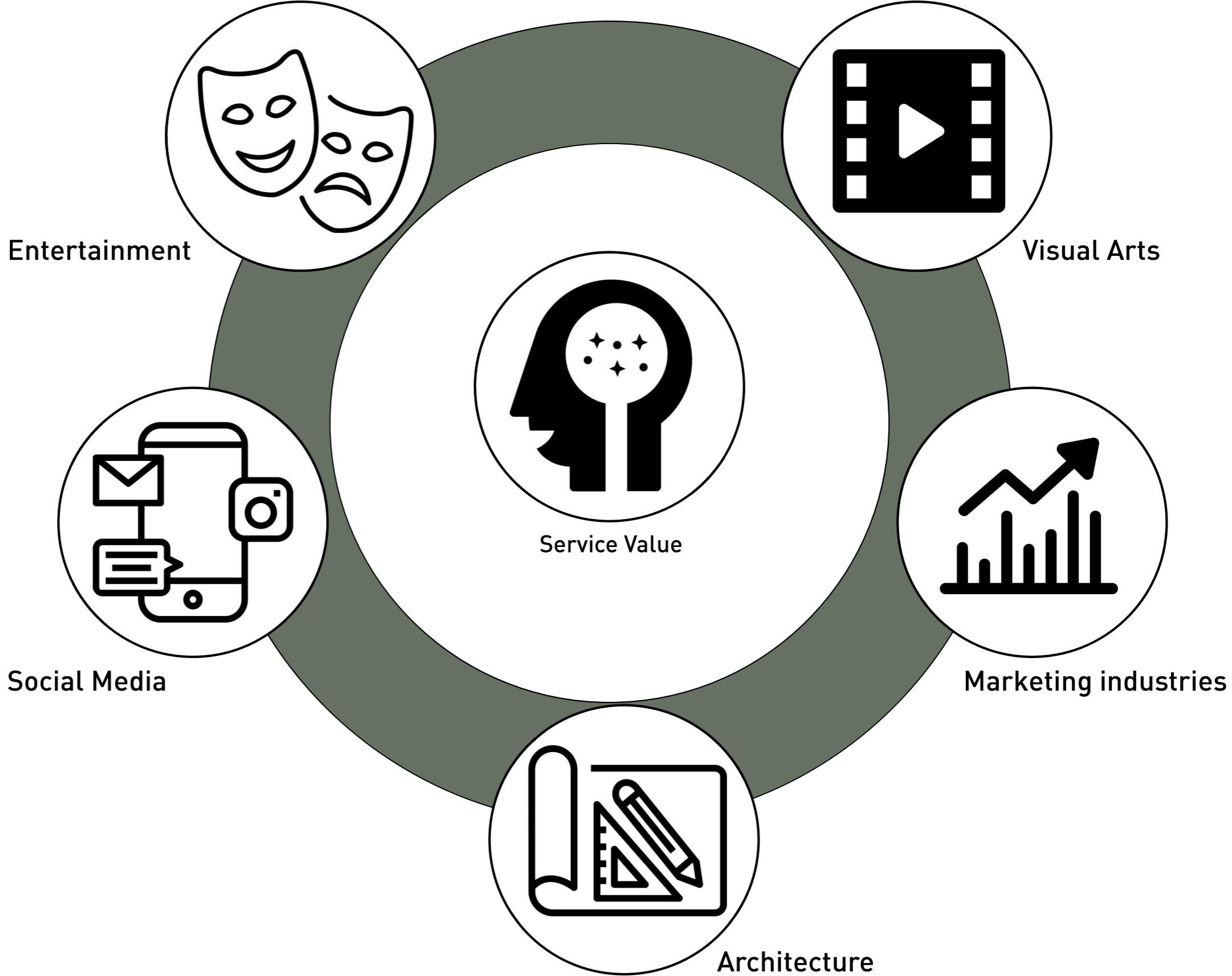
- Immersive environments for virtual museums
- Interactive collections of cultural artefacts
- Visual interfaces for geolocated interaction with DCH (digital cultural heritage) assets in physical space through mobile devices and virtual visits of inaccessible or demolished heritage monuments and historic sites.



OVRET- Service Value

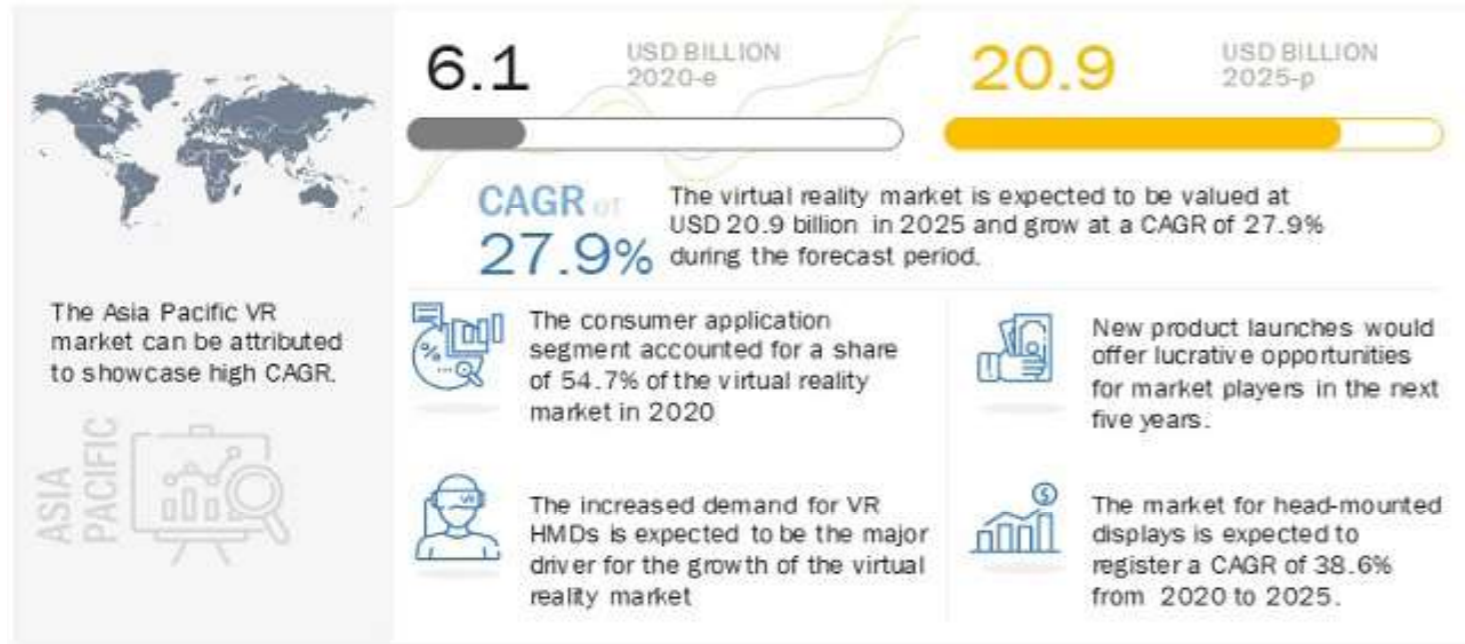
The Value

- Value of the service is high for user communities both for research and education and dissemination purposes.
- The direct engagement of the user of Virtual Reality applications, and their capacity for data visualization and interpretation is testified by its exponential adoption by various disciplines and industries



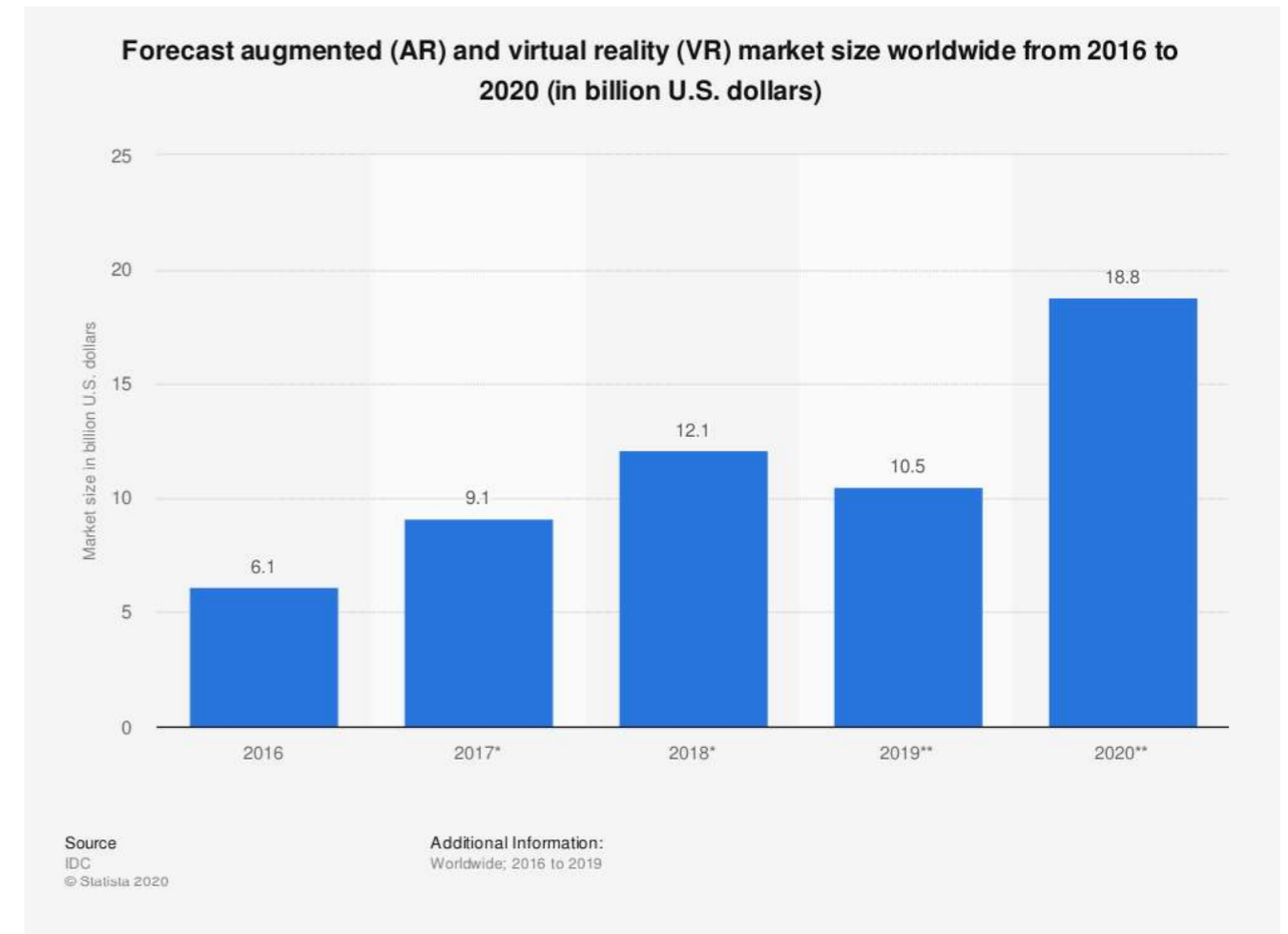
Projected size of the augmented and virtual reality market 2016-2020

Attractive Opportunities in Virtual Reality Market

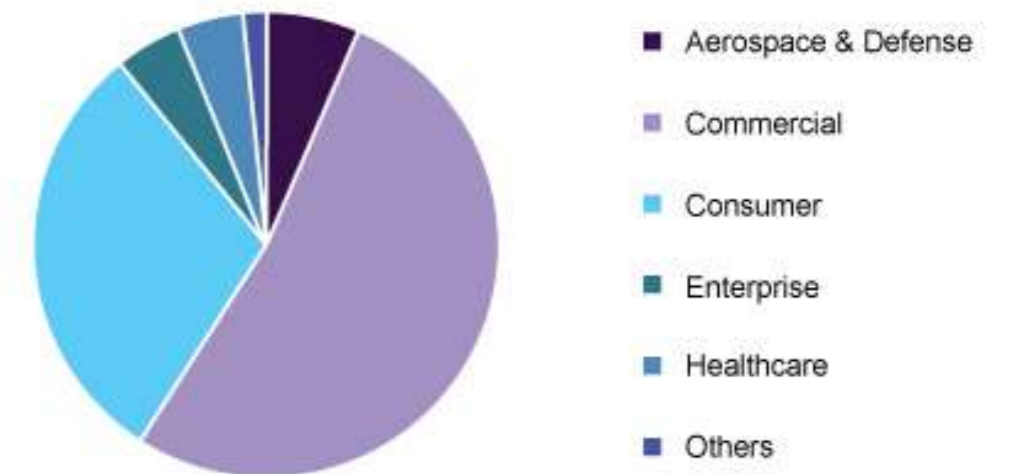


e-estimated, p-projected

- The augmented and virtual reality (AR/VR) market amounted to a forecast of 18.8 billion U.S. dollars in 2020 and is expected to expand drastically in the coming years.
- Consumer spending made up the single largest portion of the AR/VR market worldwide, followed by the discrete manufacturing segment, both of which accounted for billions of U.S. dollars in sales.
- Commercial and consumer take almost 75 % of the market



Global VR market share, by application, 2019 (%)



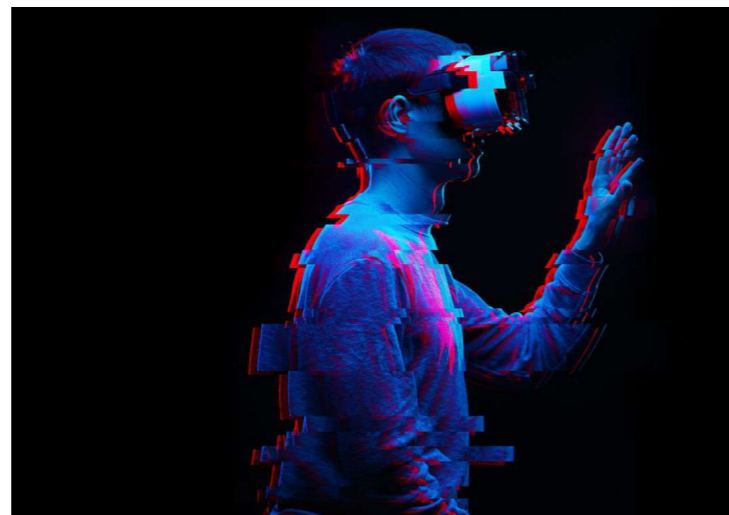
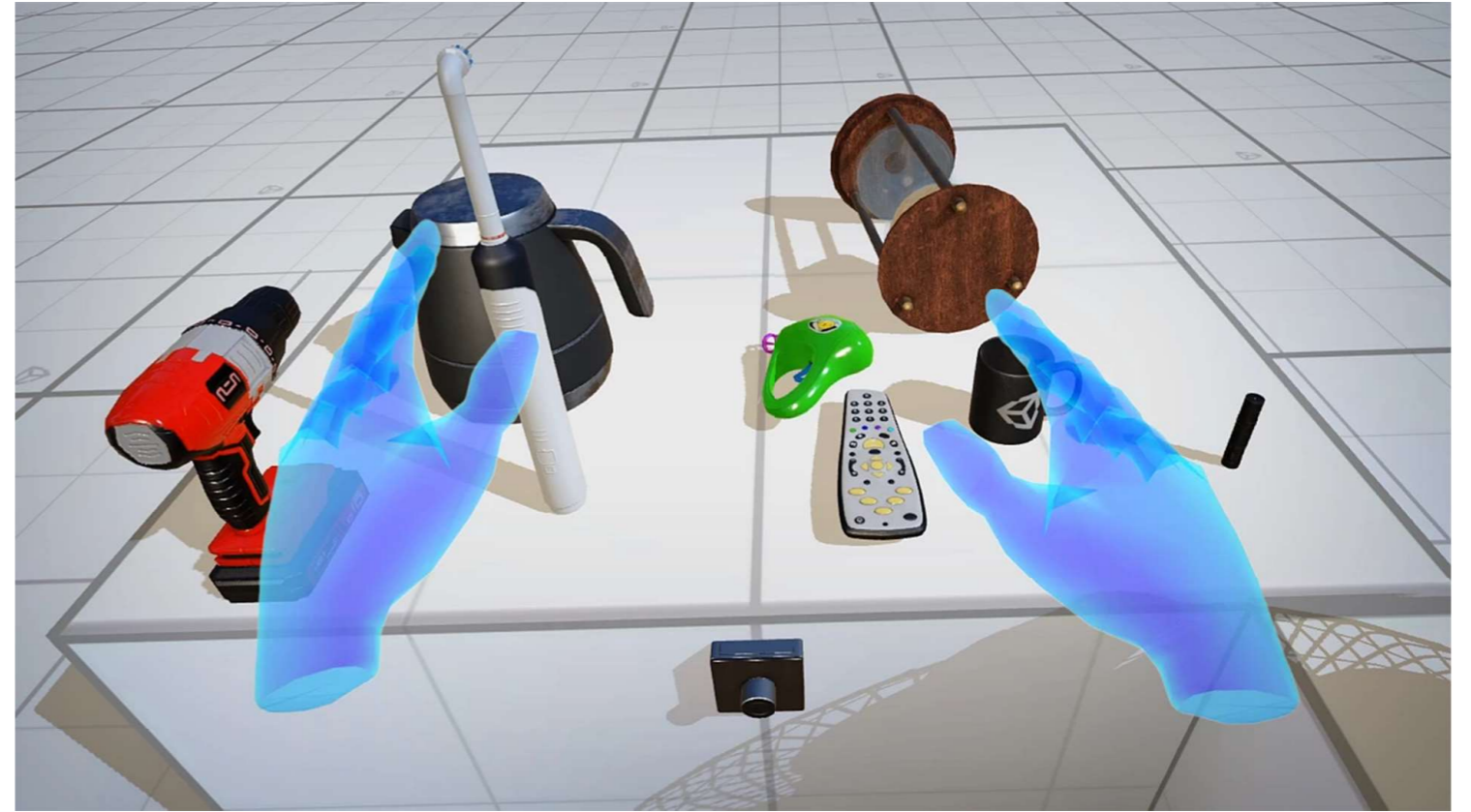
Source: www.grandviewresearch.com

What is Virtual Reality?

