



The webinar will begin shortly

# Let's get real: An introduction to AR, VR, MR, XR and more

The webinar will begin at **8 am PT** | **11 am ET** | **4 pm BST**

# ROAD TO THE METAVERSE

CREATOR SERIES

Let's get real:



2022

# An introduction to AR, VR, MR, XR and more



# Meet your **hosts**



**Drew Domokos**

Creator & Developer Advocate



**Vanesa Mendez**

Creator Advocate



**Jerome Maurey-Delaunay**

Senior Technical Specialist

[@jeromemaurey](#)



**Ben Radcliffe**

Senior Technical Specialist

[@lightandalchemy](#)



# Agenda

- **Introduction** (5 minutes)
- **Let's get real: An introduction to AR, VR, MR, XR and more** (45 minutes)
  - What is XR?
  - XR platforms overview
  - Getting started with XR in Unity!
- **Q&A + Wrap-up** (10 minutes)
- **Overtime!** (30 minutes)
  - XR best practices
  - Visual Scripting Extensions for XR Interaction Toolkit

Survey available [here](#) →





# Introduction

Tales from the Metaverse!

# Cause + Christi: Sky Temple

*A digital twin of the Al Wasl Dome in Dubai*





HBO ORIGINAL

GAME OF THRONES

HOUSE OF THE DRAGON  
DRACARYS



# The Metaverse Minute

<https://blog.unity.com/topic/metaverse-minute>

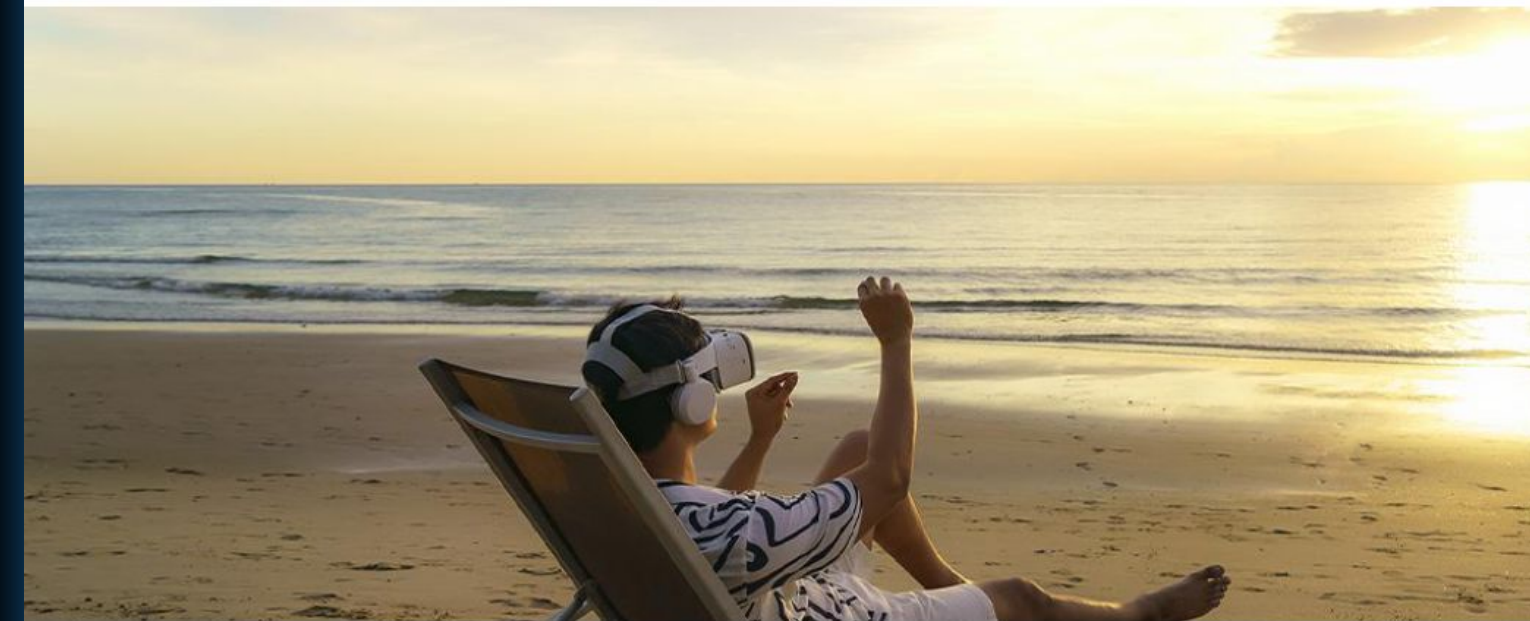


## Metaverse Minute: Reimagining summertime travel



By Community Team

July 28, 2022 in Manufacturing | 4 min. read



Topics covered

Manufacturing

Digital Twin

Metaverse Minute

Share



### Metaverse Minute: Reimagining summertime travel

It's July, which means it is time for summer holidays! We hope you're reading this edition of the Metaverse Minute from the beach with a piña colada, but if you're not, we have some options for you. Here are four ways to travel with Unity.





# Road to the Metaverse: Forums!

<https://forum.unity.com/forums/road-to-the-metaverse.798/>



## Road to the Metaverse

Filter by tag:

Title	Start Date	Replies	Views	Labels
<input type="checkbox"/> <b>Official</b> Welcome to the Road to the Metaverse Unity-Gehan, Jun 9, 2022	🗨️ 📌 🛡️	Replies: 3 Edit Views:	469	
<input type="checkbox"/> <b>Official</b> Frequently Asked Questions Unity-Gehan, Jun 9, 2022	📌 🛡️	Replies: 0 Edit Views:	284	
<input type="checkbox"/> <b>Official</b> Welcome to News and Updates Unity-Gehan, Jun 9, 2022	📌 🛡️	Replies: 0 Edit Views:	262	
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# ROAD TO THE METAVERSE

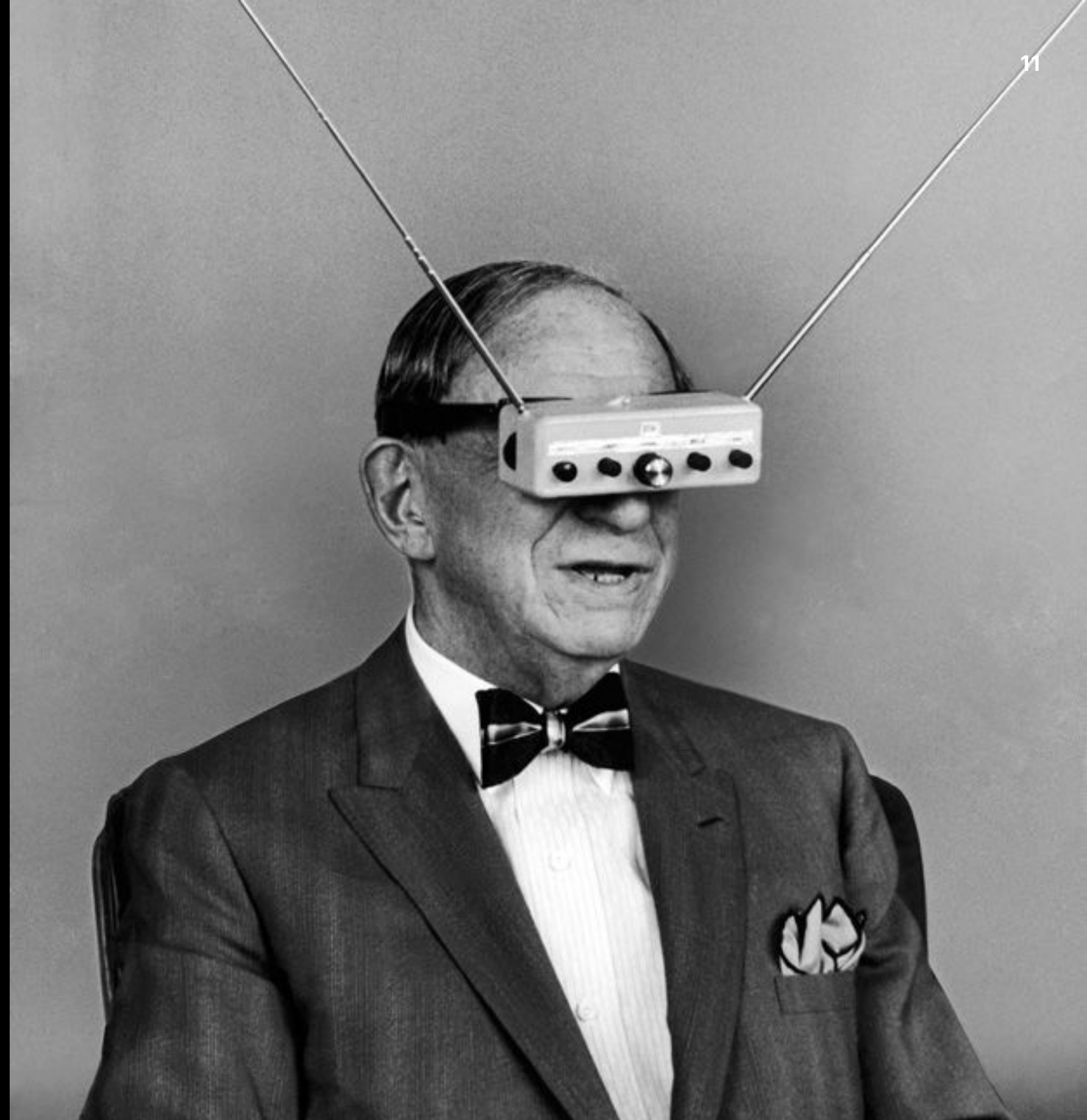
CREATOR SERIES

Let's get real:

An introduction to  
**AR, VR, MR, XR** and more



# What is XR?





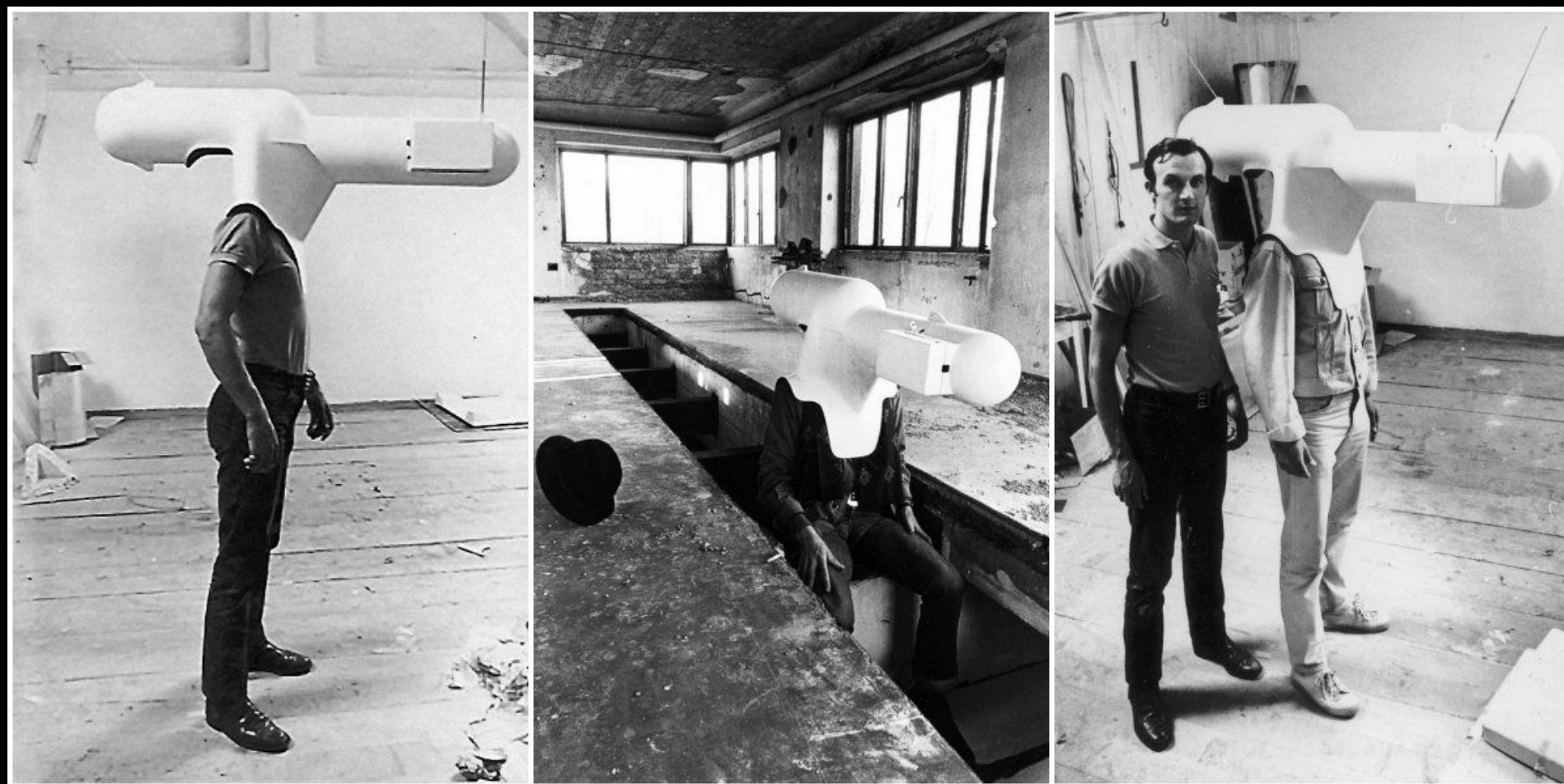
## What is XR?

What is XR? It's shorthand for a related set of new technologies that are changing the way we interact with the world and with each other: Virtual Reality, Augmented Reality, and Mixed Reality.

- **VR** - Virtual Reality
- **MR** - Mixed Reality
- **AR** - Augmented Reality
- **XR** - Umbrella term for all the above

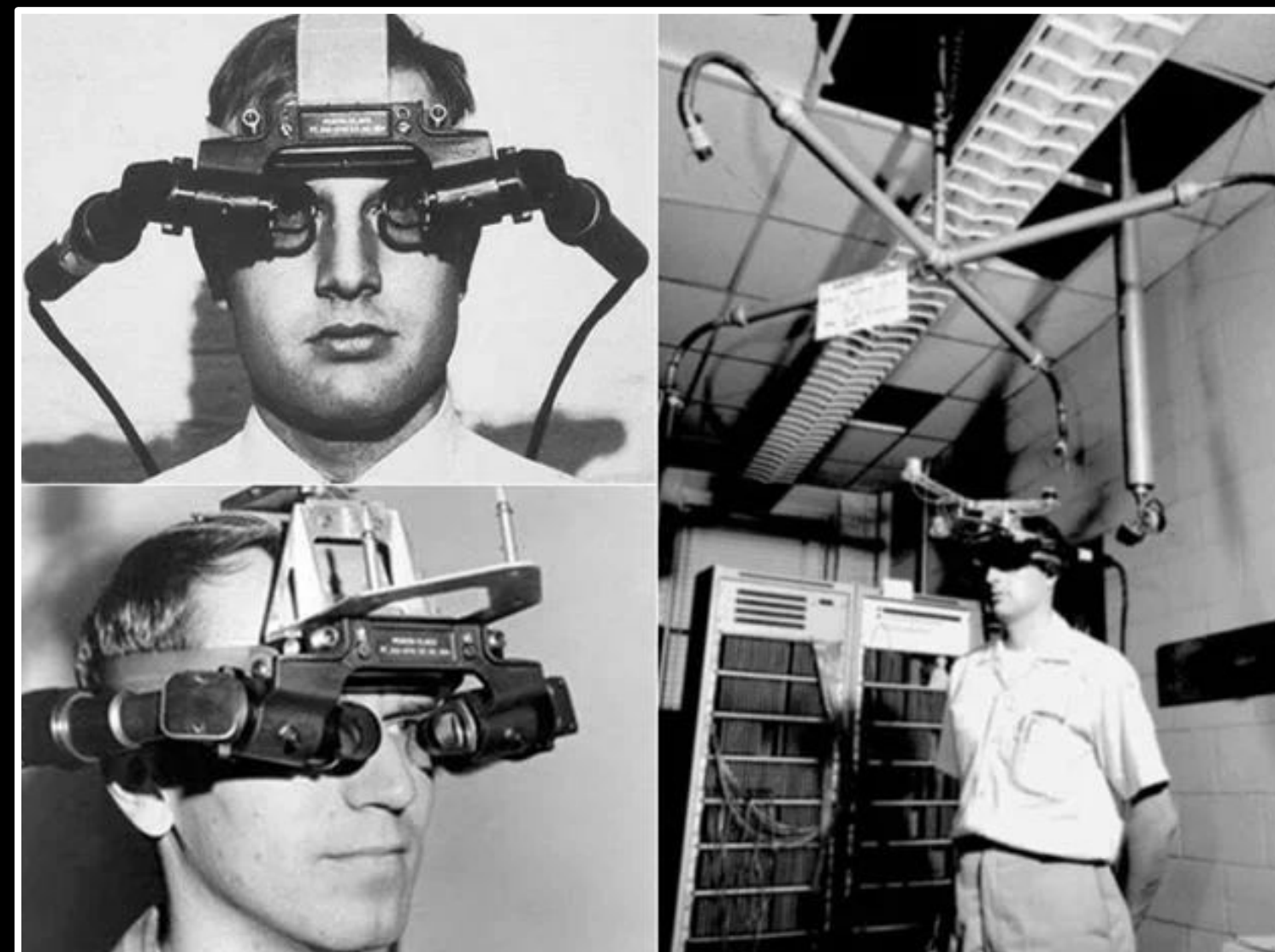


[Unity Learn Intro to XR](#)



## VR

*TV-Helmet (Portable Living Room) by Walter Pichler, 1967*



## AR

*Head-mounted display system for AR was invented by Ivan Sutherland in 1968*



# Virtual Reality Devices

Modern-day VR headsets come in many shapes and sizes.

These headsets consist of the following elements:

- a) Display and optics to generate two separate views, one for each eye.
- b) Input controllers to capture input commands by the user.
- c) Sensors to infer the position and movement as input.

- **Oculus** → Rift, Quest 1 & 2
- **Pico** → Neo 3
- **HTC** → Vive, Vive Focus, Comos, Flow
- **Valve** → Index
- **Varjo** → VR-3, XR-3
- **HP** → Reverb
- **Sony** → Playstation VR
- And so much more!





## Augmented Reality - Handheld

a technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.

Handheld AR offers the most mainstream AR solutions today on social media. People may not even realize that the AR filters they use on Instagram are augmented reality experiences.

- **Google Android - AR Core**
- **Apple IOS - ARKit**

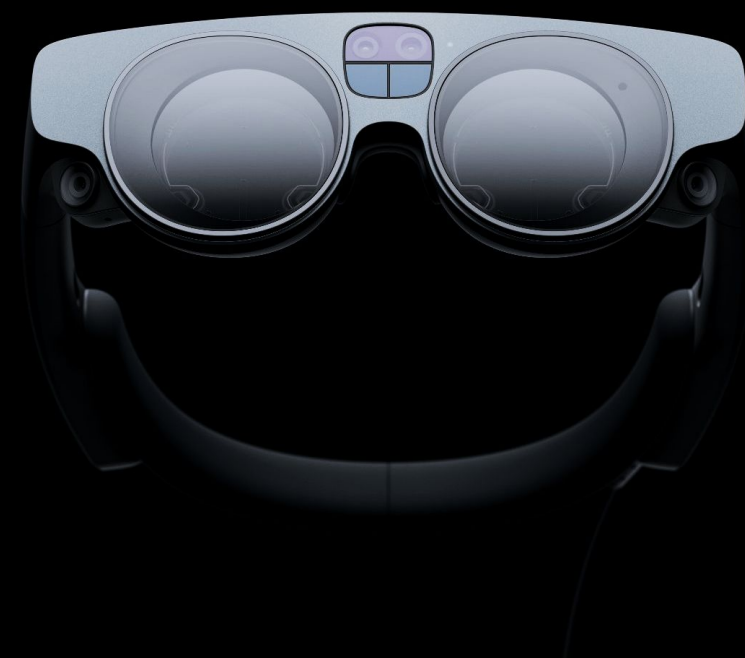




## Augmented Reality - Head-mounted

Augmented Reality HMDs also known as Optical head-mounted displays or OHMDs. The displays of these devices are transparent. They allow users to see through them while projecting images and information in front of the users' eyes.

- **Microsoft HoloLens**
- **Magic Leap**
- **Nreal**
- **Lenovo A3**



[Intro to Unity for HoloLens](#)

[Intro Unity for Magic Leap](#)

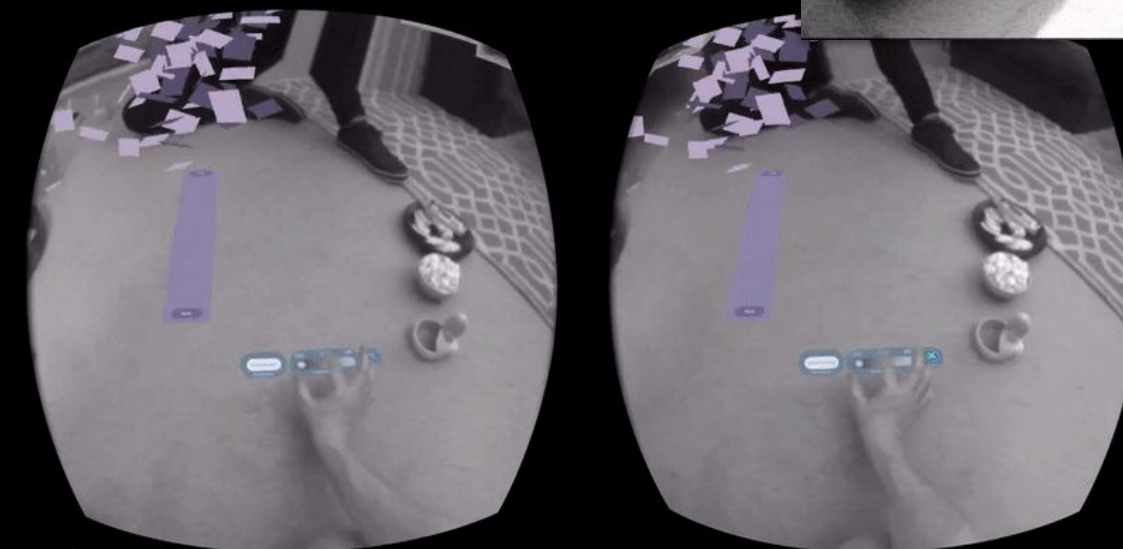
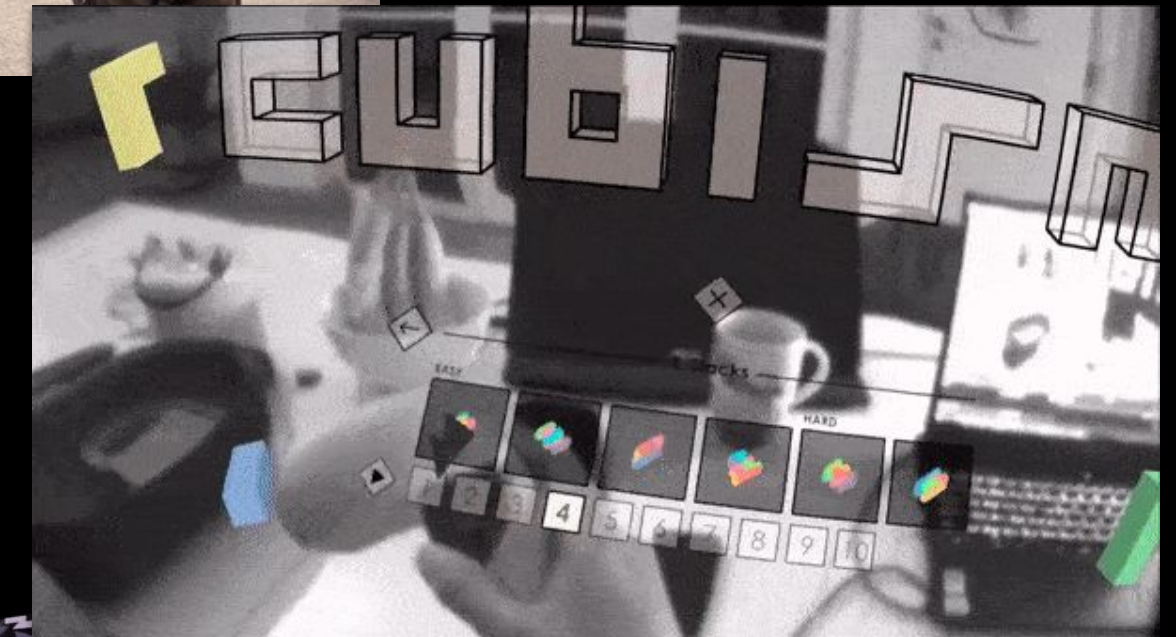




# Mixed Reality

Mixed reality is the merging of real and virtual worlds to produce new environments and visualizations, where physical and digital objects co-exist and interact in real time.