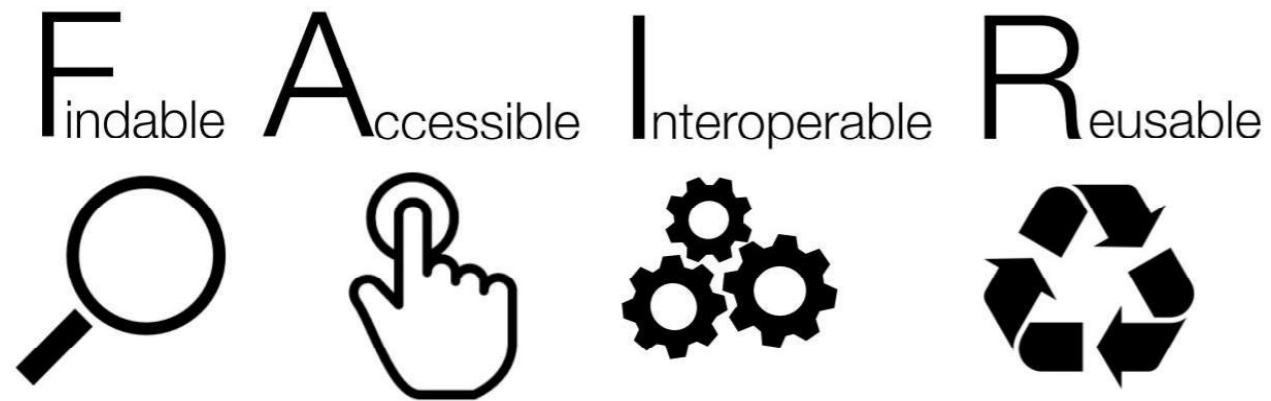
- Virtual Reality (VR) is the use of computer technology to create a simulated environment.
- VR places the user inside an experience.
- Instead of viewing a screen in front of them, users are immersed and able to interact with 3D worlds.
- By simulating as many senses as possible, such as vision, hearing, touch
- Virtual Reality's most immediately-recognizable component is the head-mounted display (HMD).
- Human beings are visual creatures, and display technology is often the single biggest difference between immersive Virtual Reality systems and traditional user interfaces.

Difference Between Virtual Reality and Augmented Reality

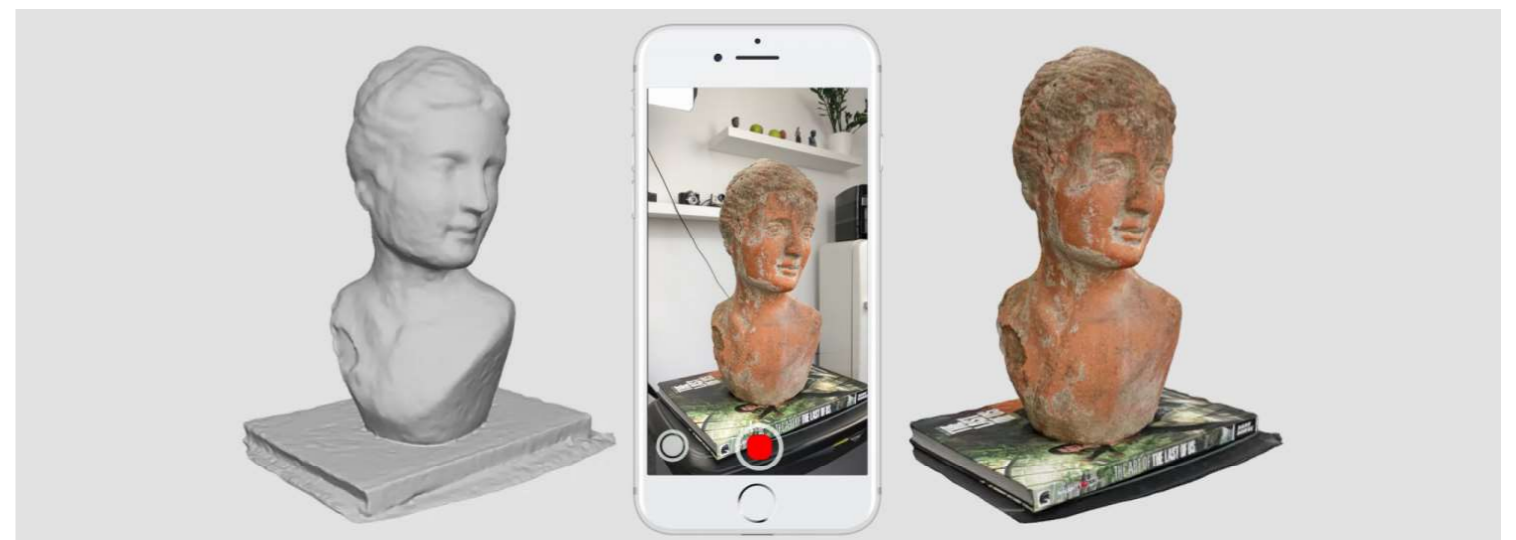
- You could think of Augmented Reality as VR with one foot in the real world:
- Augmented Reality simulates artificial objects in the real environment; Virtual Reality creates an artificial environment to inhabit.
- In Augmented Reality, the computer uses sensors and algorithms to determine the position and orientation of a camera.
- AR technology then renders the 3D graphics as they would appear from the viewpoint of the camera, superimposing the computer-generated images over a user's view of the real world.



How the service relates to FAIR Data

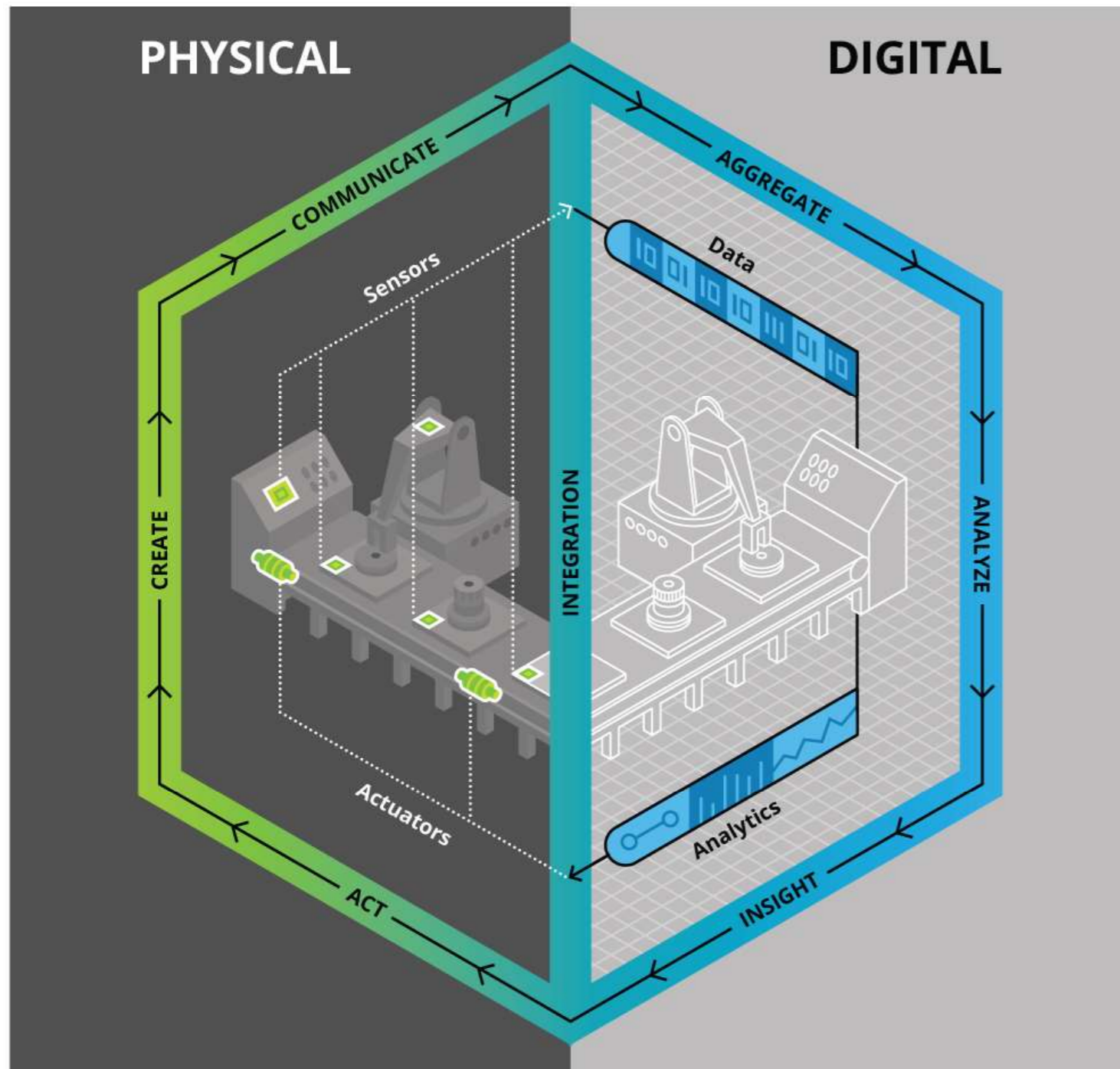


- Urgent need to improve the infrastructure supporting the reuse of scholarly data.
- A diverse set of stakeholders have designed and jointly endorse a concise and measurable set of principles that we refer to as the FAIR Data Principles.
- These may act as a guideline for those wishing to enhance the reusability of their data holdings. w
- The FAIR Principles put specific emphasis on enhancing the ability of machines to automatically find and use the data.
- Physical data, such as museum exhibits and archives can be digitized and add intelligence upon the physical object with the form of metadata



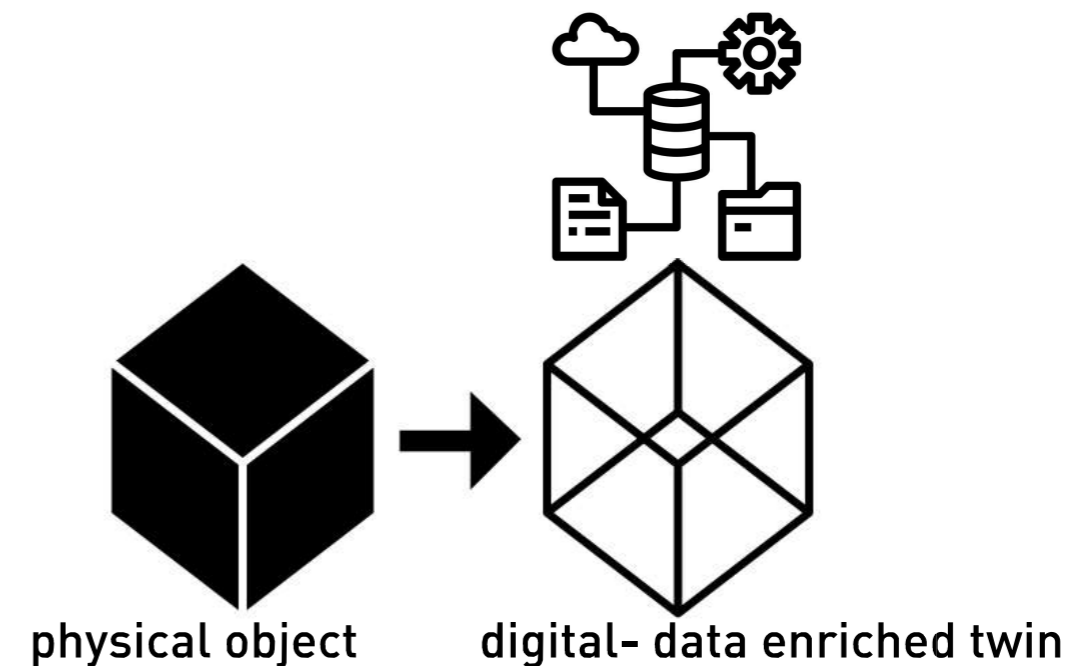
The advantages of digitizing and going FAIR in museums

- an overall effort to mirror physical objects in digital space in order to improve efficiency and interoperability
- digitizing collections makes them available and enriched with metadata and information



need for fair data

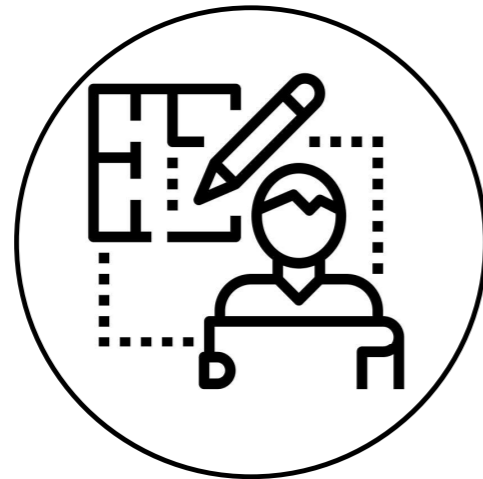
- increase production and availability of online resources
- Users can search, tag, annotate data at various granularities
- Publication: the fair guiding principles for scientific data management and stewardship
- FAIR is a set of principles not a standard
 - Findable
 - Accessible
 - Interoperable
 - Reusable
- specific emphasis on enhancing the ability of machines to automatically find and use the data.
- FAIR data doesn't equal open data, FAIR data can be shared under restrictions and still be fair
- How to make your data fair?
 - make your data findable searchable and discoverable online
 - make your data accessible
 - make your data interoperable
 - make your data reusable
 - use new innovative research approaches and tools



Target communities for the service



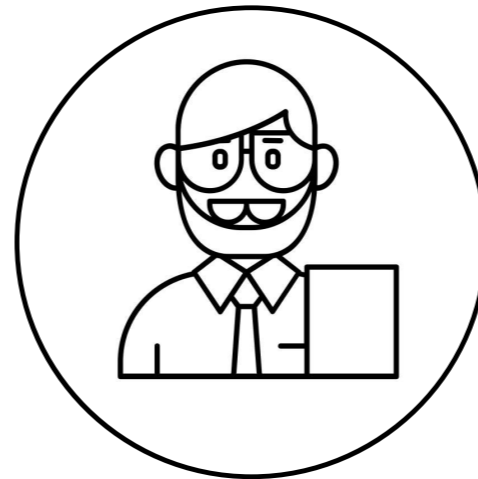
Archeologists



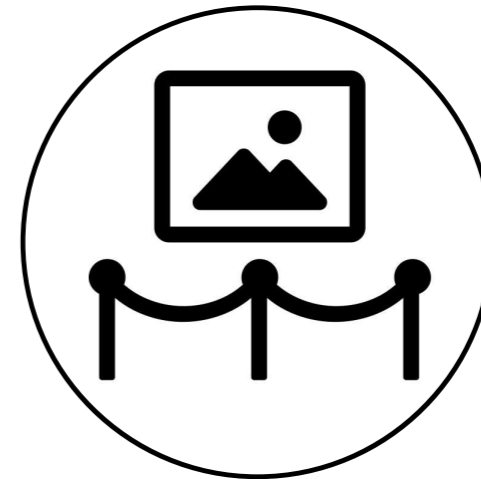
Architects



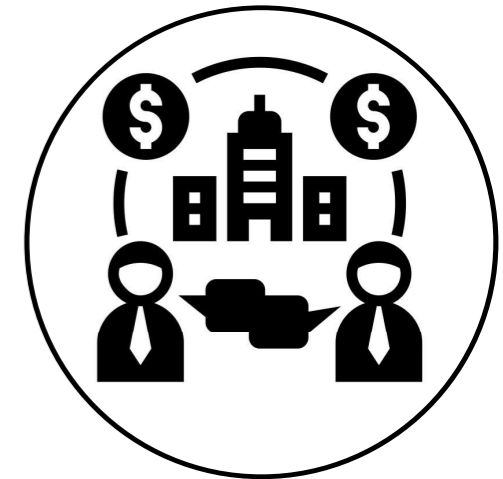
Research Groups



Historians



Museums



City Stakeholders

TIME MACHINE Community

Time Machine allows Europe to restore its engagement with its past and use it as a vital resource for a common future

- Time Machine is a large-scale research initiative aiming to develop the big data of the past, creating a huge distributed digital information system mapping the European social, cultural and geographical evolution across times.
- By designing and implementing advanced new digitisation and Artificial Intelligence (AI) technologies to mine Europe's vast cultural heritage, Time Machine will provide fair and free access to information that will support future scientific and technological developments.
- Open platforms for navigating the multicultural and multilingual perspectives of our common past will turn our long history into a pan-European cultural, economic and social asset

CONCRETE OUTCOMES AND EXPECTED IMPACT FOR SOCIETY AND ECONOMY



A strong boost in EU competitiveness in AI and ICT



A transformational impact on Social Sciences and Humanities



Making education more accessible, interactive and diversified

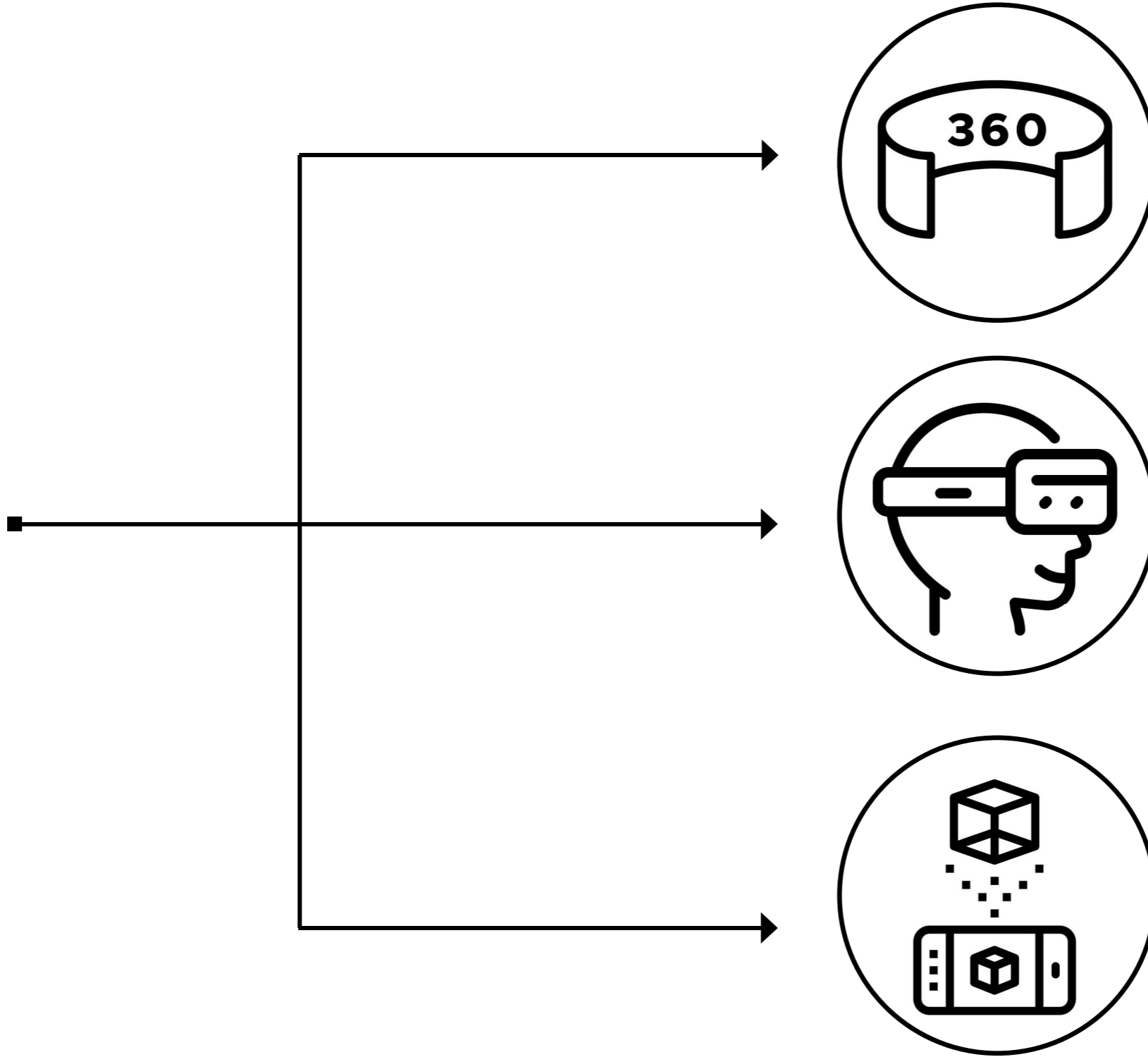


Creating new disruptive business models in key economic sectors



State of the art

• 3 types of platforms



• 360 virtual experience

• immersive virtual reality experience

• augmented reality experience

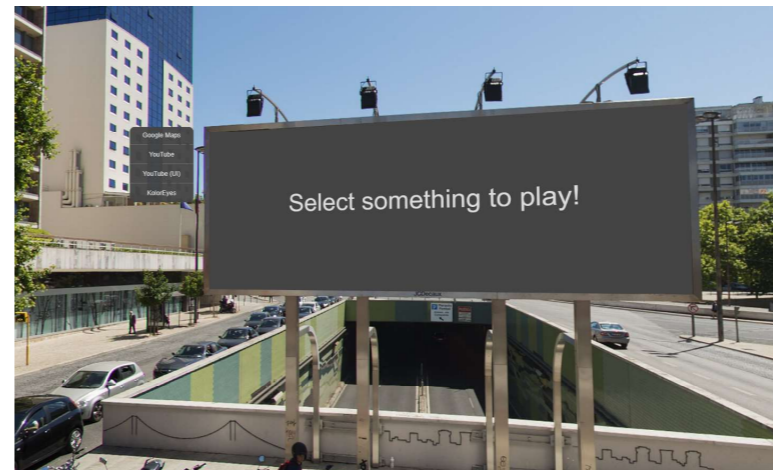
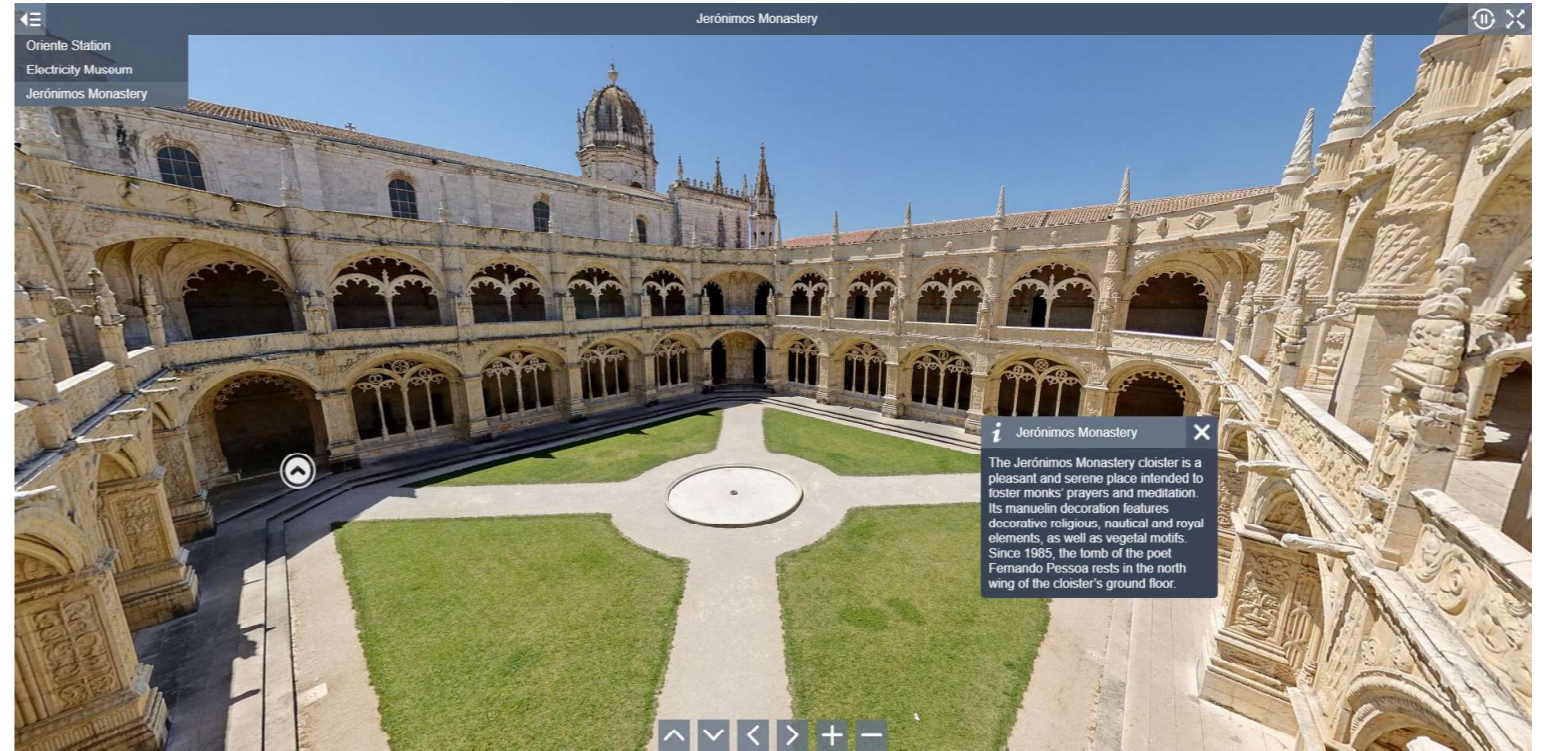
360 virtual experience

use of panoramas along with a preset java script to create a virtual experience with limited interaction

tools used:

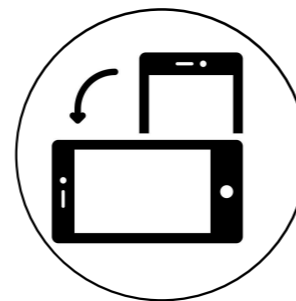


360 camera:

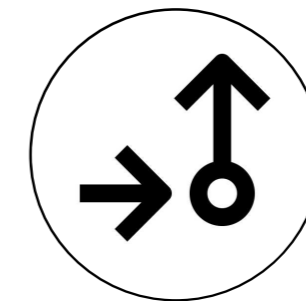


- Single Resolution Cube:
- Multiresolution Cube
- Video

• Embedded Hotspots



• Device Orientation



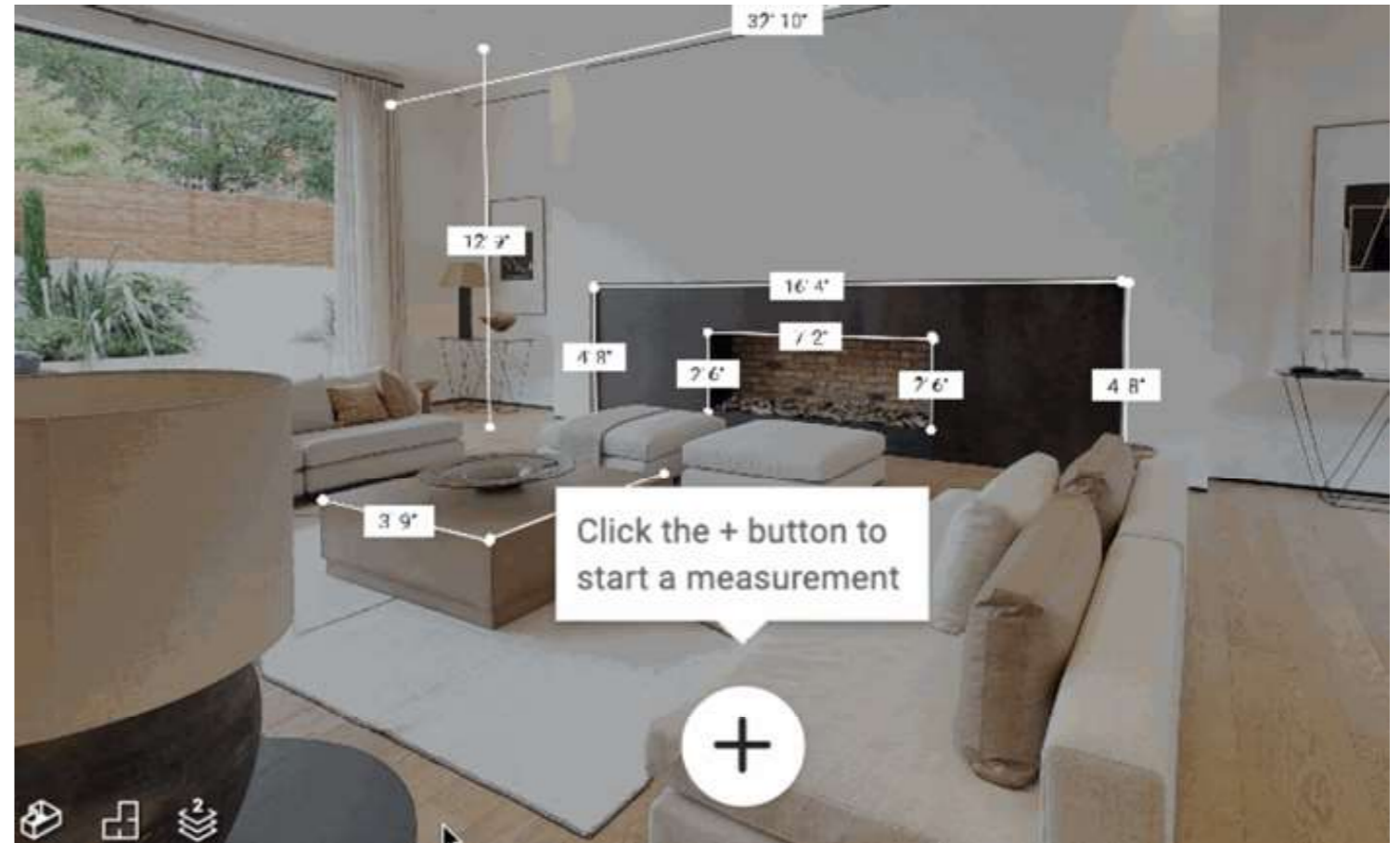
• Transitions



• Extra Touch Gestures

The National Museum of Computing Block H, Bletchley Park Photogrammetry generated virtual tour

- Viewers can move around the galleries looking at the machines and their descriptions with the added bonus of hyperlinks to video and text explanations providing further detail and history of the exhibits.
- Users can move around the galleries and zoom in on points of interest.
- They can read the explanations already displayed in the galleries and have the added bonus of links to further information and even videos of machines in action.

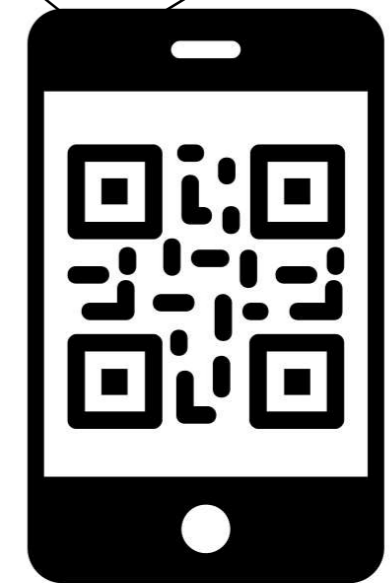


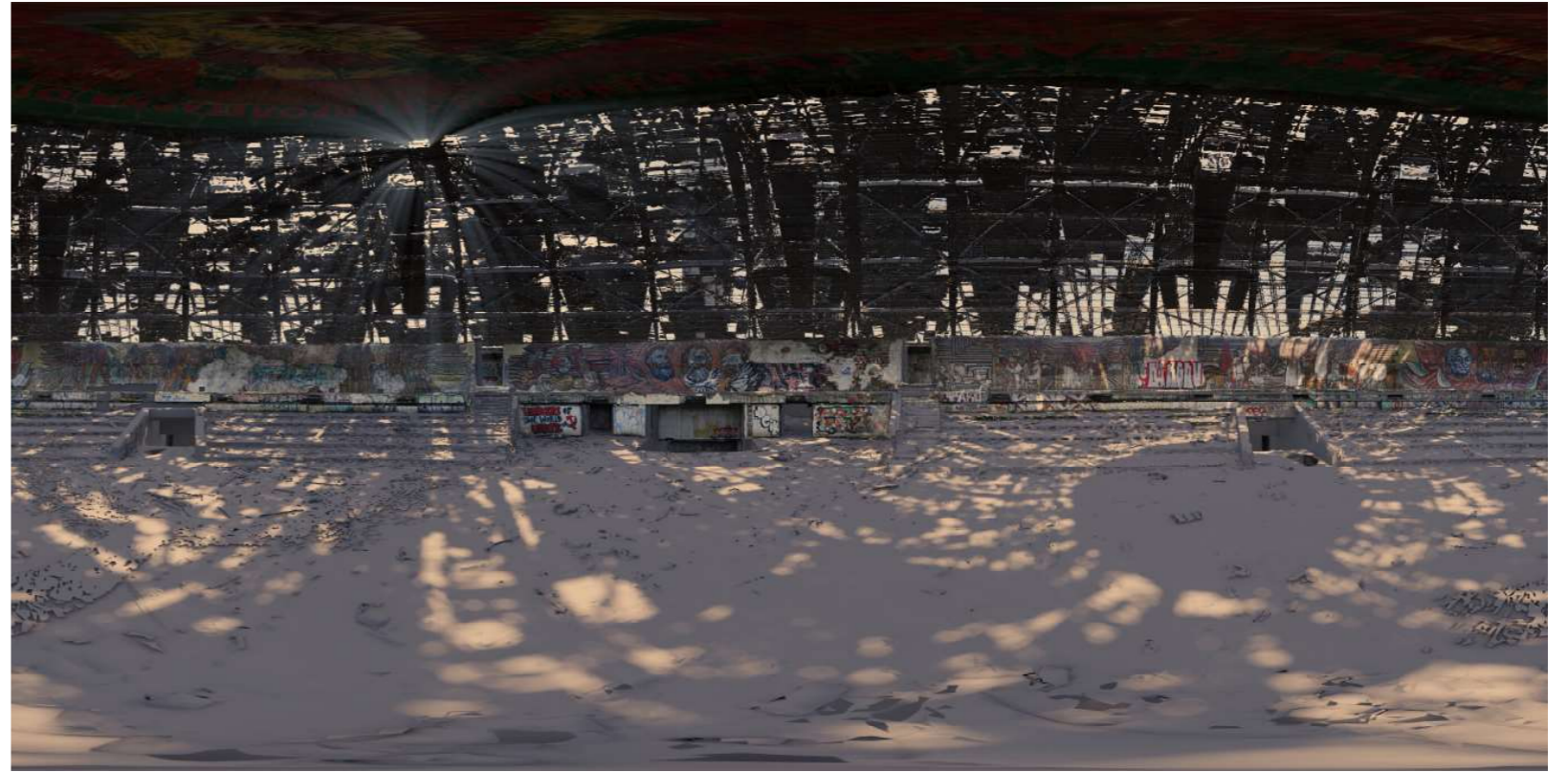
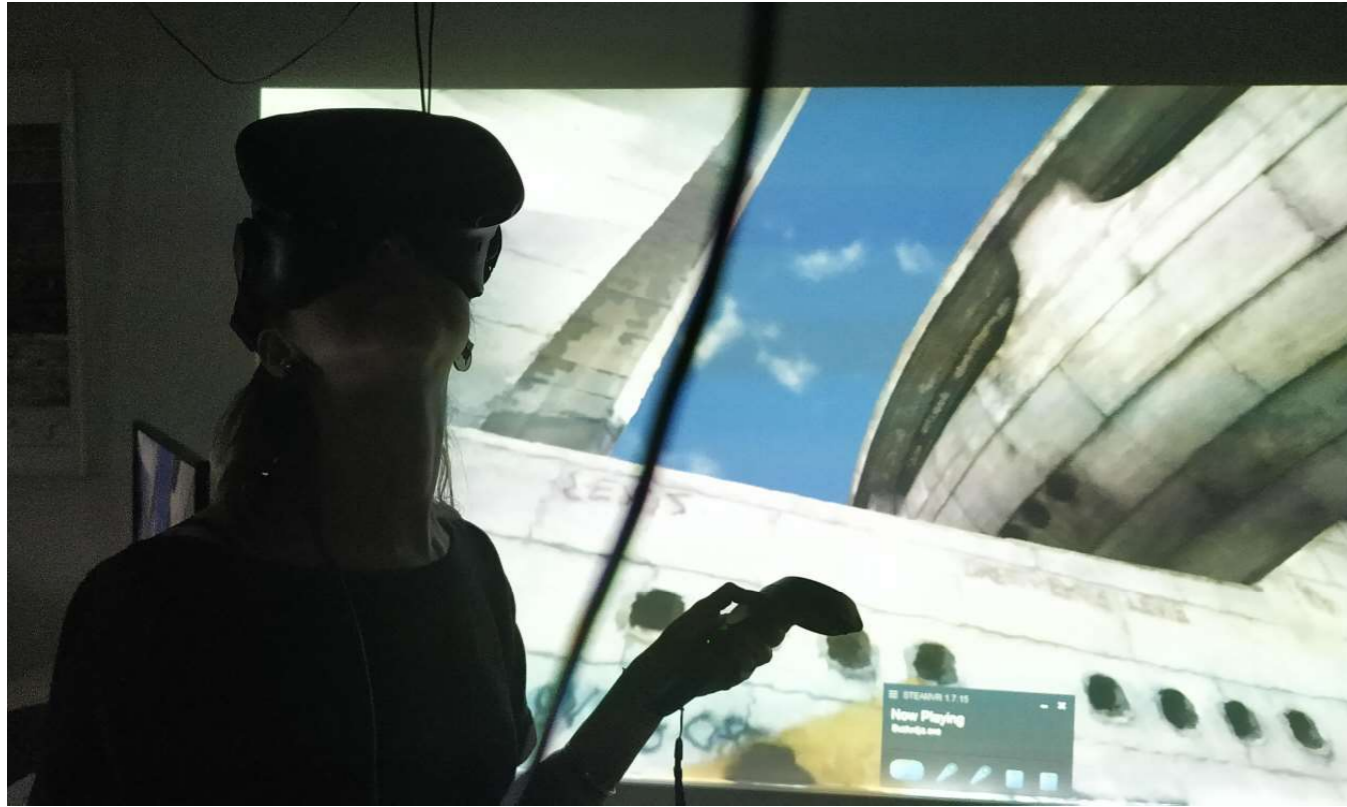
Buzludzha monument_Virtual Reality Application VeLab, CYI

Heritage is anything that helps us collectively to better understand the present and think of the future. Now historic places can be of any form, such as ecological zones, parks, culturally valuable structures, or public squares. In this project, we sought a more holistic understanding of the past which will contribute to achieving a more inclusive vision of the future. In the context of the Creative Europe Nonuments project, the Cyl team used sophisticated digital tools of 3D documentation and immersive visualisation to promote the cultural value of 'difficult heritage' and buildings that are not yet listed as monuments but which carry significant social meanings and cultural values. Nonuments project aims to document and participate in the creation of multiple narratives of the past, in order to show people that their past is into the present and that it should be understood as part of their future.