- **Varjo**
- **Quest**
- **Windows Mixed Reality Headsets**



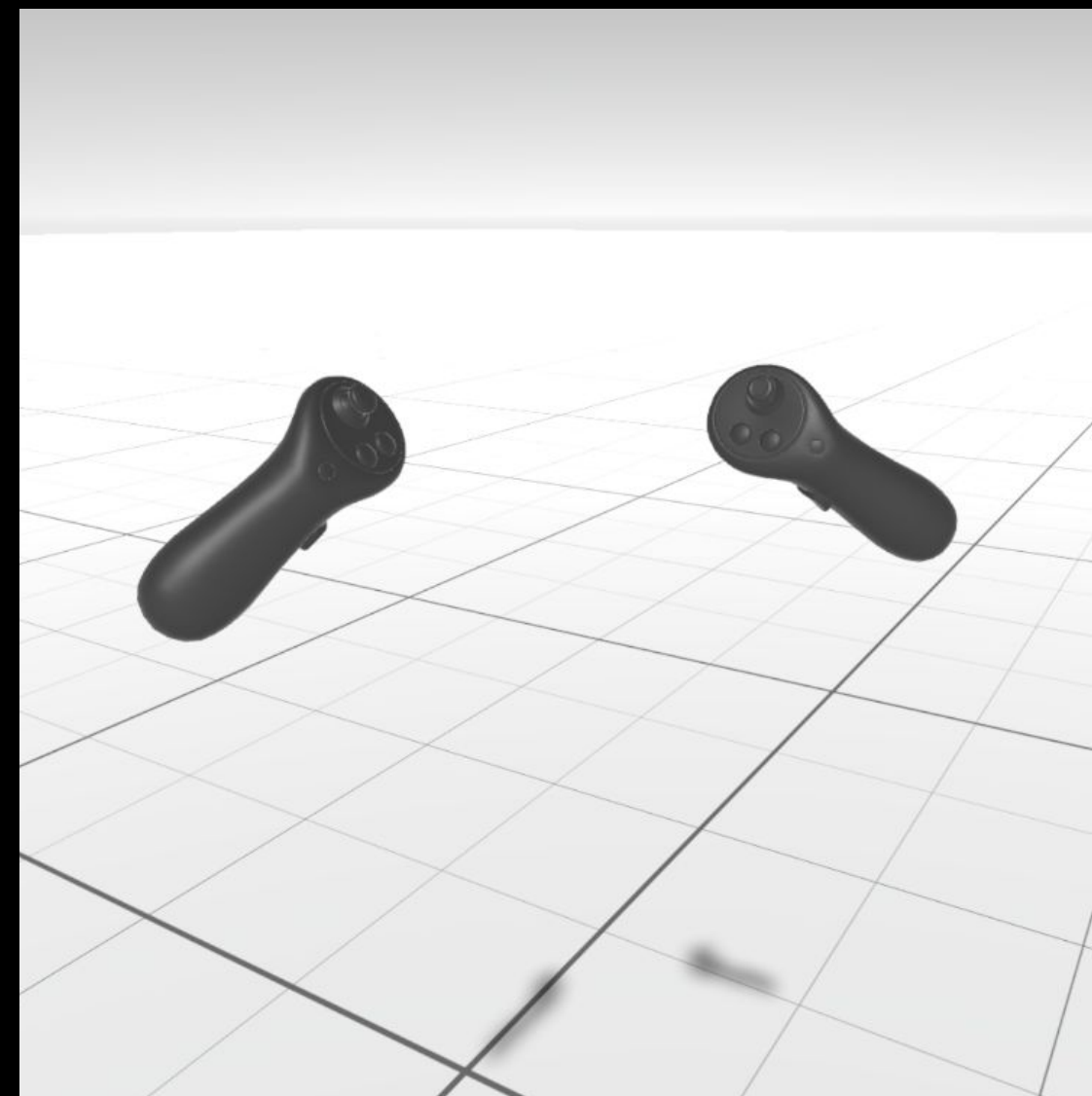
Unity Labs

[Unity Slices Demo](#)



# Let's jump in!

Getting started with the **VR Core Template**





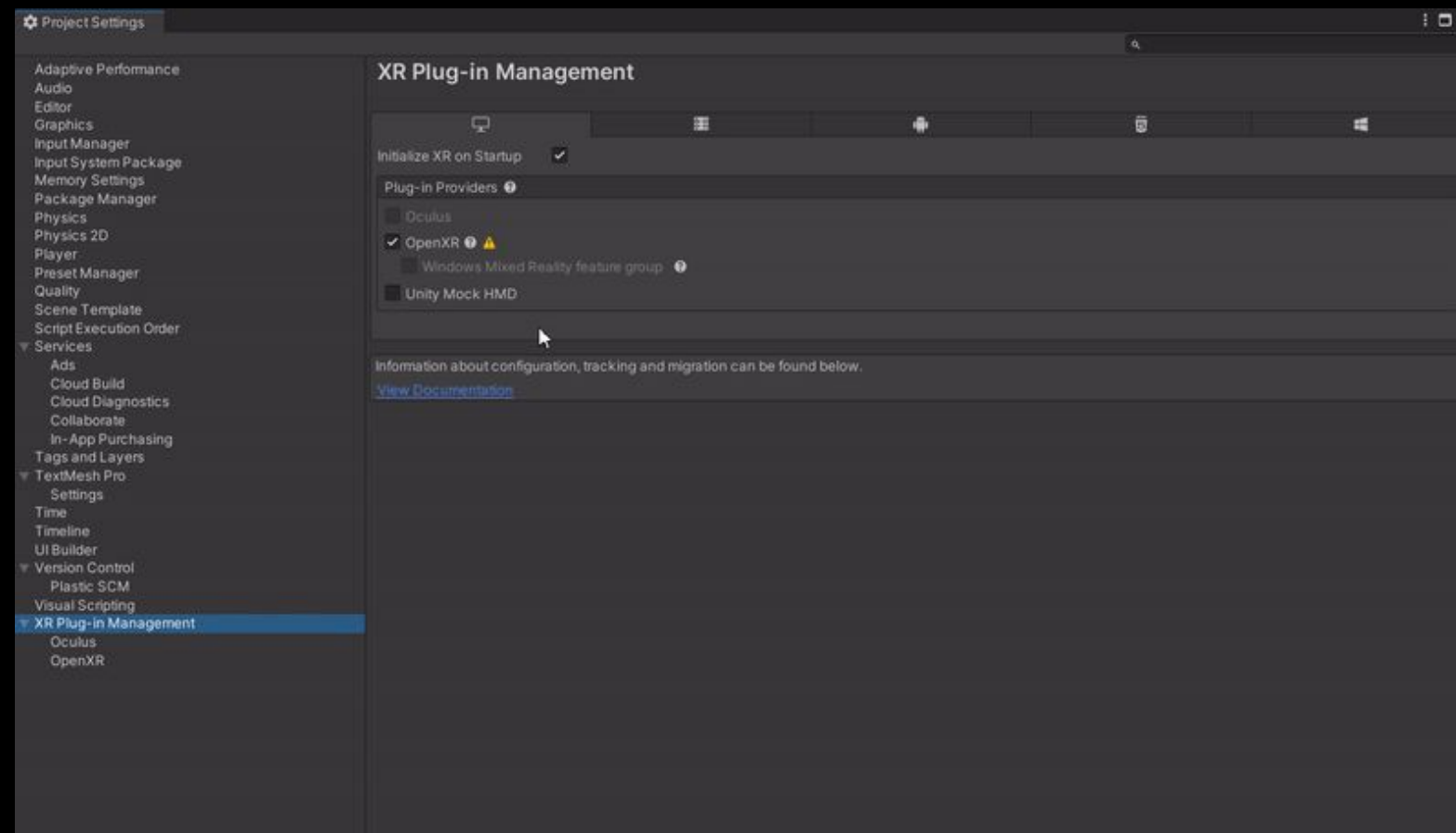
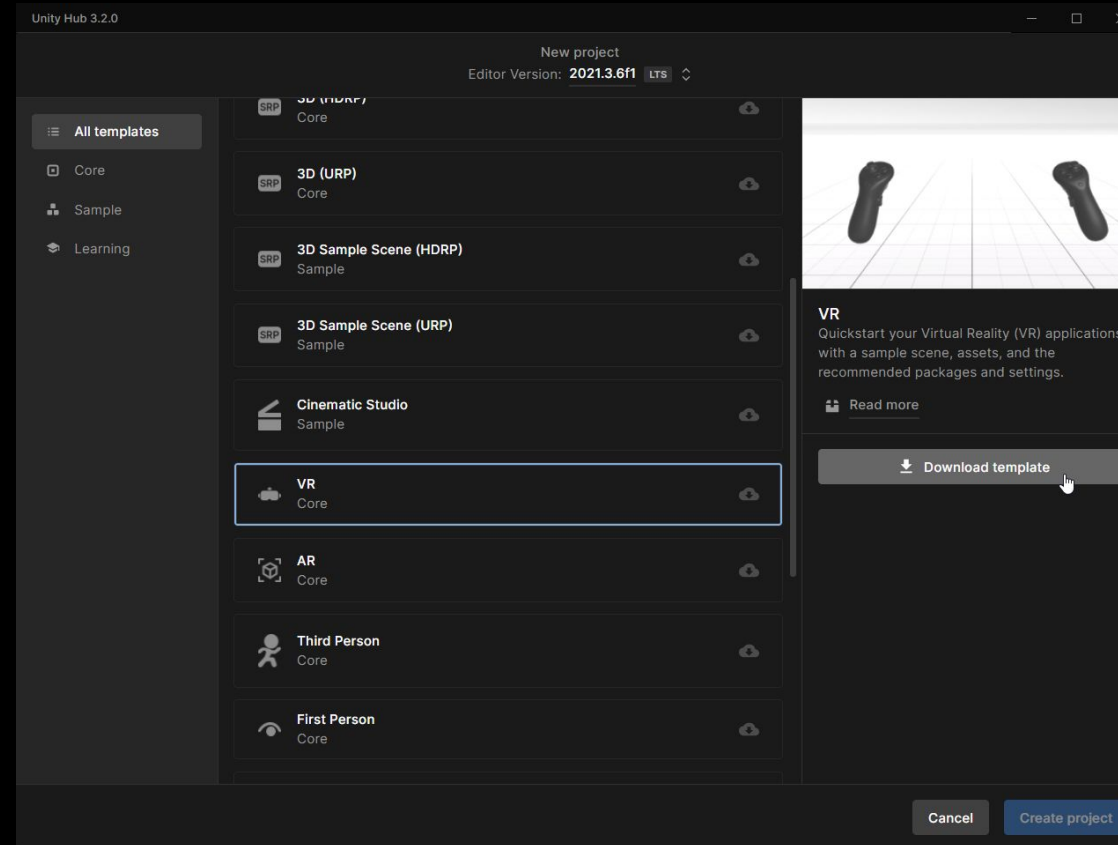
# VR Core Template Demo

## Download template via the **Unity Hub**

- Fix missing **interaction profile** issues in the OpenXR settings
- Fix camera near plane distance

## Optional → Add Oculus Integration

- Install Oculus Integration [package](#)
- Explore Sample Scenes under Assets/Oculus/**Interaction**/Samples/Scenes/Examples
  - Add all the scenes to Scenes in Build list
  - Use the menu to navigate through examples!