SCAN ME!



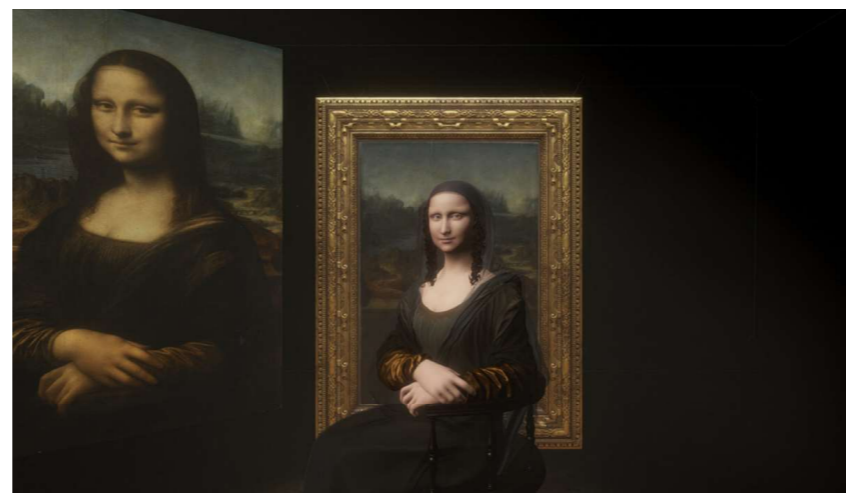
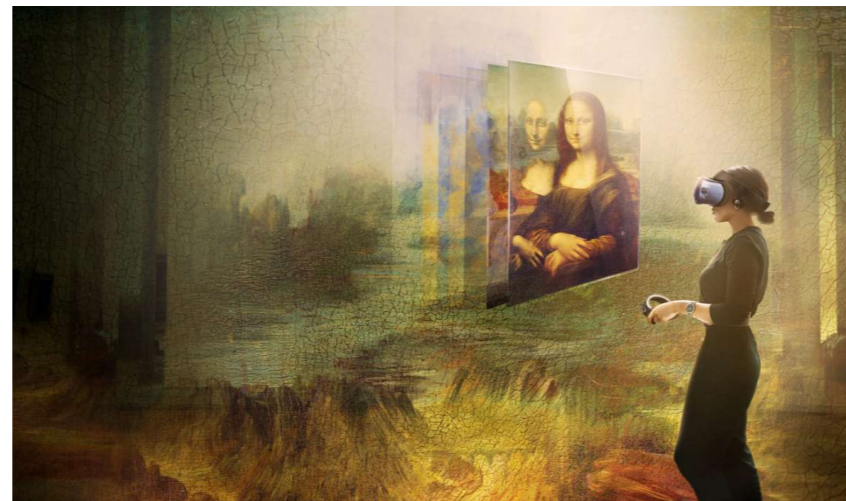


Immersive virtual experience

Mona Lisa: Beyond the Glass

digital recreation of an environment and use of immersive virtual reality tools to create not physically possible experiences and environments

- Mona Lisa: Beyond the Glass is the first VR experience presented to the public by the Louvre Museum
- Mona Lisa: Beyond the Glass reveals the latest scientific research on da Vinci's artistic innovation and his painting techniques and processes through exceptional visualization in virtual reality, bringing them to life.

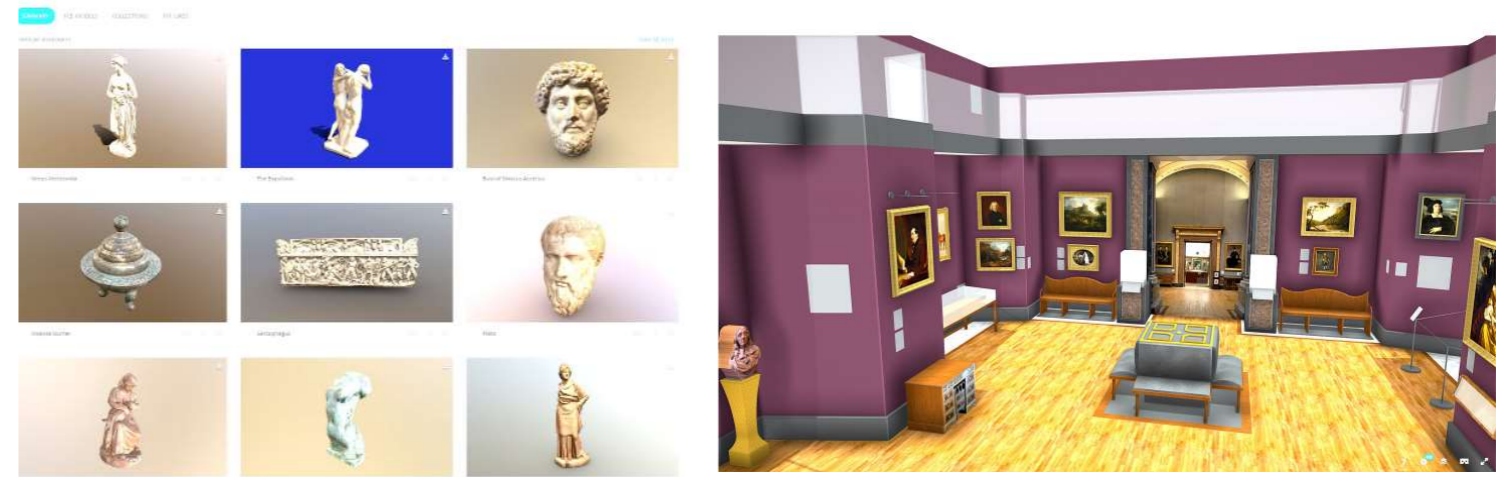
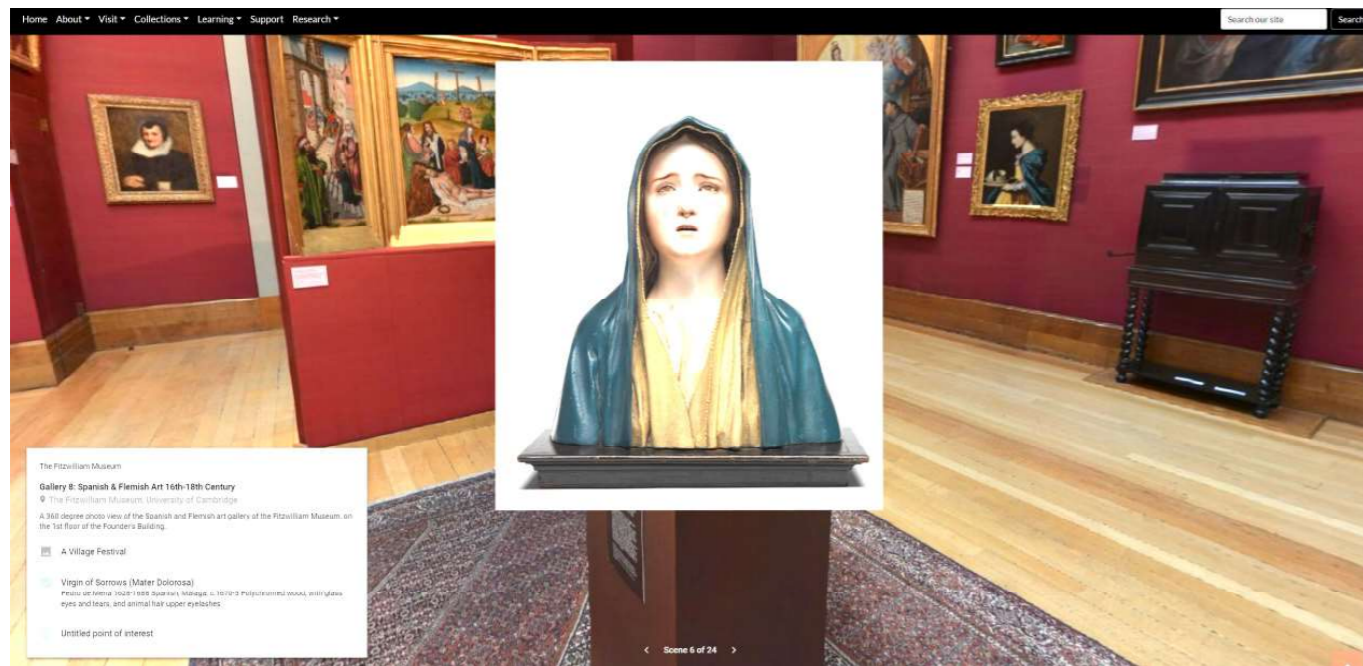


Immersive virtual experience

The Fitzwilliam Museum, Cambridge UK

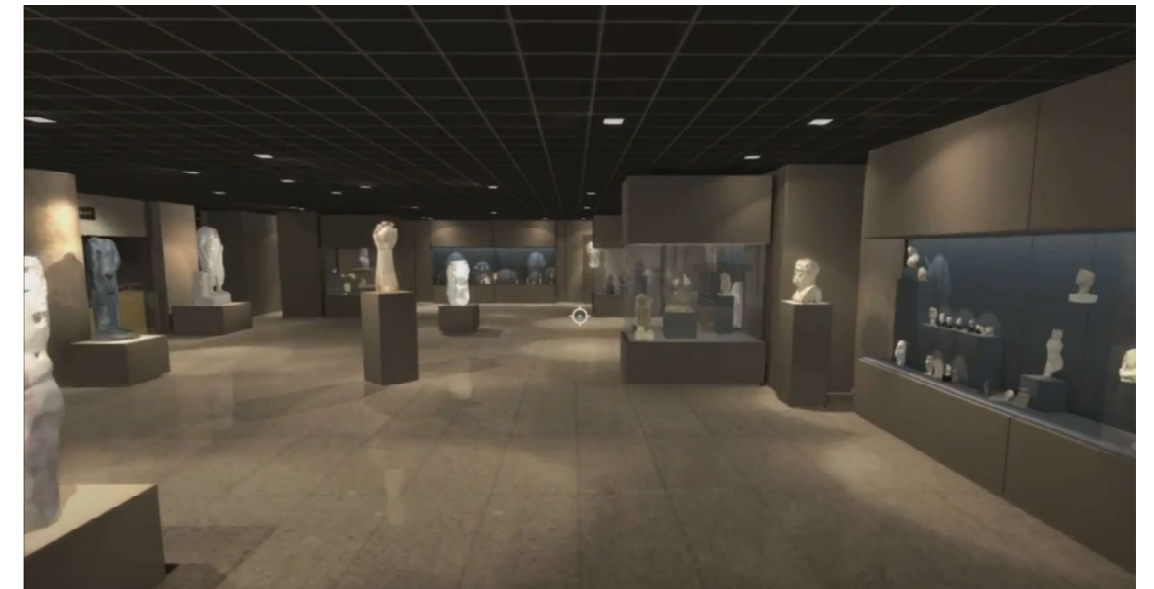
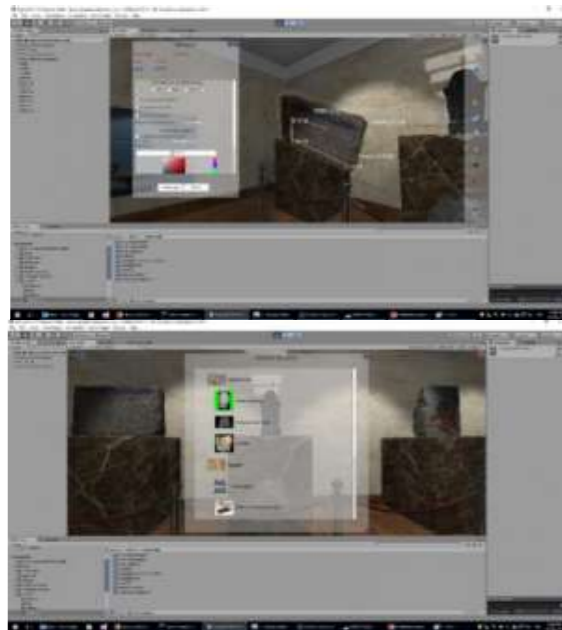
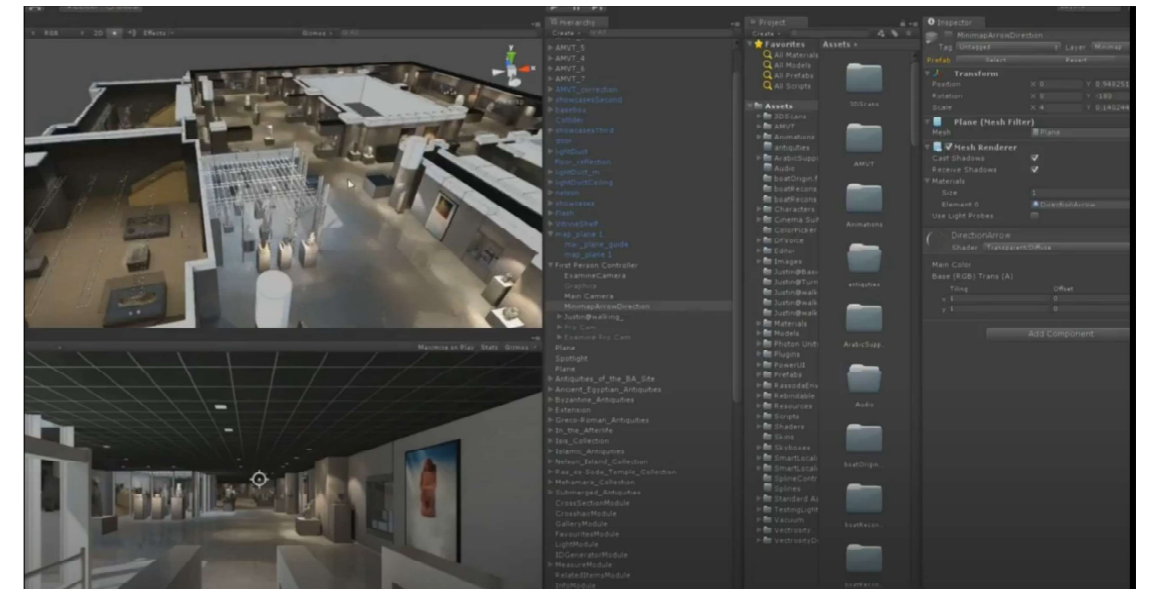
Digital repository and 360 tour

- online repository of environment and artifacts using sketchfab
- 360 web based application for exploration



Immersive virtual experience VIRMU – VIRTUAL MUSEUM FRAMEWORK FOR EXHIBITING DIGITIZED COLLECTIONS

- The Bibliotheca Alexandrina (BA) Virtual Antiquities Museum application (2015), consists of more than 700 pieces
- VirMuF is a set of tools that can be used by non-developers to effortlessly create and publish 3D virtual museums in a very short time.
- The application allows museums that digitize their collections to publish 3D virtual museums and exhibit these collections without the need for software developers to do the job.
- VirMuF is user-friendly and requires only a few clicks to create a feature-rich virtual museum.
- VirMuF allows organizations and institutions, to exhibit their digitized collections through web, desktop, and mobile platforms, quickly and effectively.
- VirMuF is open-source; hence, teams that include software developers can further extend VirMuF to fit their needs.
- A virtual museum should complement the real one by giving users the ability to do things they cannot do in real museums, such as freely manipulating objects or measuring them.
- The virtual museum should act as a medium for interactive story-telling, to provide more interesting ways of introducing history and archaeology.
- VirMuF has been released to the VI-SEEM Virtual Research Environment (VRE) and was presented at the e-Infrastructures for Excellent Science in Southeast Europe and Eastern Mediterranean international conference in Sofia, Bulgaria, May 2018



Augmented reality experience

How can museums use augmented reality?

Audio Augmented Reality

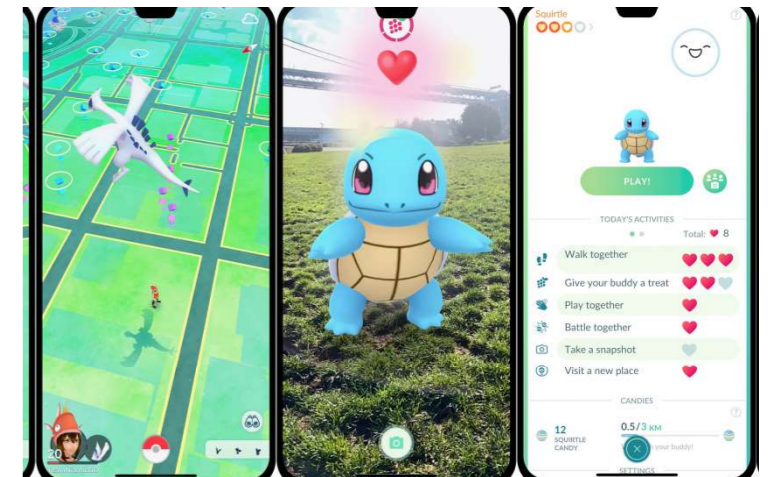
- With the use of augmented reality apps and a smart headset, you can blend the information from all the sensors your phone has.
- By tracking your position (GPS), the direction you look at (Gyroscope), your movement speed changes (Accelerometer), it is possible to create a 3D audio environment so that the visitor can actually understand where the sounds are coming from.
- You can experiment by placing AR audio sources and change their volume based on the visitor's actions.
- The immersion level skyrockets drastically in comparison to standard tours.

Outdoor Exploration

- There are GPS-based augmented reality platforms that allow for creating interactive AR applications.
- Pokémon Go is a prime example of successfully using the location-based augmented reality apps for entertainment.
- AR Markers that trigger a particular process whenever captured by a camera through an augmented reality application by overlapping an image, audio, a video or 3d model

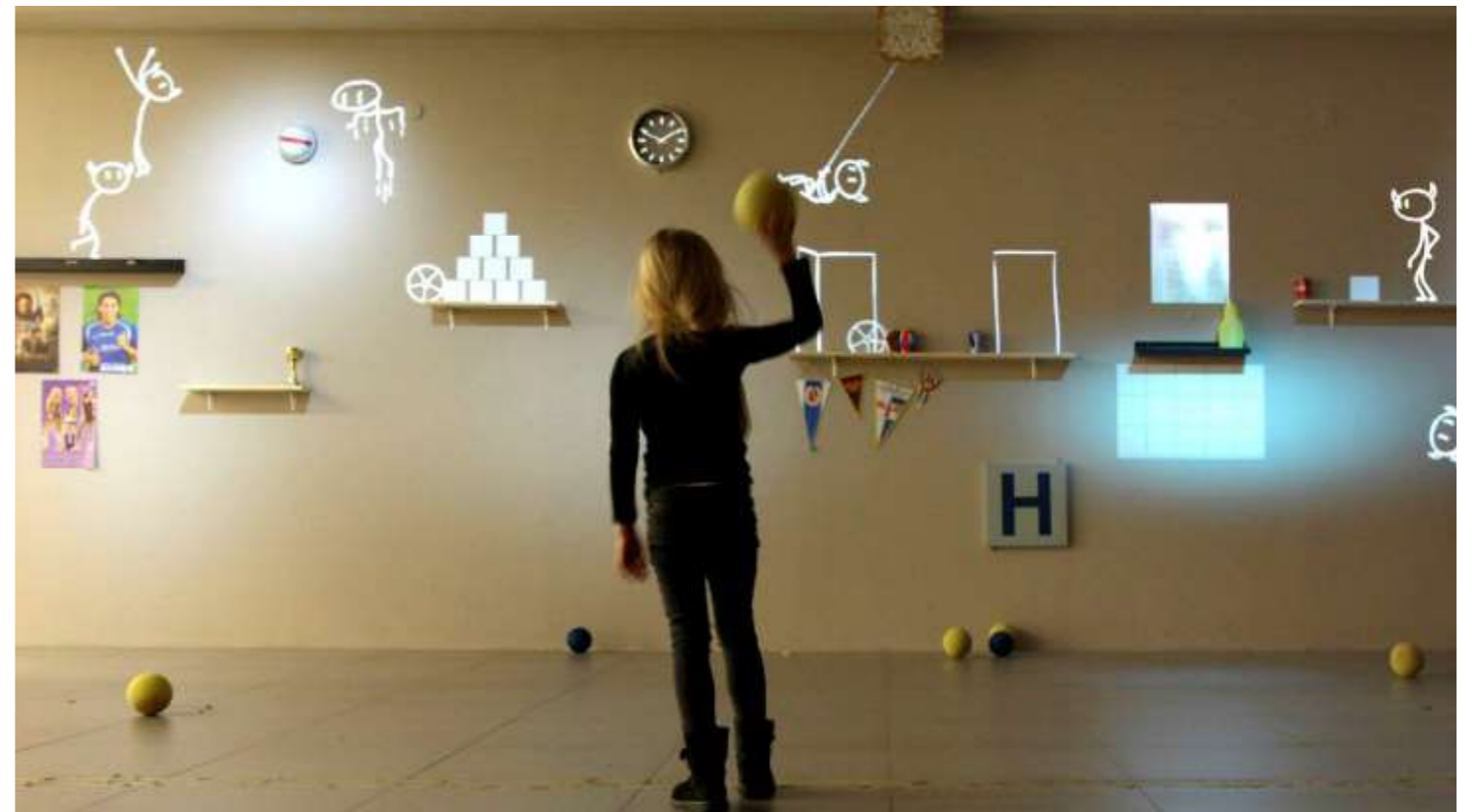
With augmented reality, you can:

- Attract more visitors.
- Bring exhibitions to life.
- Provide play-and-learn experience.
- Recreate historical events and structures. .
- Inform people.



Augmented Reality experience projection mapping Digital Playgroundz, Initi

- Combines projection mapping and large-scale motion detection to introduce interactive experiences to real environments.
- The platform is designed to encourage playful interactions and bring people together to socialize using game-like stories and virtual characters.
- The technology can transform any flat surface into a multi-touch area to turn it into a gaming stage of an unlimited size and engage an unlimited number of users in interactive games simultaneously.
- The system consists of a custom-built PC, high-end motion detection units, projectors and proprietary software.
- The virtual playground can be projected on multiple walls using one or more projection units. It works best in dimmed light, in spaces with real objects on the wall, which the game can use to create virtual objects.

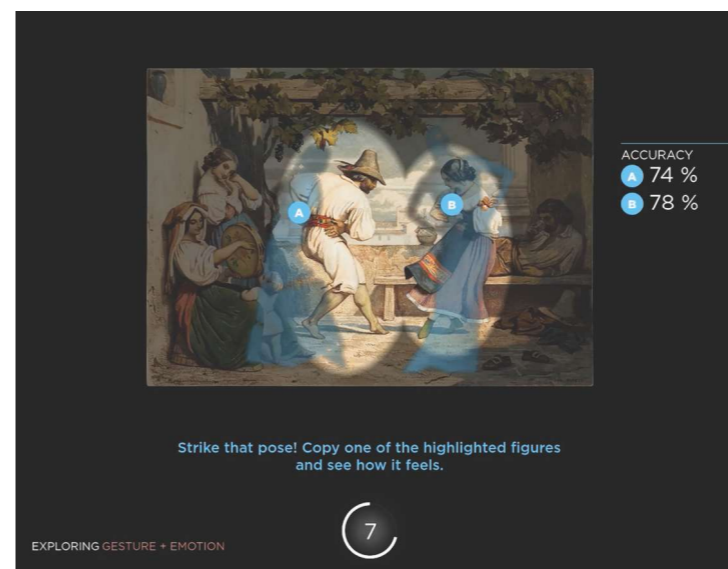
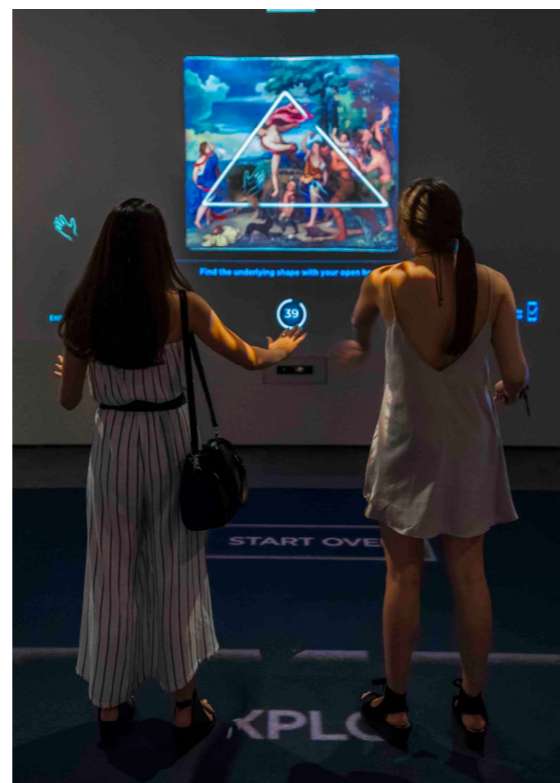


Augmented Reality experience ArtLens

- ARTLENS Exhibition at Cleveland Museum of Art allows visitors to digitally interact with art as never before
- In the reinvented ARTLENS Exhibition, visitors are able to interact with the foundational principles of what makes art art, and gain a new understanding of their own subjectivity.
- Instead of creating a digital block in front of art, we want art to sit in front of digital.
- Instead of a complex interface, could visitors meaningfully explore digital representations of artworks by using their bodies?
- In ARTLENS Exhibition, we use scale dynamically to create drama, engage visitors and help influence how they look at art throughout the museum.

Overview

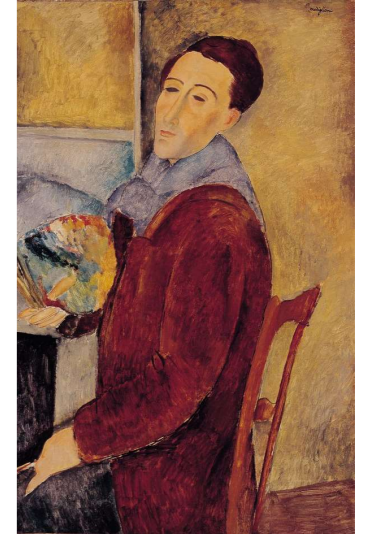
- 16 different multi-player games with over 1,000 artworks
- New features including full body gesture, facial recognition, and gaze tracking
- Over 70' of immersive projection
- Real-time bluetooth syncing to visitors' personal devices
- 100% fully updatable



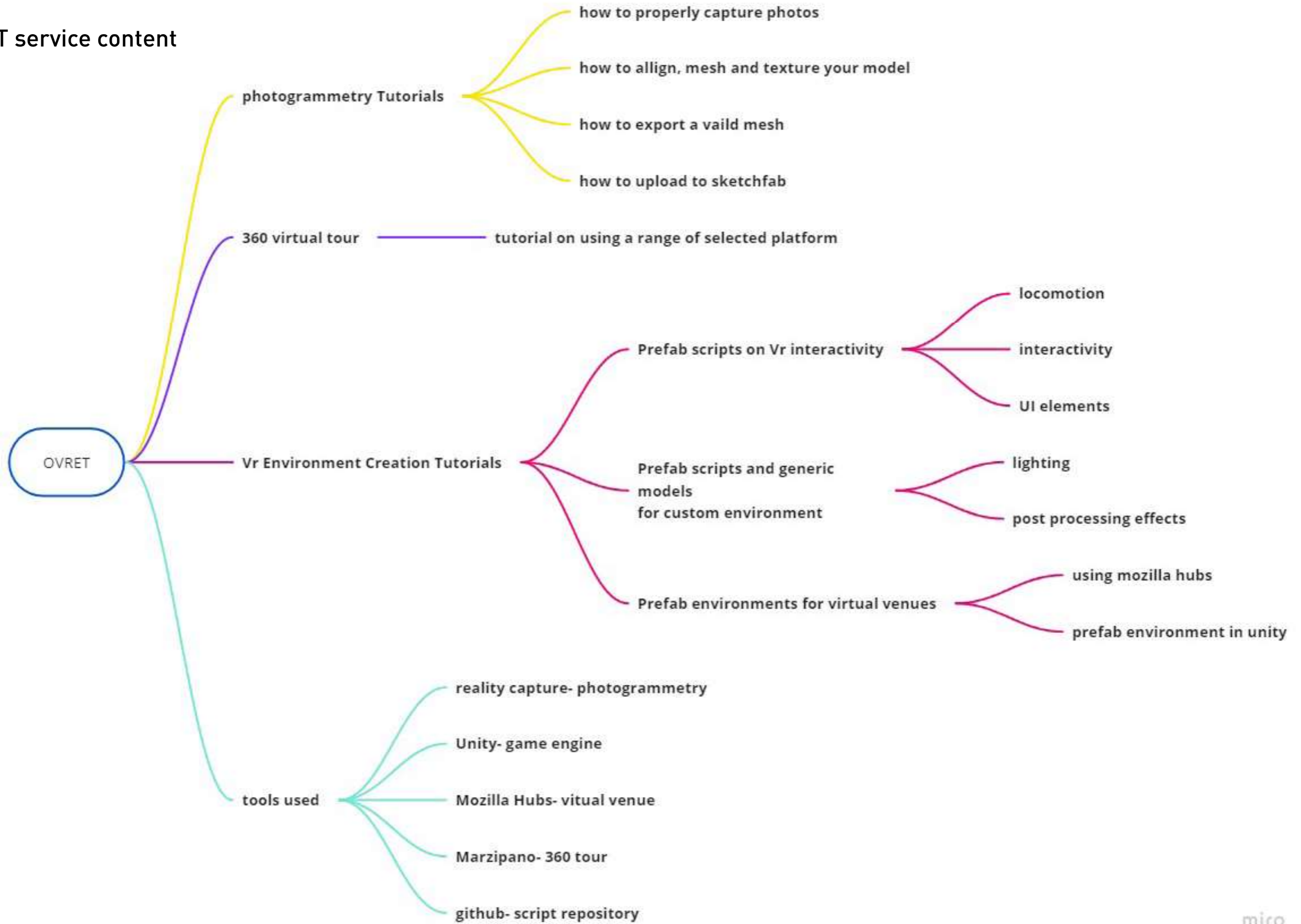
TATE

Modigliani VR The Ochre Atelier

- Modigliani's final studio still exists, but almost 100 years after the artist's death, its appearance has changed significantly.
- Through study of documentary material and of Modigliani's works themselves, the environment in which the artist made his last works is reimagined.
- In this VR experience you can immerse yourself in a virtual reality recreation of Modigliani's final studio, which uses the actual studio space as a template.
- The Modigliani VR: The Ochre Atelier can be experienced as part of the Modigliani exhibition at Tate Modern 23 November 2017 – 2 April 2018.
- The Modigliani VR: The Ochre Atelier reimagines Modigliani's final Parisian studio, where he lived and worked in the final months of his life in 1919 and 1920. A previously undocumented space, the artist's studio has been brought back to life through more than 60 objects, artworks and materials.
- Almost 100 years since the artist's death, hear the words of those who knew Modigliani best and explore the studio where he is likely to have painted Self-Portrait 1919.



OVRET service content



Tools used in OVRET

Photogrammetry tutorials using Reality Capture

Advantages:

- Fast, very quick results with minimum training
- Easy for beginners, advanced functionality for expert users
- Free to download- PPI licence- Pay per input



RealityCapture

Images Remove

Number of images

Megapixels per image

Cost € 6.25 (625 PPI Credits)

Images Remove

Number of images

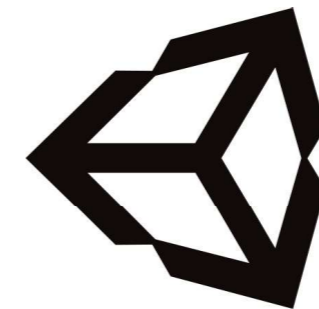
Megapixels per image

Cost € 112.5 (11250 PPI Credits)

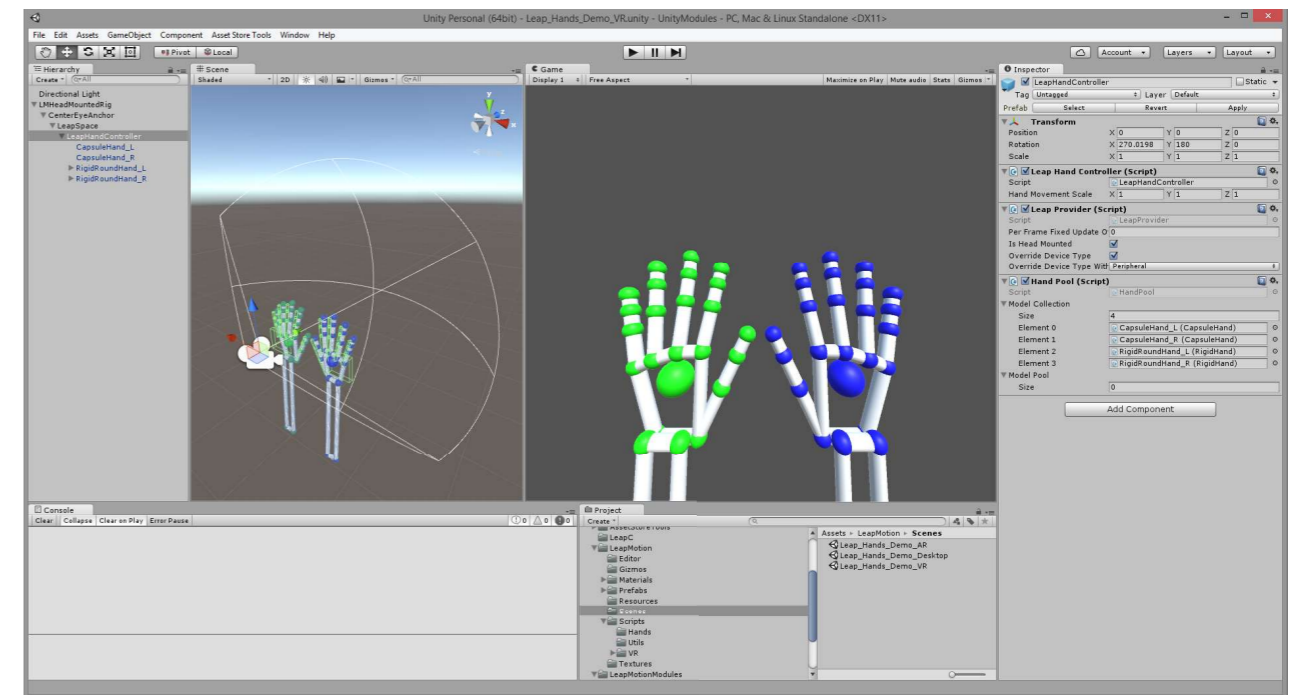
Vr environment Creation tutorials using Unity Game Engine