# Getting started with XR in Unity





All your **Toolkits** are belong to us





Unity

# XR Interaction Toolkit

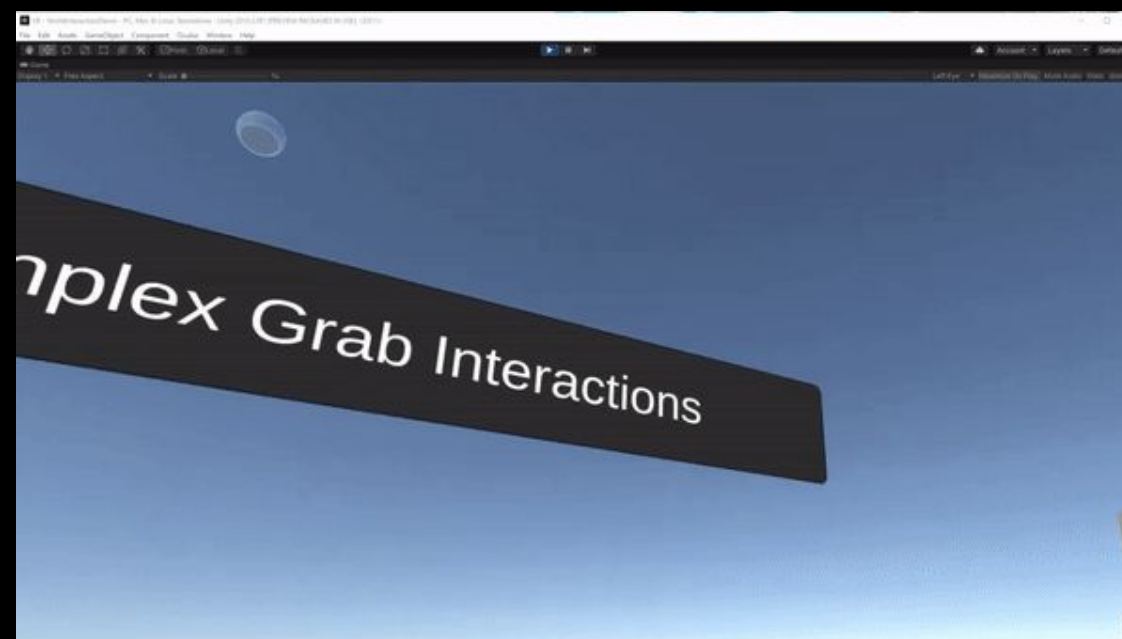
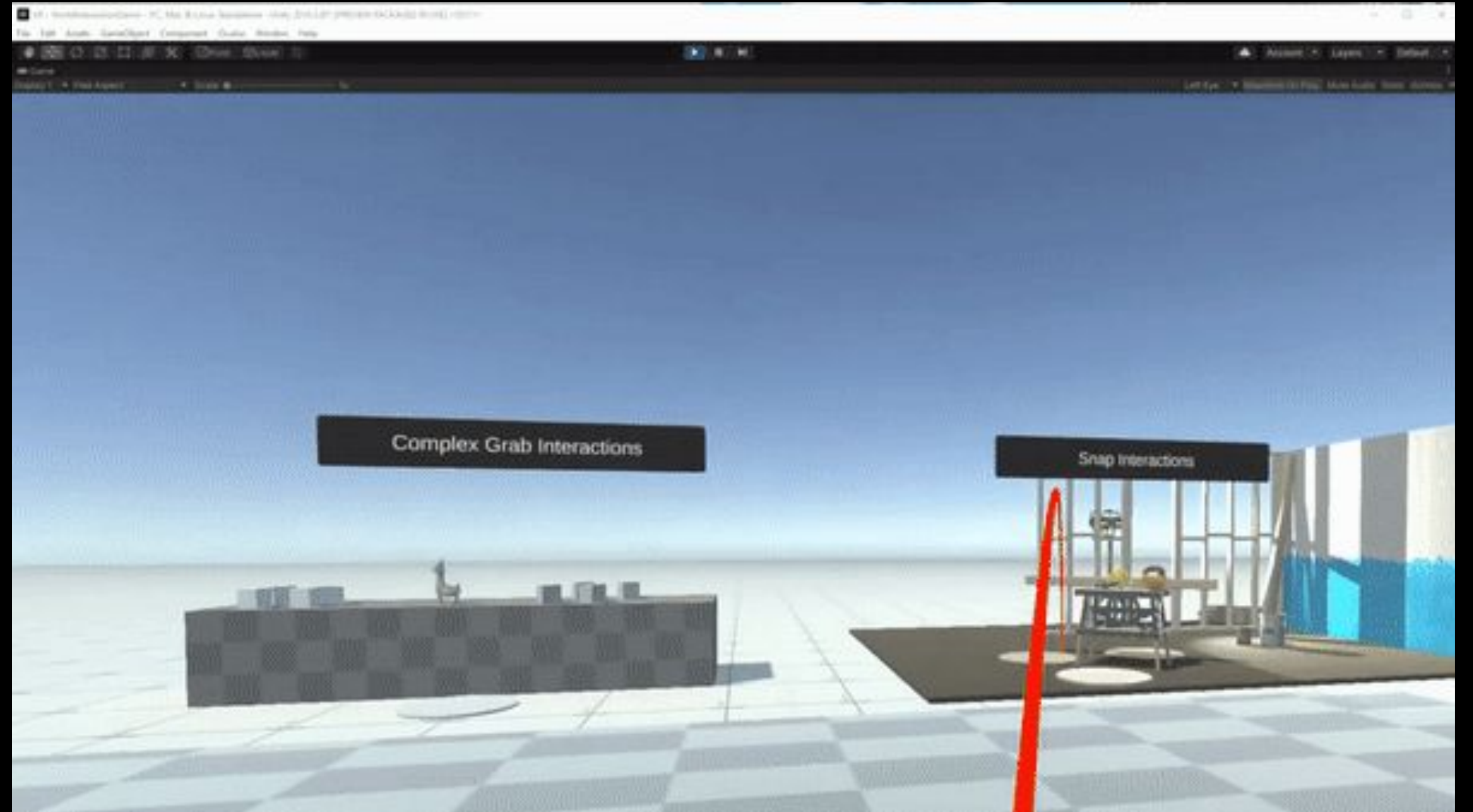
The XR Interaction Toolkit package is a high-level, component-based, interaction system. It provides a framework that makes 3D and UI interactions available from Unity input events.

2022.x → **Release** Package

2021.x → Add Package By Name → **com.unity.xr.interaction.toolkit**

[Docs](#)

[Samples](#)





Microsoft

# Mixed Reality Toolkit

Microsoft MRTK3 is distributed as a set of **packages** that are imported into Unity using the **Mixed Reality Feature Tool** for Unity and the Unity Package Manager (UPM).

Microsoft MRTK3 leverages the **Unity XR Subsystem Management** infrastructure for writing extensible modules that can help provide cross-platform support for features like speech and hand tracking.