Advantages:

- Open Source, free to download
- Huge community support
- Lots of Assets and prefabs to choose from

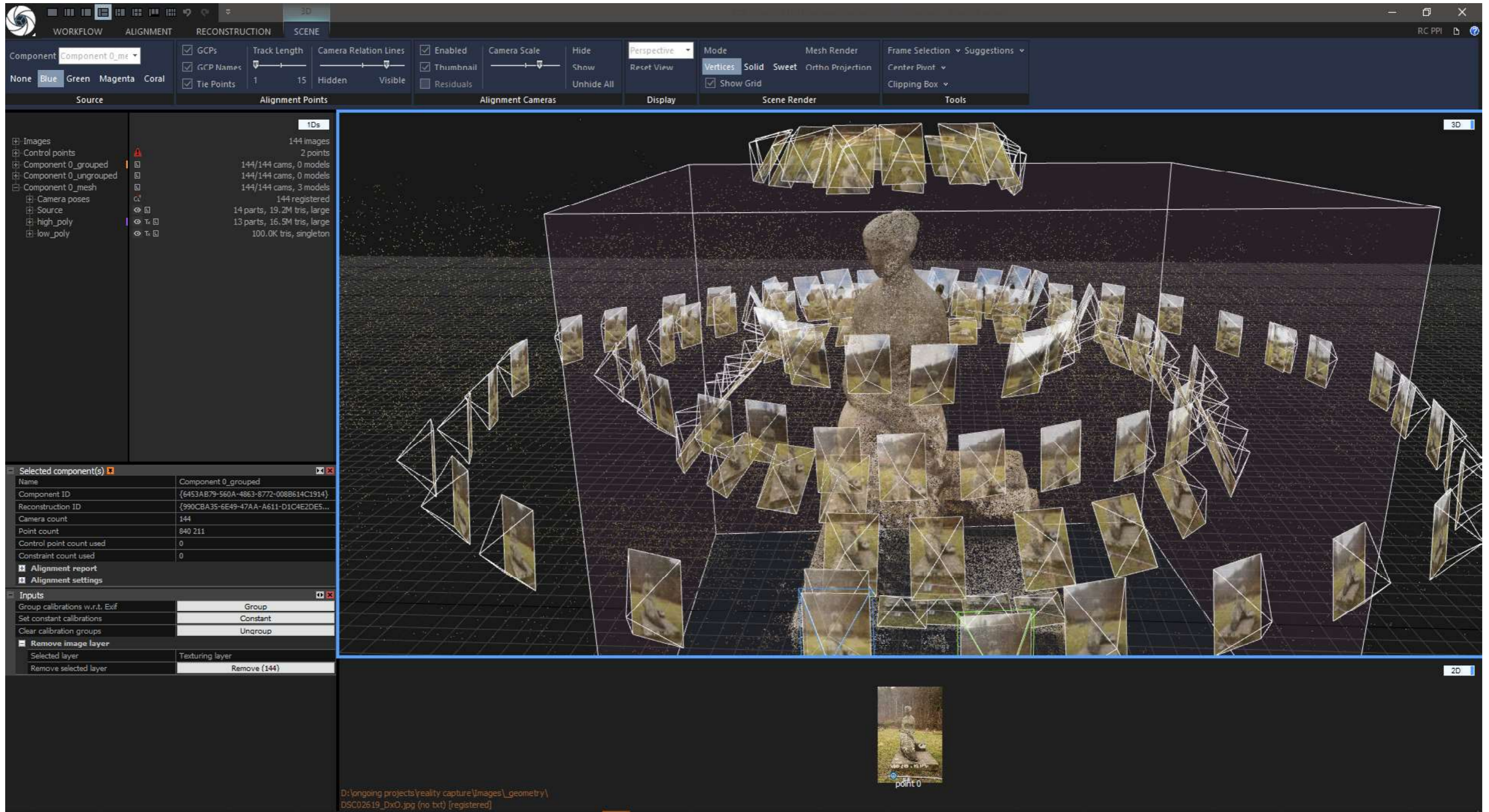


unity



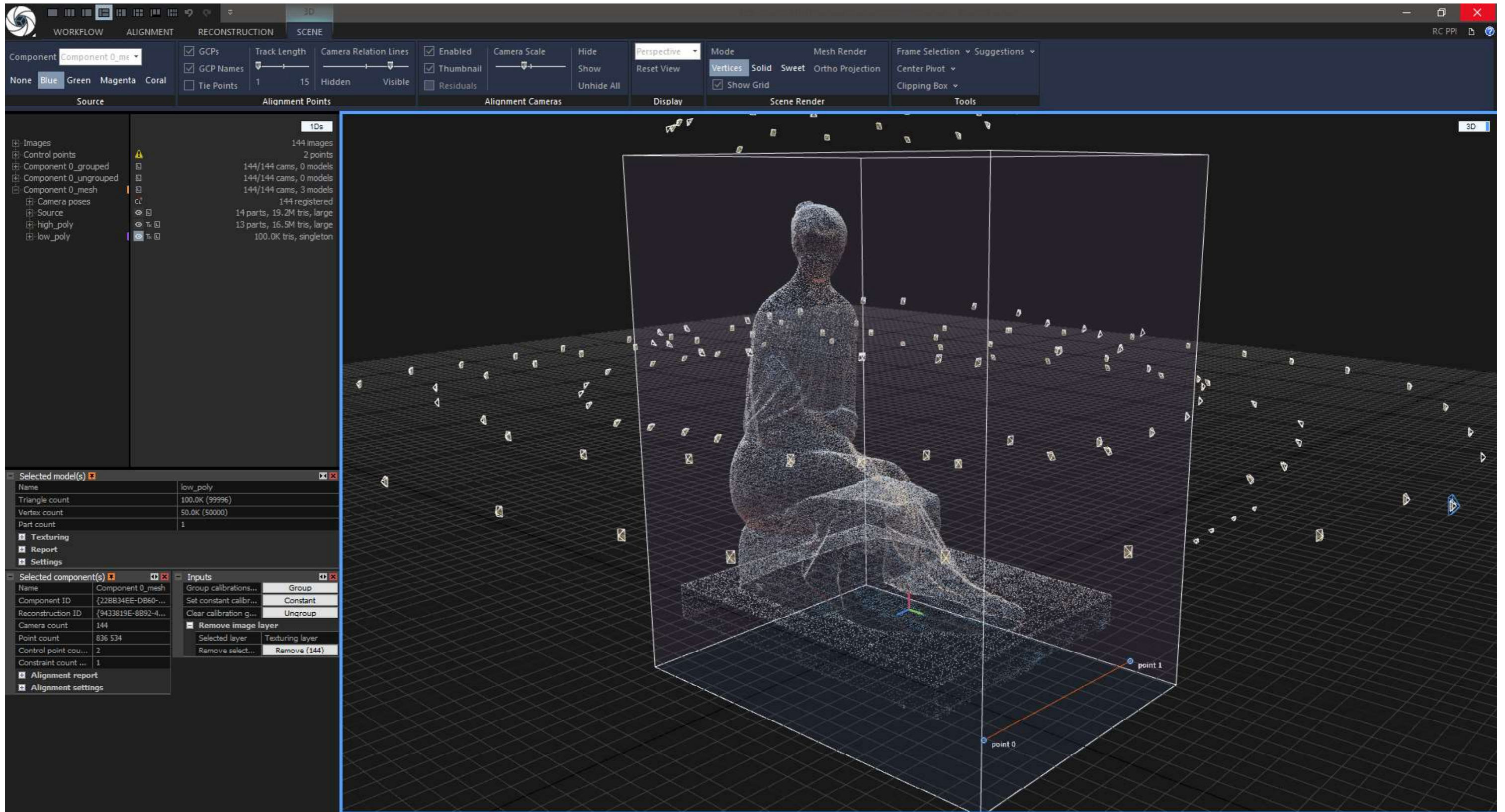
Photogrammetry Process

1. Align and process input images



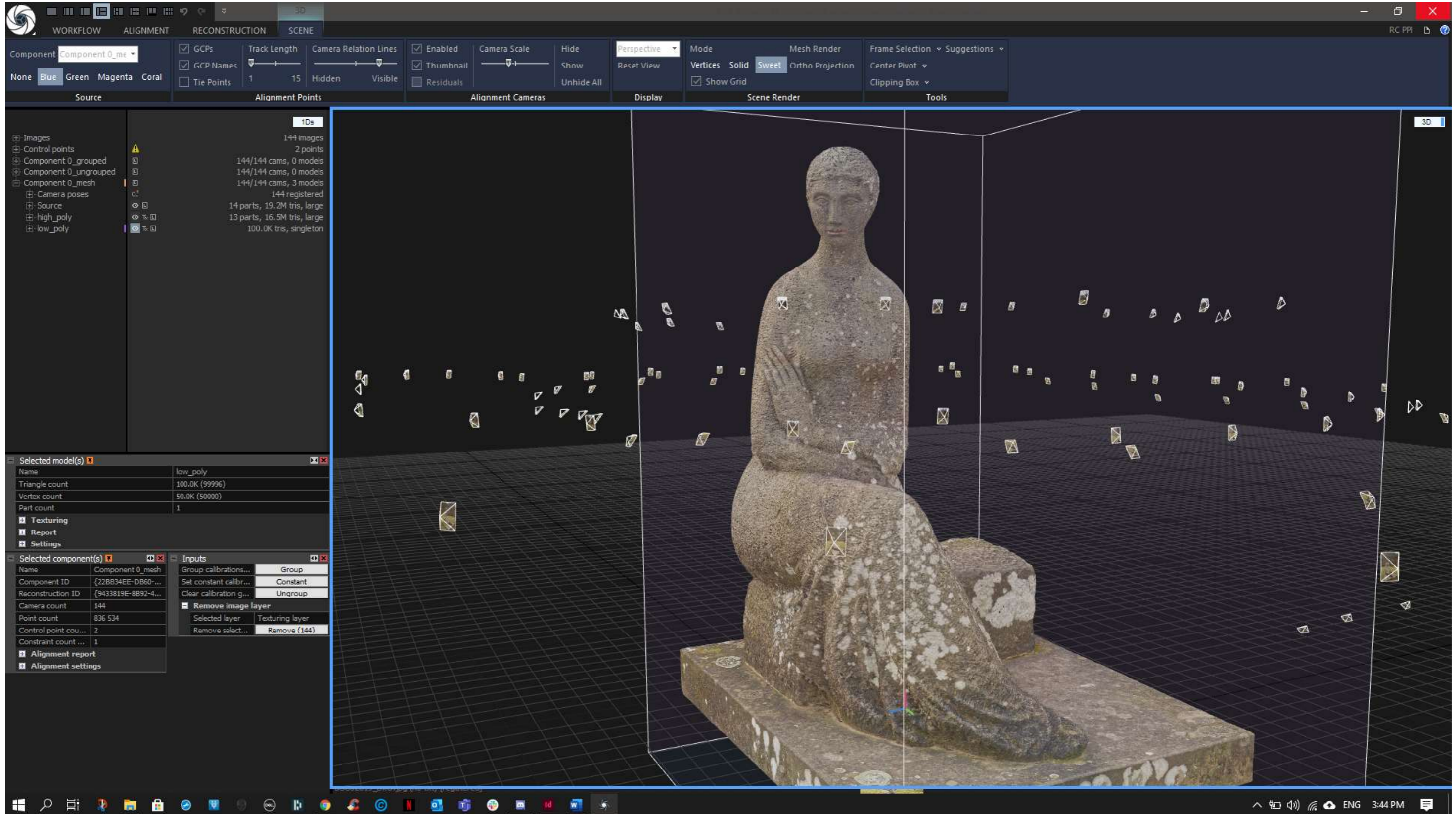
Photogrammetry Process

2. Create the Sparse Point Cloud



Photogrammetry Process

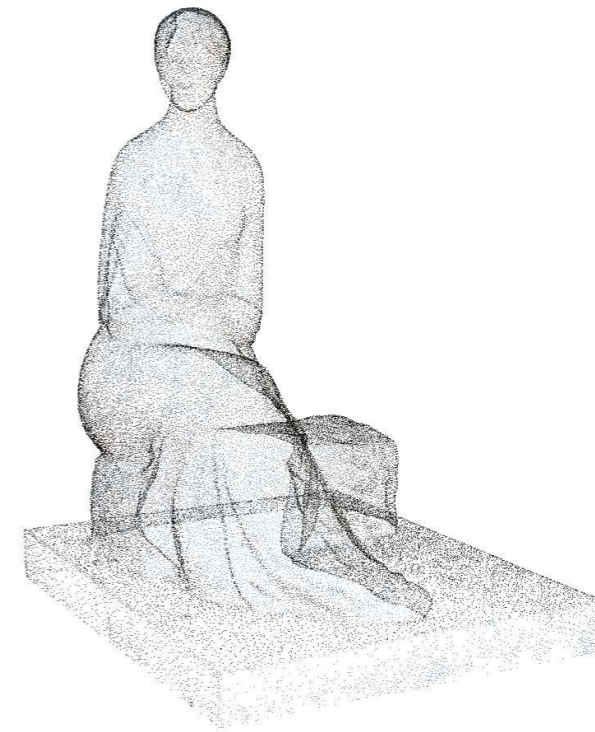
3. Create Mesh model and Texture



Photogrammetry Process
4. Export model and assets



input photo



point cloud



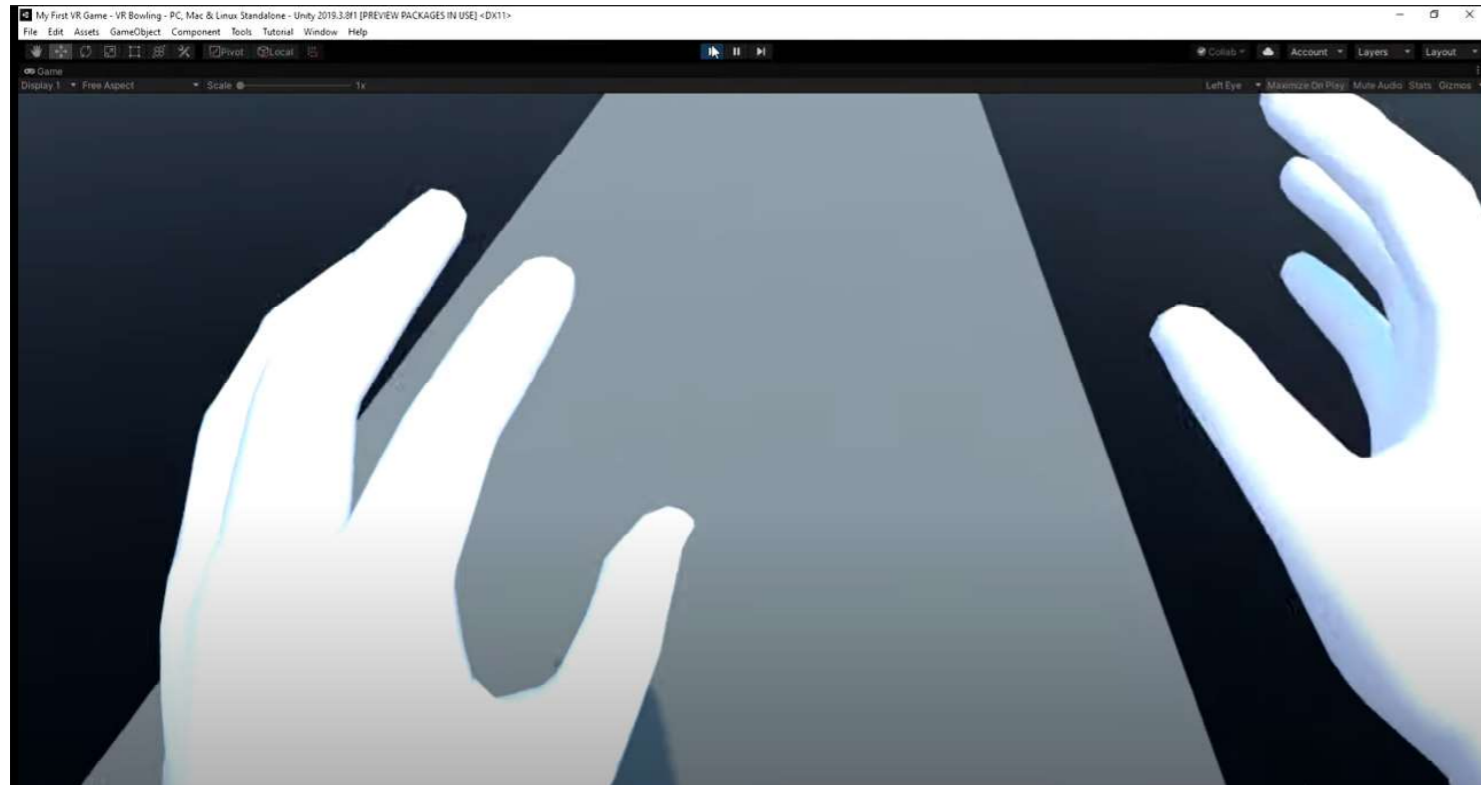
textured mesh



mesh model

VR interaction

1. Setup VR hand and controller



hand tracking



gestures

all scripts and prefabs will be generically preprogrammed and can be used in a plug and play logic

```
HandPresence.cs
Assembly-Charp
HandPresence
UpdateHandAnimation()

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if(prefab)
{
    spawnedController = Instantiate(prefab, transform);
}
else
{
    Debug.LogError("Did not find corresponding controller model");
    spawnedController = Instantiate(controllerPrefabs[0], transform);
}

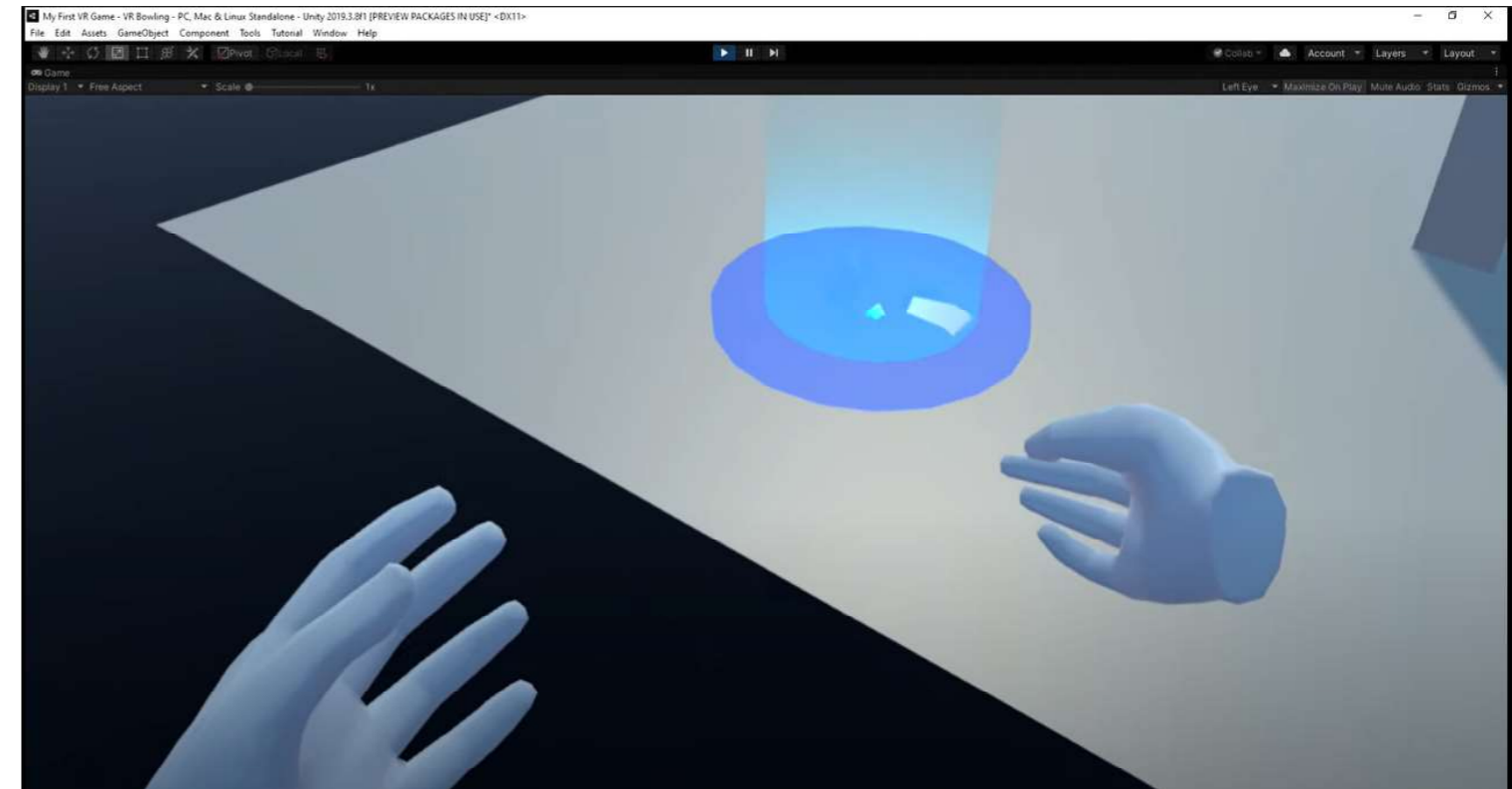
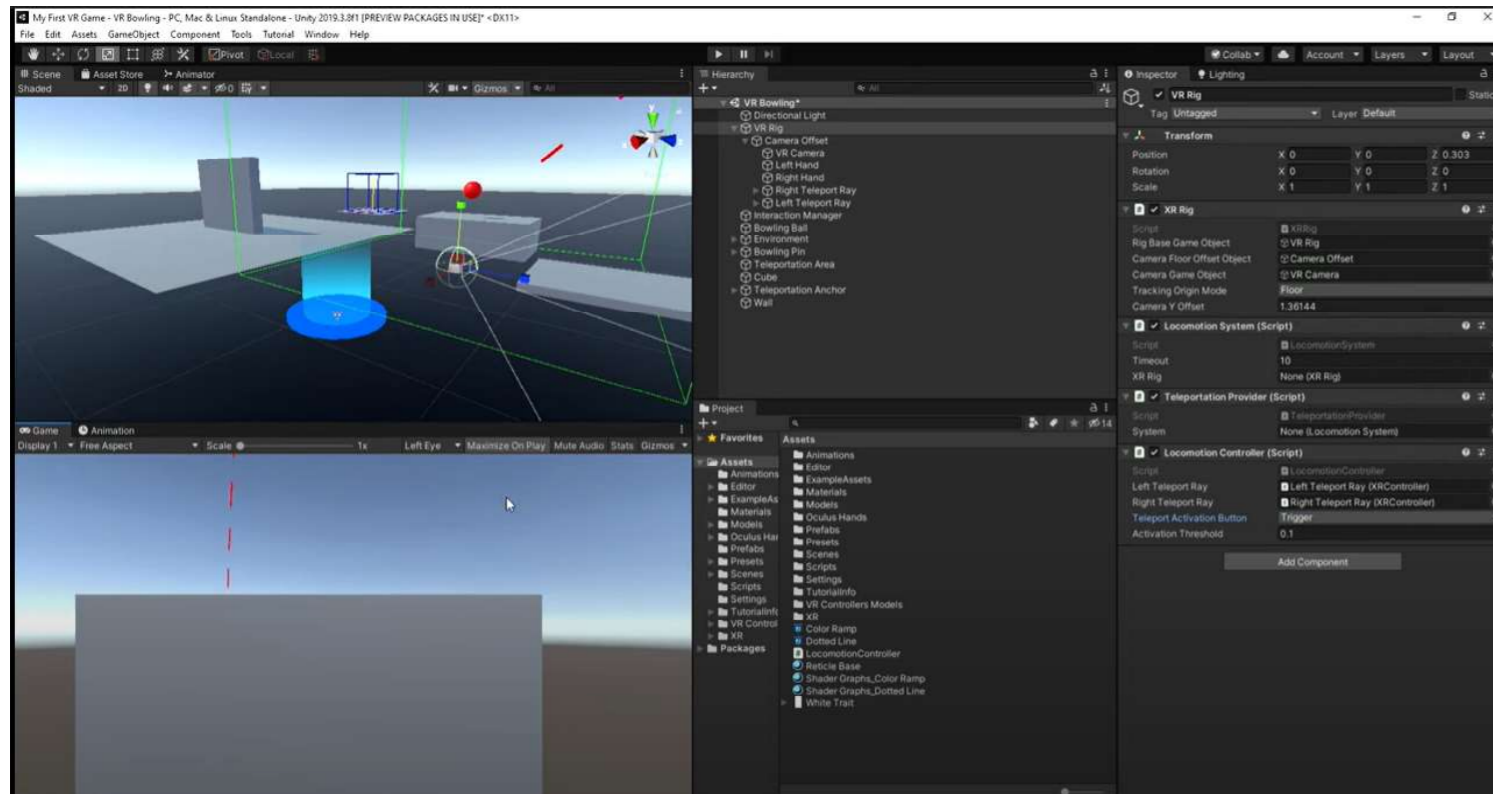
spawnedHandModel = Instantiate(handModelPrefab, transform);
handAnimator = spawnedHandModel.GetComponent<Animator>();
}

void UpdateHandAnimation()
{
    if(targetDevice.TryGetFeatureValue(CommonUsages.trigger, out float triggerValue))
    {
        handAnimator.SetFloat("Trigg")
    }
}

// Update is called once per frame
void Update()
{
    if(showController)
```

VR interaction

2. Locomotion System- teleportation

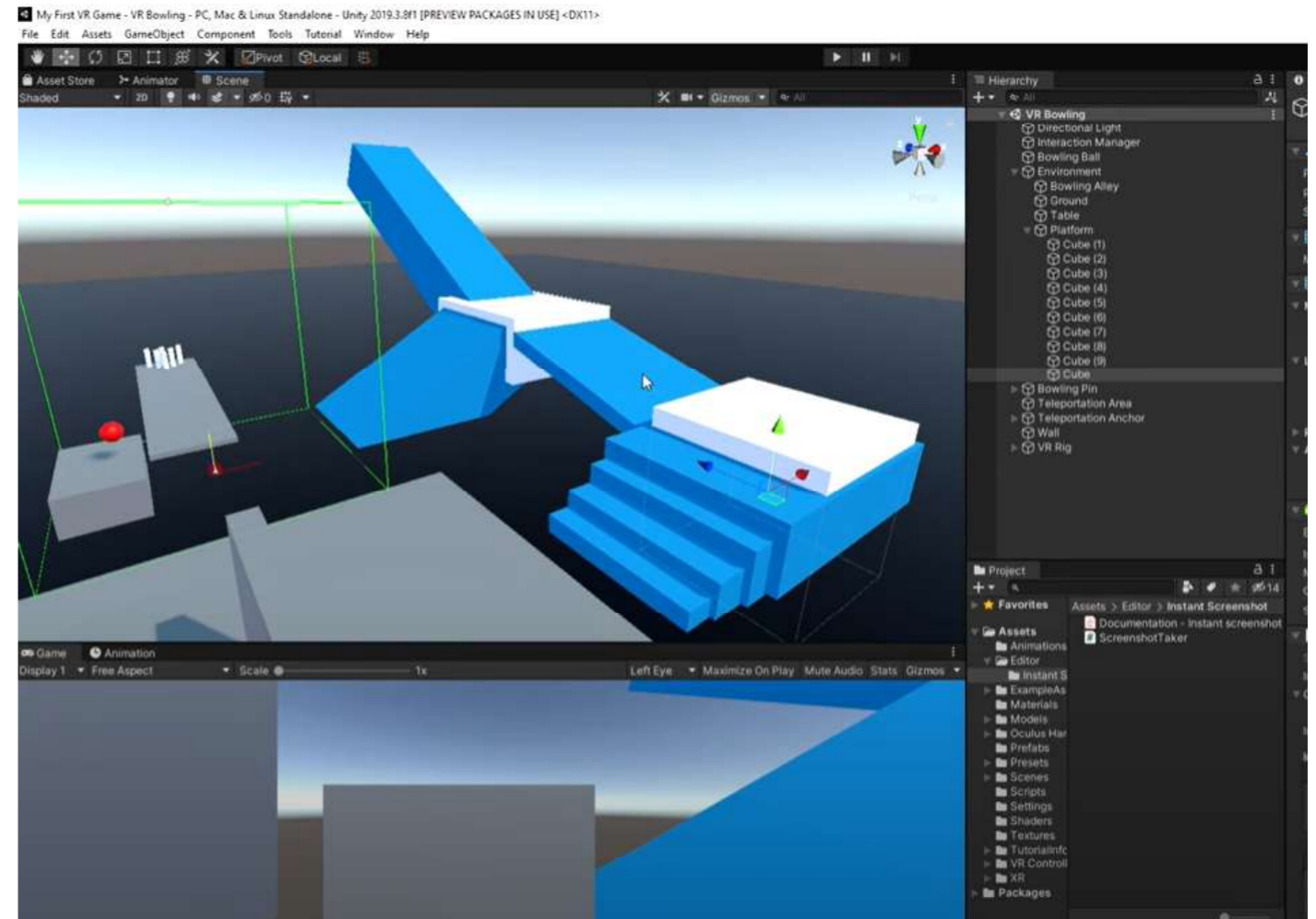
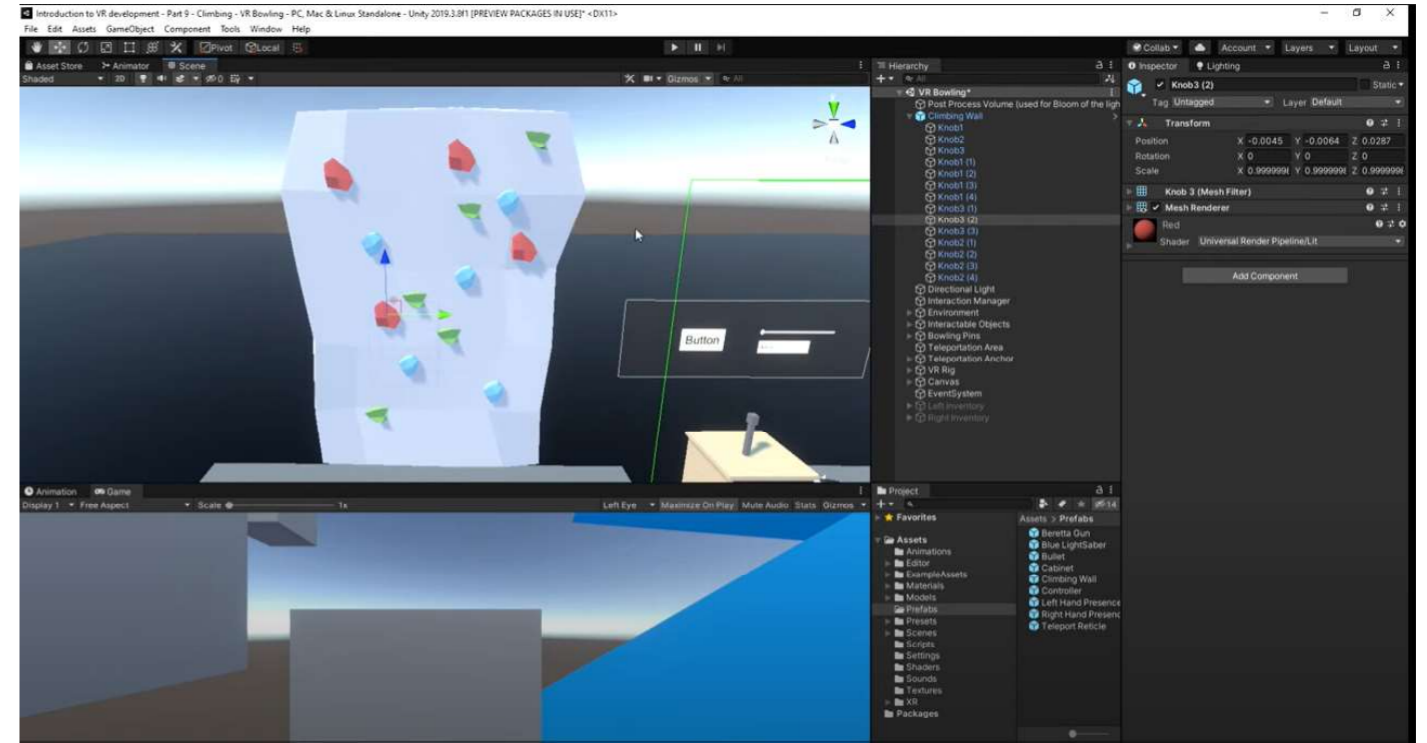


- most efficient way to move in VR- teleportation
- least propable method to develop nausea and disorientation
- retacle for targeting
- turns on based on threshold force on the grip