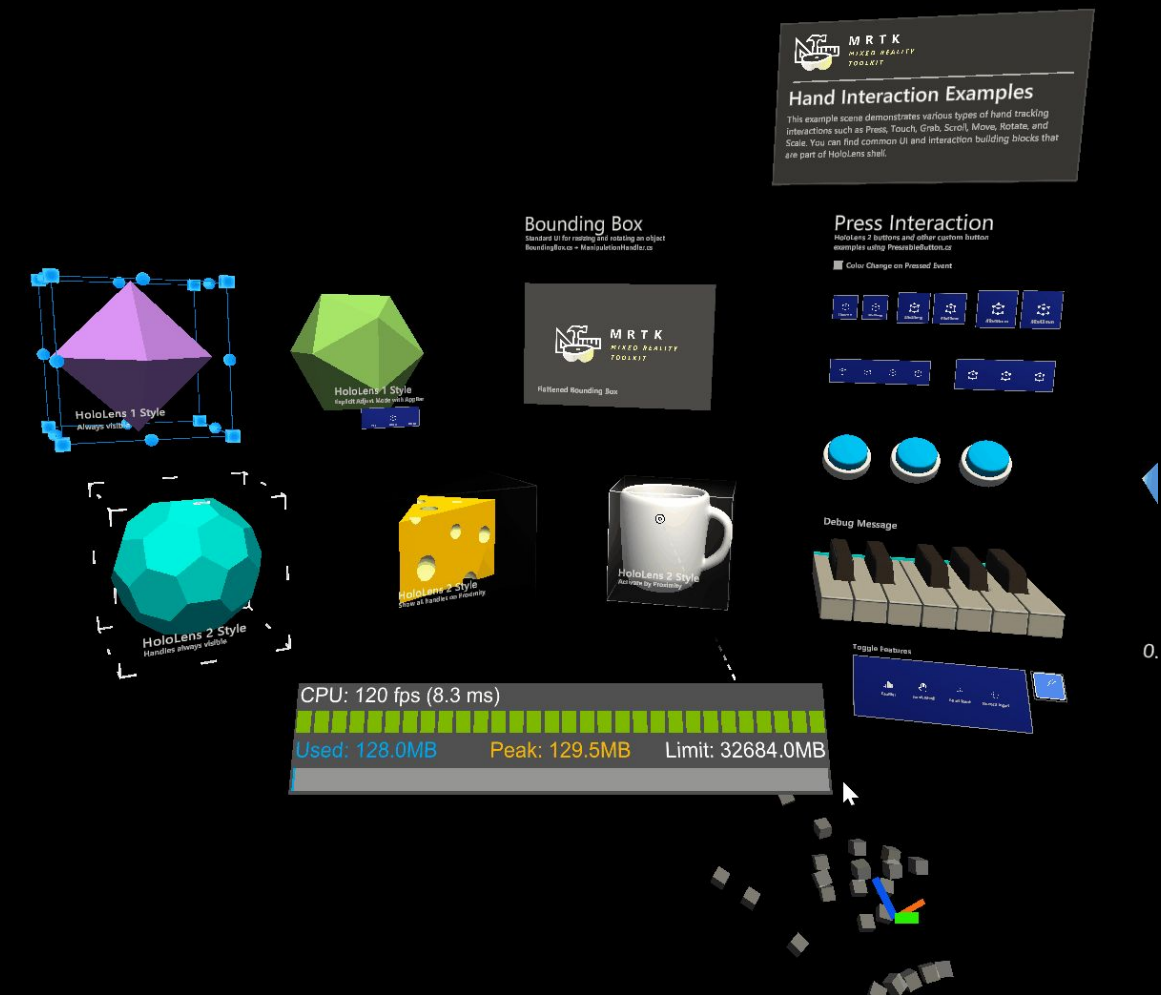
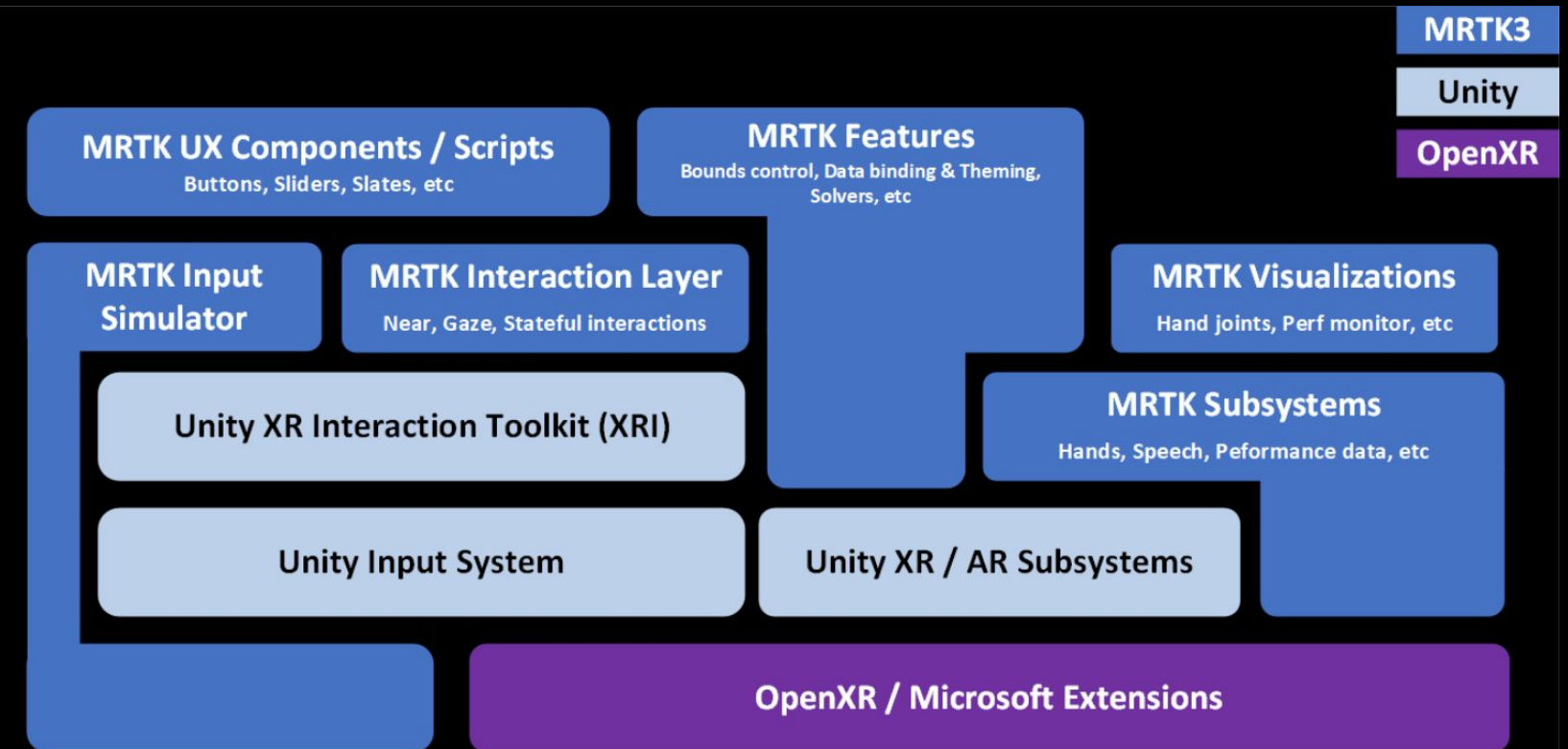
[Docs](#)

[Initial Setup for MRTK3](#)

[MRTK3 packages](#)


[Subsystems](#)

[MRTK2 to MRTK3 concept migration guide](#)





# Holographic Remoting

Stream holographic content to your HoloLens in real time, quickly test and debug your app, **without building** and deploying a full project.

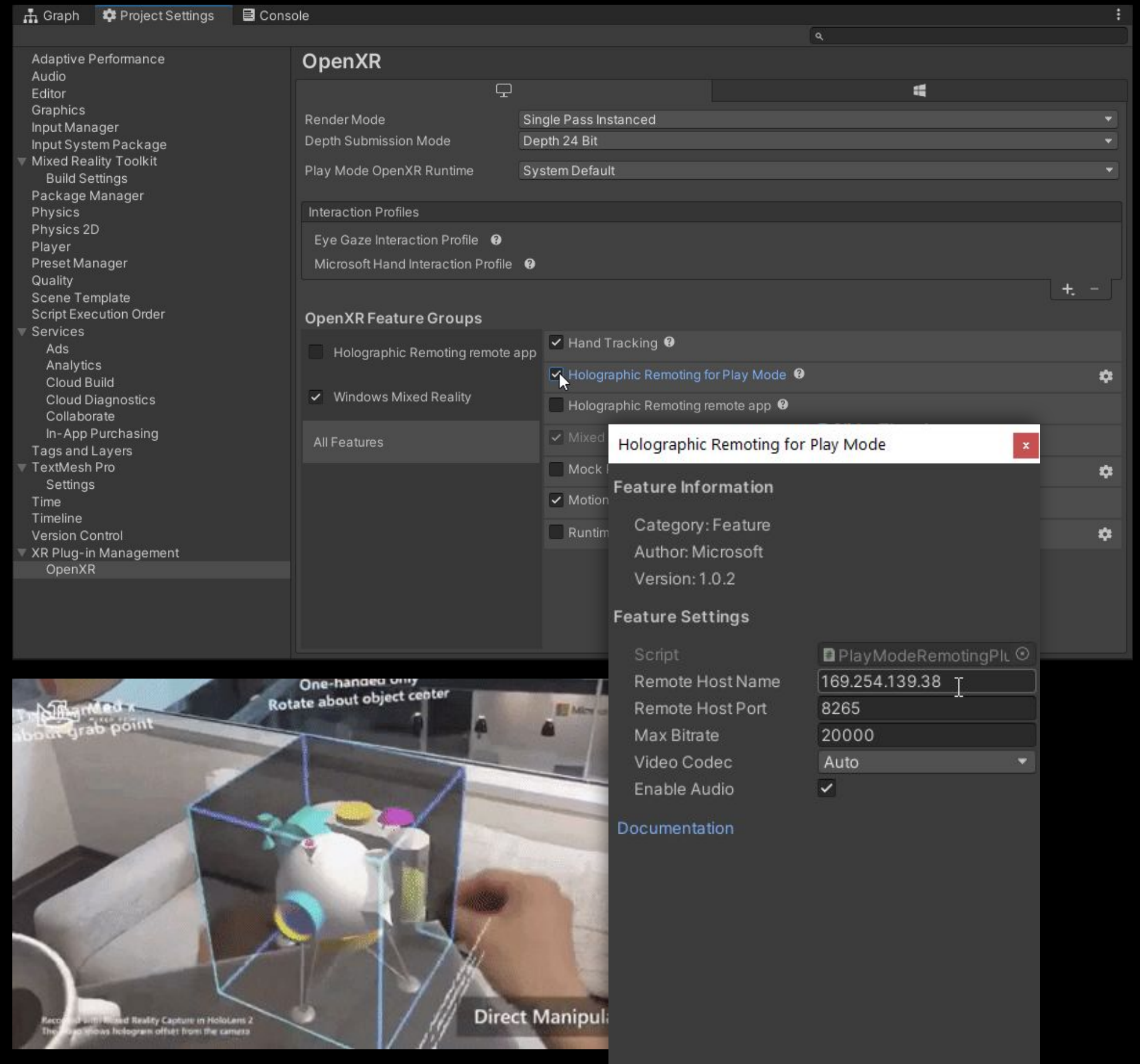
1. Download the Holographic Remoting app from the Windows Store on your HoloLens
2. Enable Holographic Remoting for Play Mode in Project Setting → XR Plug-in Management → OpenXR
3. Click the  icon to reveal the settings

There are two options for connecting:

- Wifi for wireless freedom
- USB for speed and stability

 When connected via a USB cable, make sure to disable Wifi on the HoloLens. 

[Docs](#)

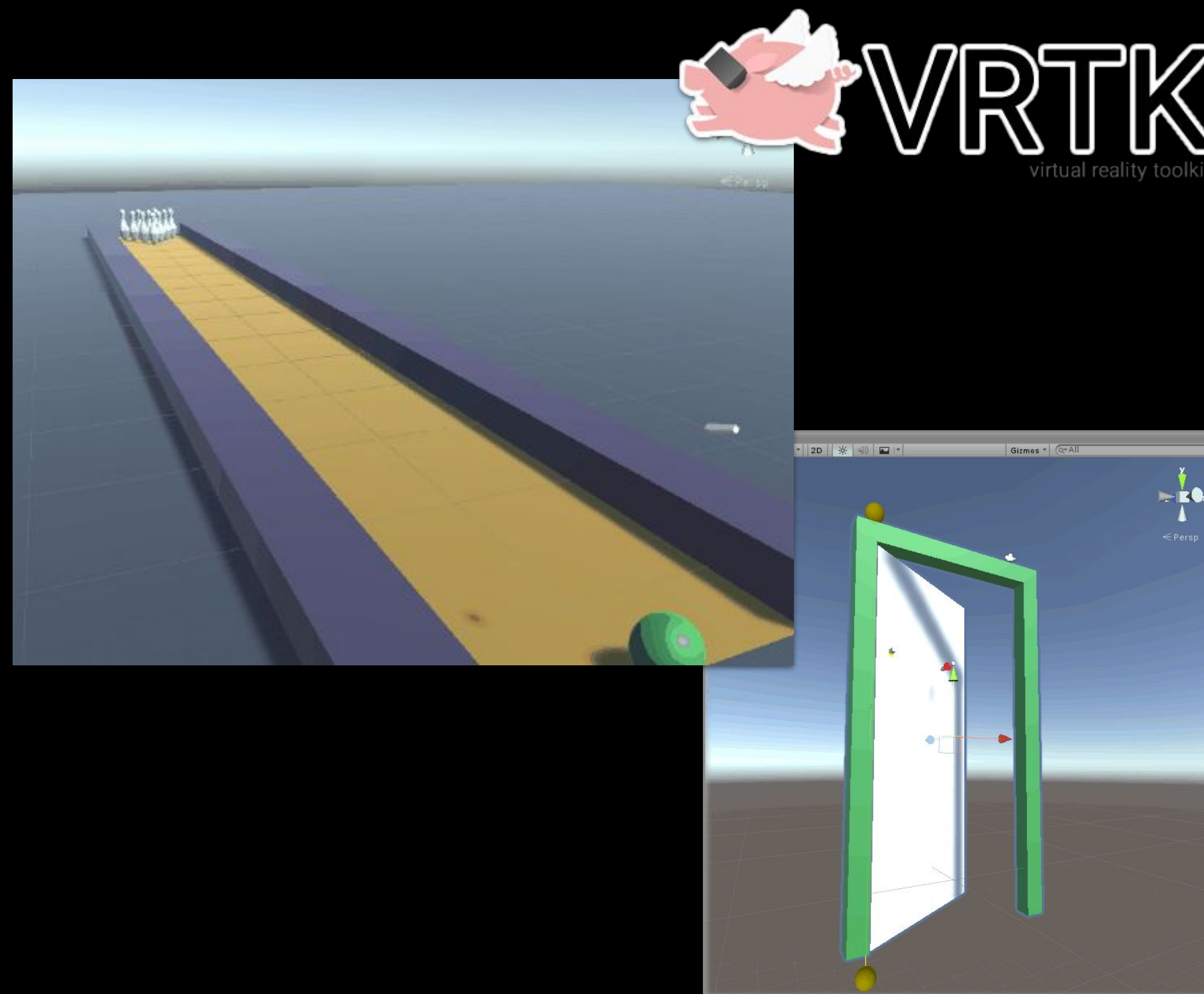






## Virtual Reality Toolkit

VRTK aims to make building spatial computing solutions in the Unity software fast and easy for beginners as well as experienced developers.



[Github](#)

[Docs](#)

[How-To Guides](#)



# Vive Wave Integration

## VIVE Wave XR Plugin

Provides basic Unity XR Plugin Framework support.

## VIVE Wave XR Plugin - Native

Provides access to Wave native API through C# wrapper. If you need to use Wave API directly, install this package.

## VIVE Wave XR Plugin - Essence

Contains all the exclusive features that Wave provides such as Controller Model, Input Module, Interaction Tool Kit extensions, performance tuning tools and debug tools.

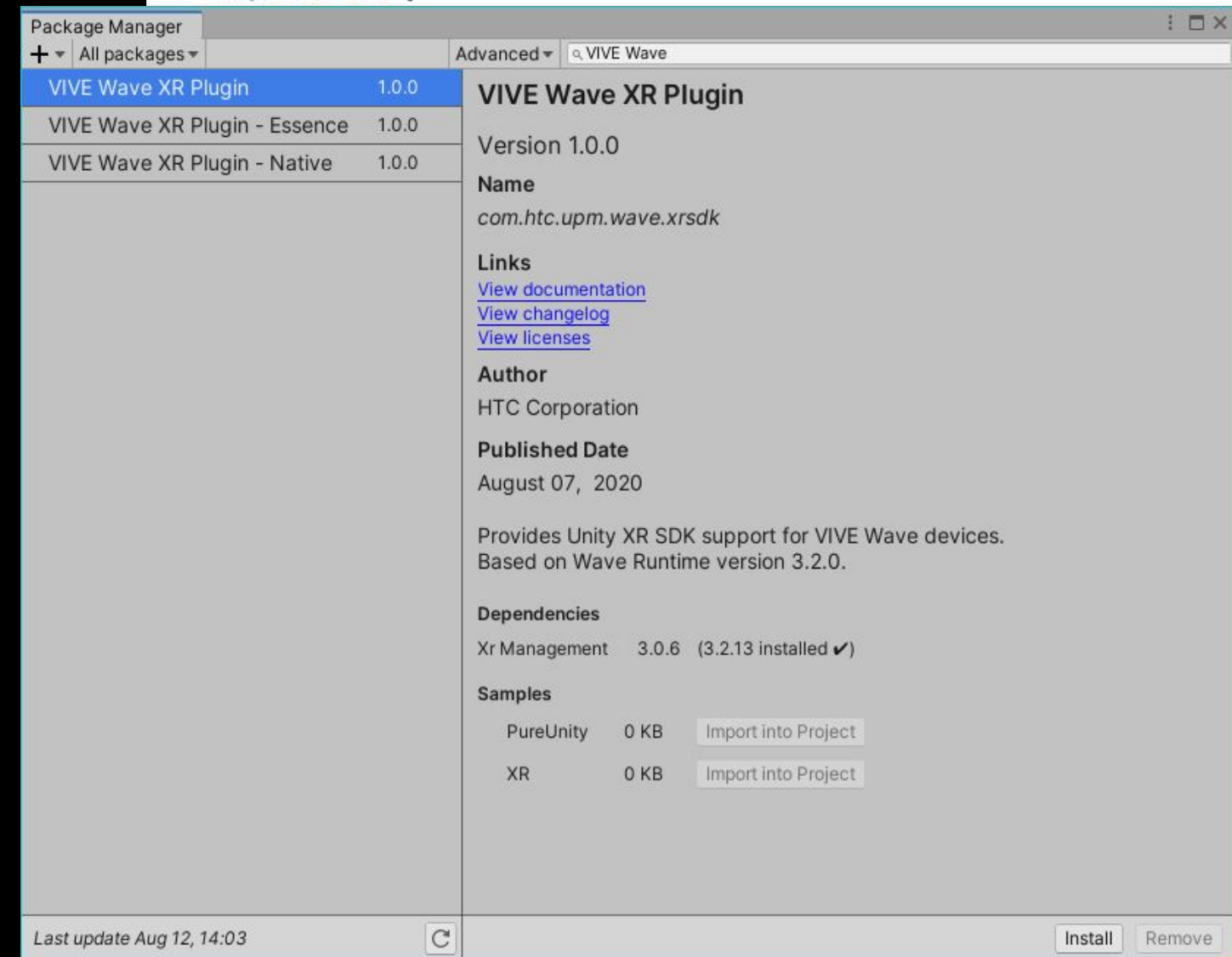
[Docs](#)