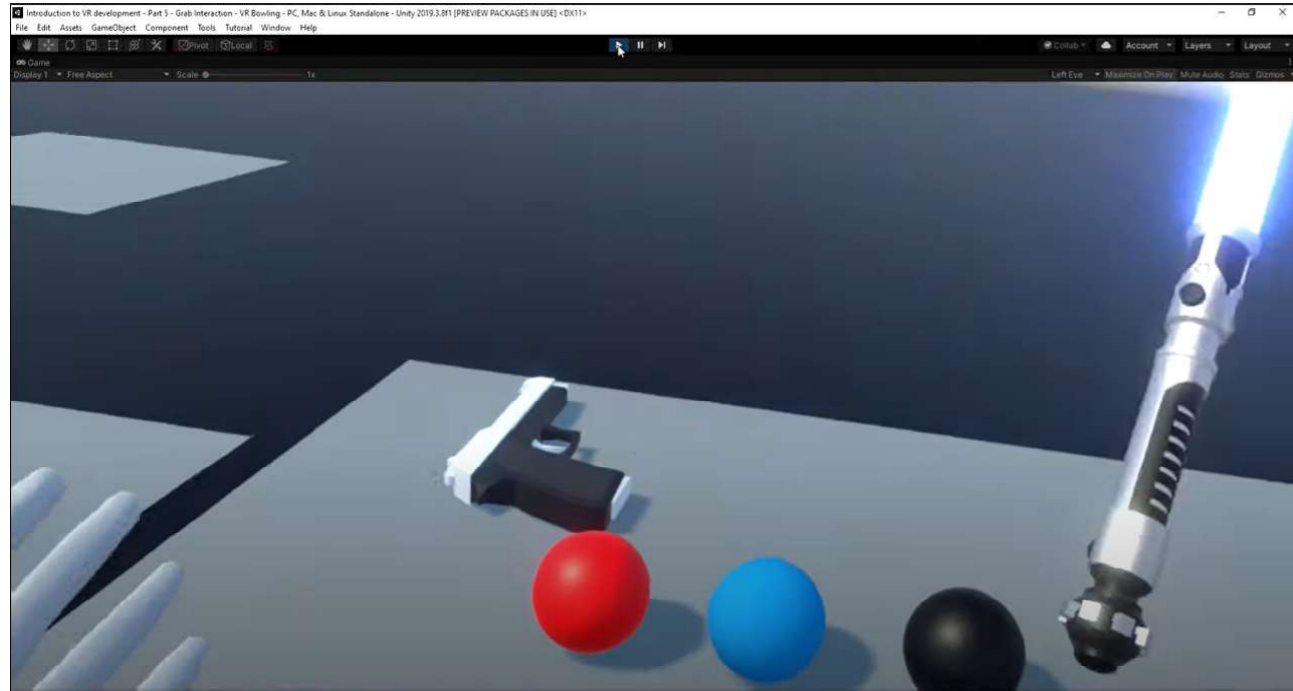
VR interaction

3. Advanced Locomotion System- Free walk and climbing

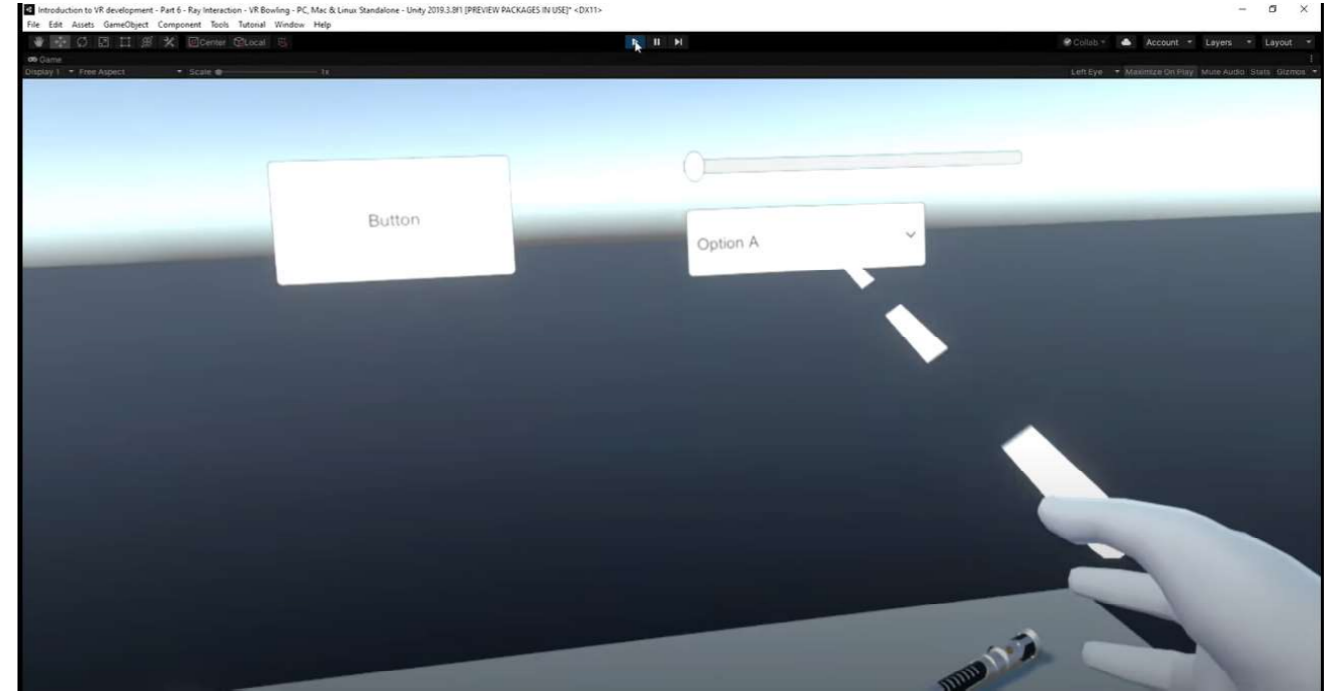


VR interaction

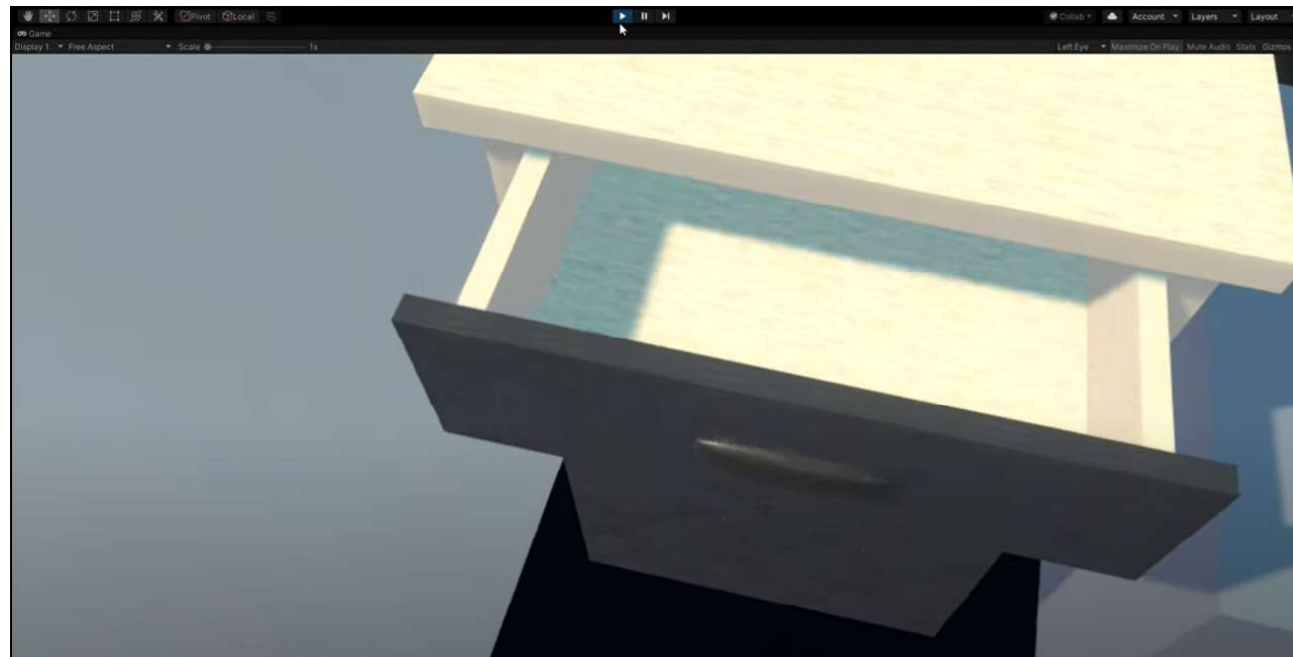
4. Vr interaction



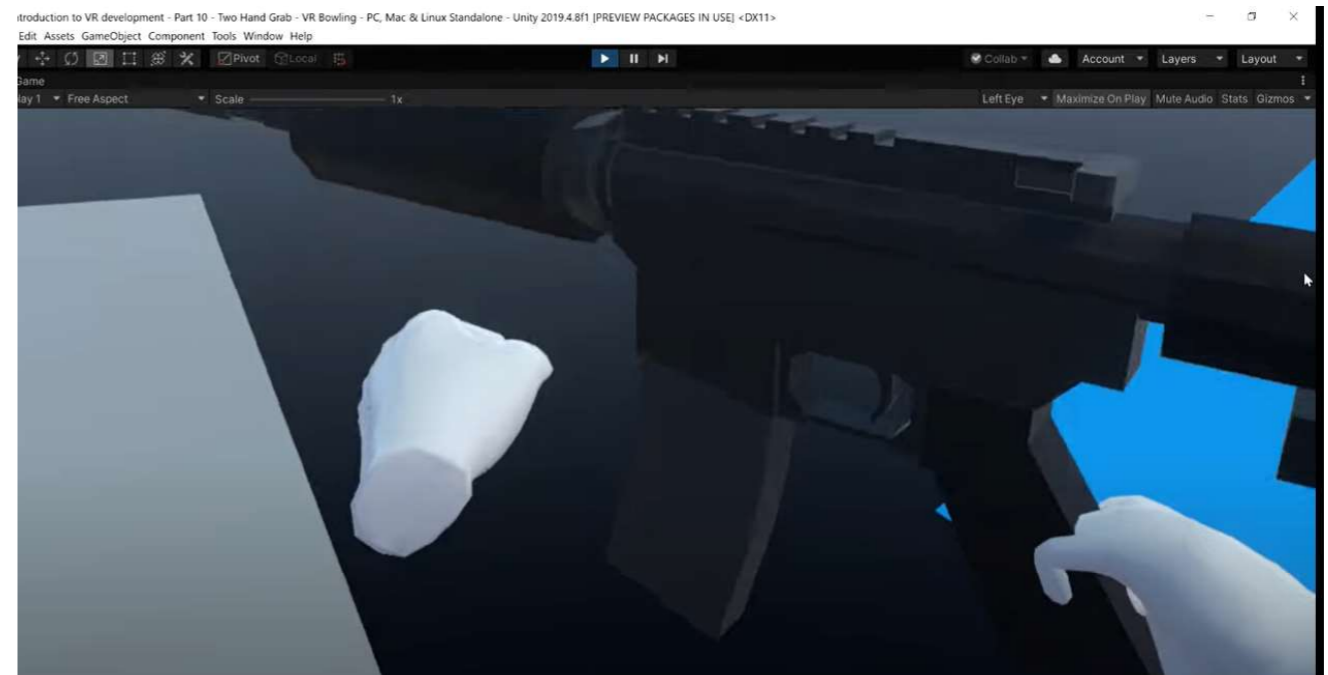
grab interaction



ray- interaction and buttons



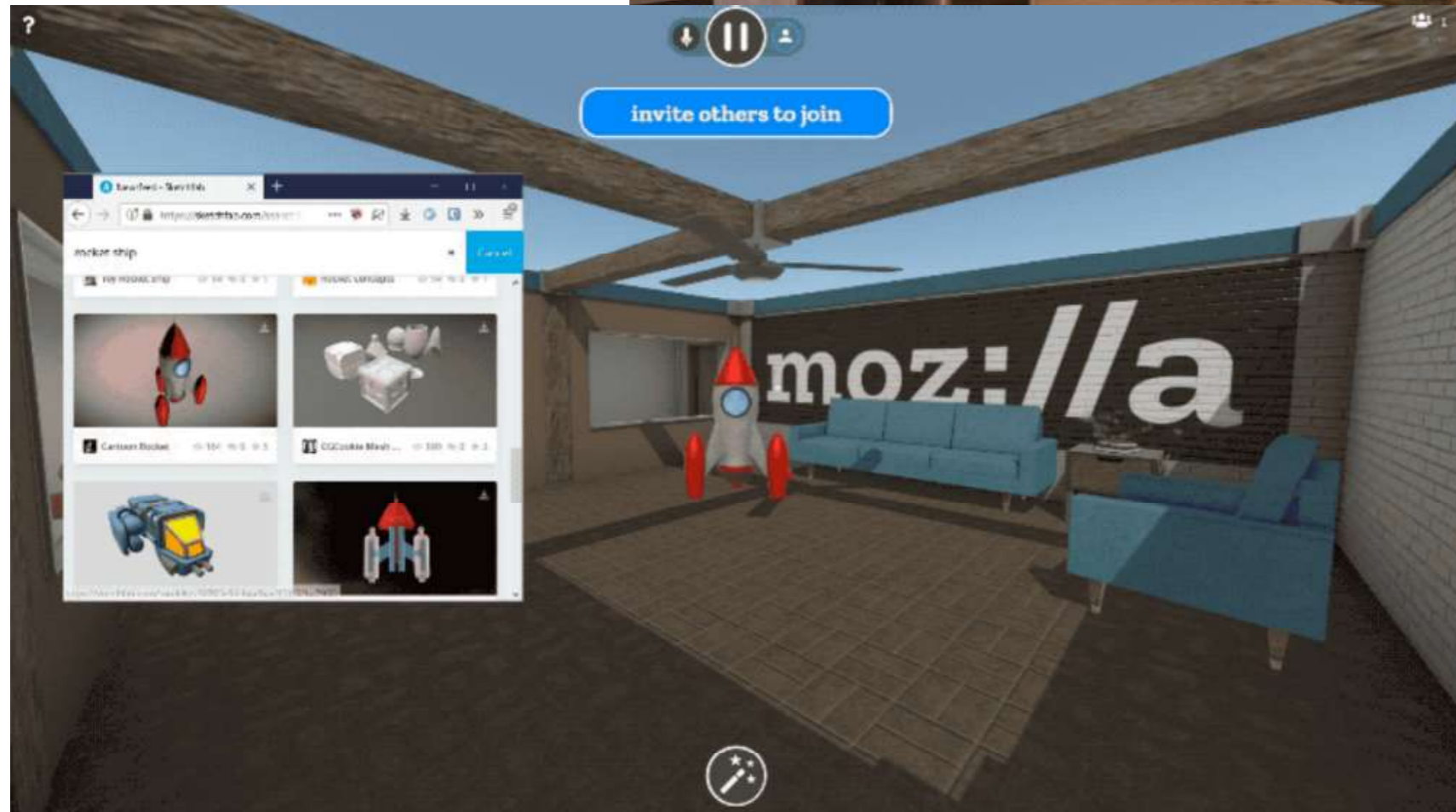
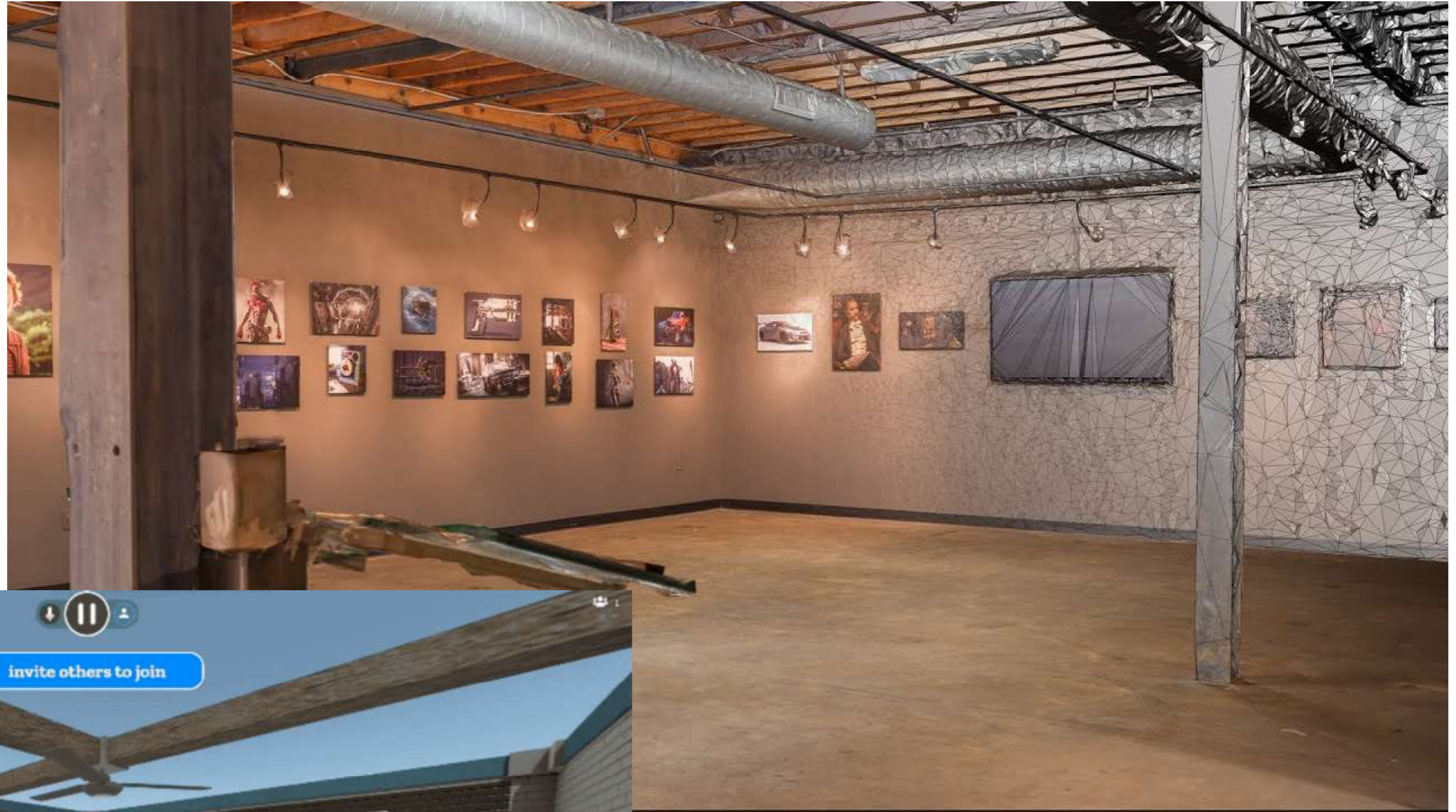
lever and doors interactions



two hand grab interaction

Environment preparation

- lighting settings prefab
- post processing effects
- UI prefabs and info markers
- use photogrammetry generated environment
- use a virtual venue such as mozilla hubs



User input

visit link and lets co-create! co-imagine! co-develop!

<https://miro.com/welcomeonboard/YdwqQwuheET9jxnI0kH0HKT2koT6IrrEsYSdikL9rc-dRW6v8jmsG6XqDsie24ugj>

References

youtube links:

- <https://www.youtube.com/channel/UCPJlesN59MzHPPCp0Lg8sLw> -Valem VR tutorials
- <https://www.youtube.com/channel/UCG8bDPqp3jykCGbx-CiL7VQ> -VR with Andrew
- <https://www.youtube.com/channel/UCgd3l8iA5zBYVa4sQ6-ONFw> - Unity Gurus

Academies:

- <https://learn.unity.com/project/vr-beginner-the-escape-room?tab=overview> -Vr game- the escape room
- <https://www.thegnomonworkshop.com/>

Presentation material

- <https://timemachineproject.eu/>
- <https://fablabbcn-projects.gitlab.io/fablab-barcelona-virtual-360-tour/>
- <https://mpembed.com/show/?details=1&ga=UA-32443811-1&hdir=2&m=pq6v8gMmxMw&mdir=3&minimap=2&minimap-tags=0>
- https://arts.vive.com/us/articles/projects/art-photography/mona_lisa_beyond_the_glass/
- <https://beta.fitz.ms/>
- <https://sketchfab.com/fitzwilliammuseum>
- <https://vi-seem.eu/2018/07/19/virmuf-virtual-museum-framework-for-exhibiting-digitized-collections/>
- <https://fitnessgaming.com/news/events-and-fun/digital-playgroundz-integrates-virtual-games-into-real-environments.html>
- <https://www.potiondesign.com/project/artlens-exhibition/>
- <https://www.tate.org.uk/whats-on/tate-modern/exhibition/modigliani/modigliani-vr-ochre-atelier>