[Getting Started](#)

```

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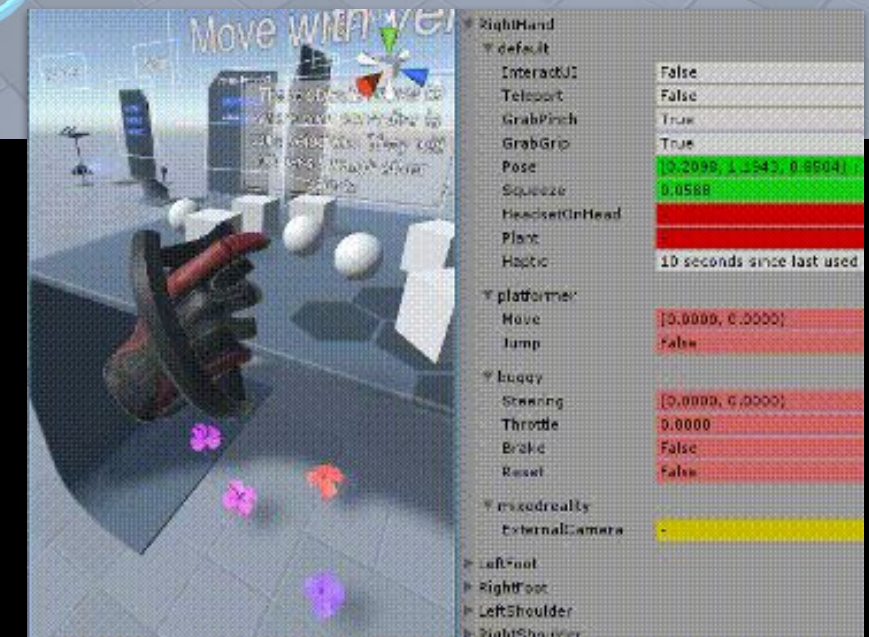
Valve

# SteamVR

## SteamVR Plugin

The modern SteamVR Unity Plugin manages three main things for developers:

- Loading **3d models** for VR controllers
- **Handling input** from those controllers,
- Estimating what your **hand looks like** while using those controllers.



[Asset Store](#)

[Github](#)



Meta

## Quest 1 & 2

### Oculus SDK

Available on the Unity Asset Store [here](#)

### Oculus platform Features

- Avatar SDK
- Spatialized Audio
- LipSync SDK
- Hand Tracking

### Resources

- [Interaction SDK](#)
- [Sample Framework](#)
- [Passthrough API](#)

*Interaction SDK*



*Debug hand tracking directly in the Unity Editor with Oculus Link!*



*Passthrough API*



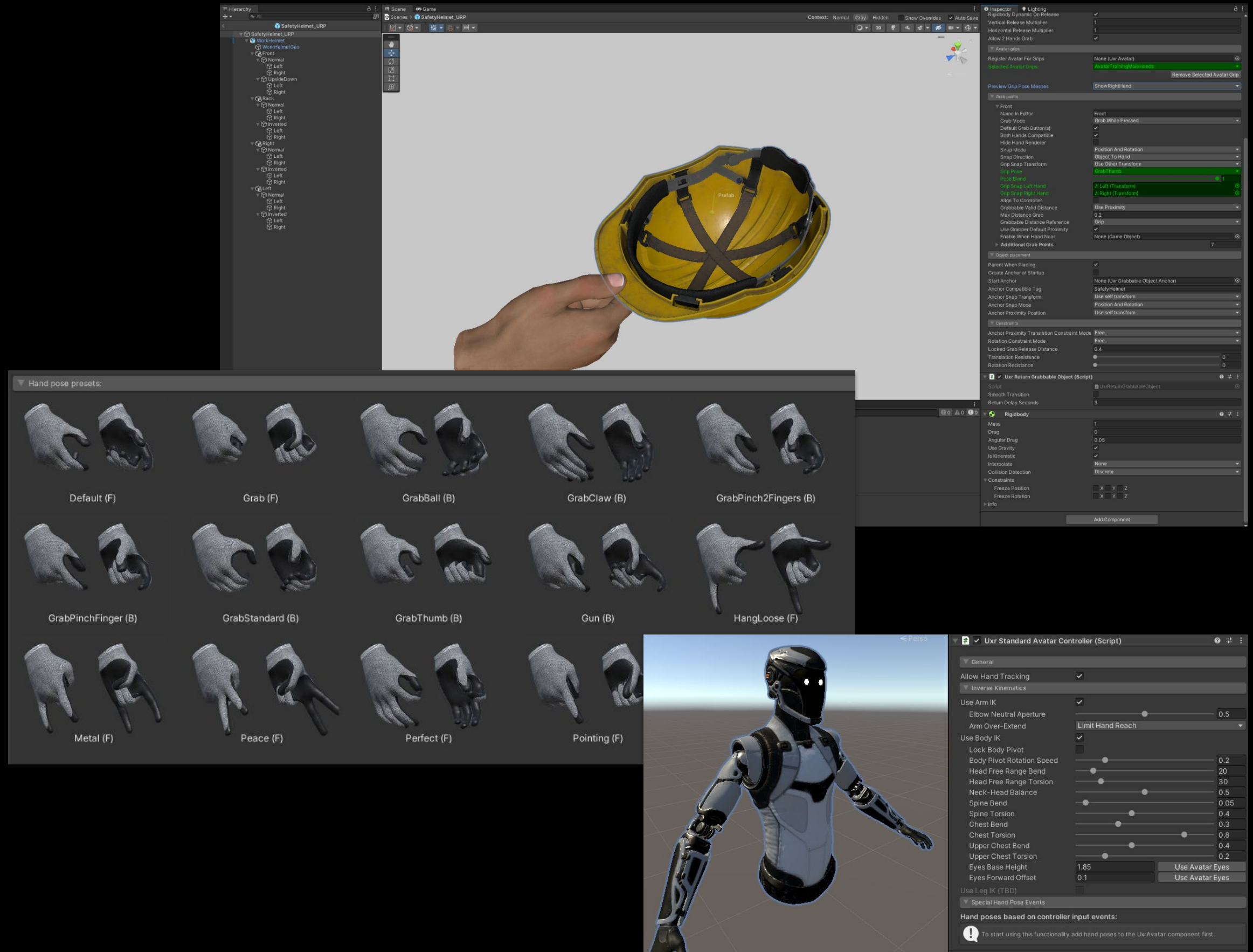
# VRMADA UltimateXR

Free, open source framework and toolkit for Unity that includes:

- cross-device compatibility
  - Oculus SDK
  - Pico XR SDK
  - SteamVR
  - WaveXR
  - Windows Mixed Reality
- state-of-the-art grab and manipulation mechanics
- a library of gender, and race, agnostic hands
- customizable full body avatar representation
- advanced UI components
- locomotion mechanics, and much more.

[Docs](#)

[Source Code](#)





Unity

# AR Foundation

AR Foundation allows you to work with augmented reality platforms in a multi-platform way within Unity.

This package presents an interface for Unity developers to use, but doesn't implement any AR features itself. To use AR Foundation on a target device, you also need separate packages for the target platforms officially supported by Unity:

[ARCore XR Plug-in](#) on **Android**

[ARKit XR Plug-in](#) on **iOS**

[OpenXR Plug-in](#) on **HoloLens**



## Feature support per platform

You can refer to this table to understand which parts of AR Foundation are relevant on specific platforms:

	ARCore	ARKit	OpenXR
Device tracking	✓	✓	✓
Plane tracking	✓	✓	
Point clouds	✓	✓	
Anchors	✓	✓	✓
Light estimation	✓	✓	
Environment probes	✓	✓	
Face tracking	✓	✓	
2D Image tracking	✓	✓	
3D Object tracking		✓	
Meshing		✓	✓
2D & 3D body tracking		✓	
Collaborative participants		✓	
Human segmentation		✓	
Raycast	✓	✓	
Pass-through video	✓	✓	
Session management	✓	✓	✓
Occlusion	✓	✓	

**Note:** To use ARCore cloud anchors, download and install Google's ARCore Extensions for Unity's AR Foundation.

[Docs](#)



# AR Foundation Samples

## Download sample project via the github

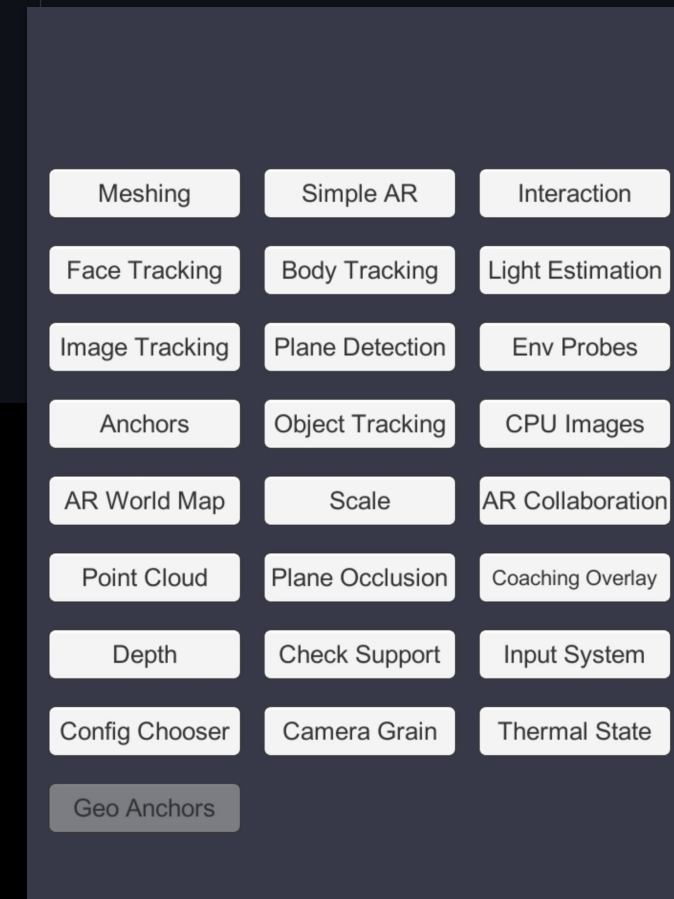
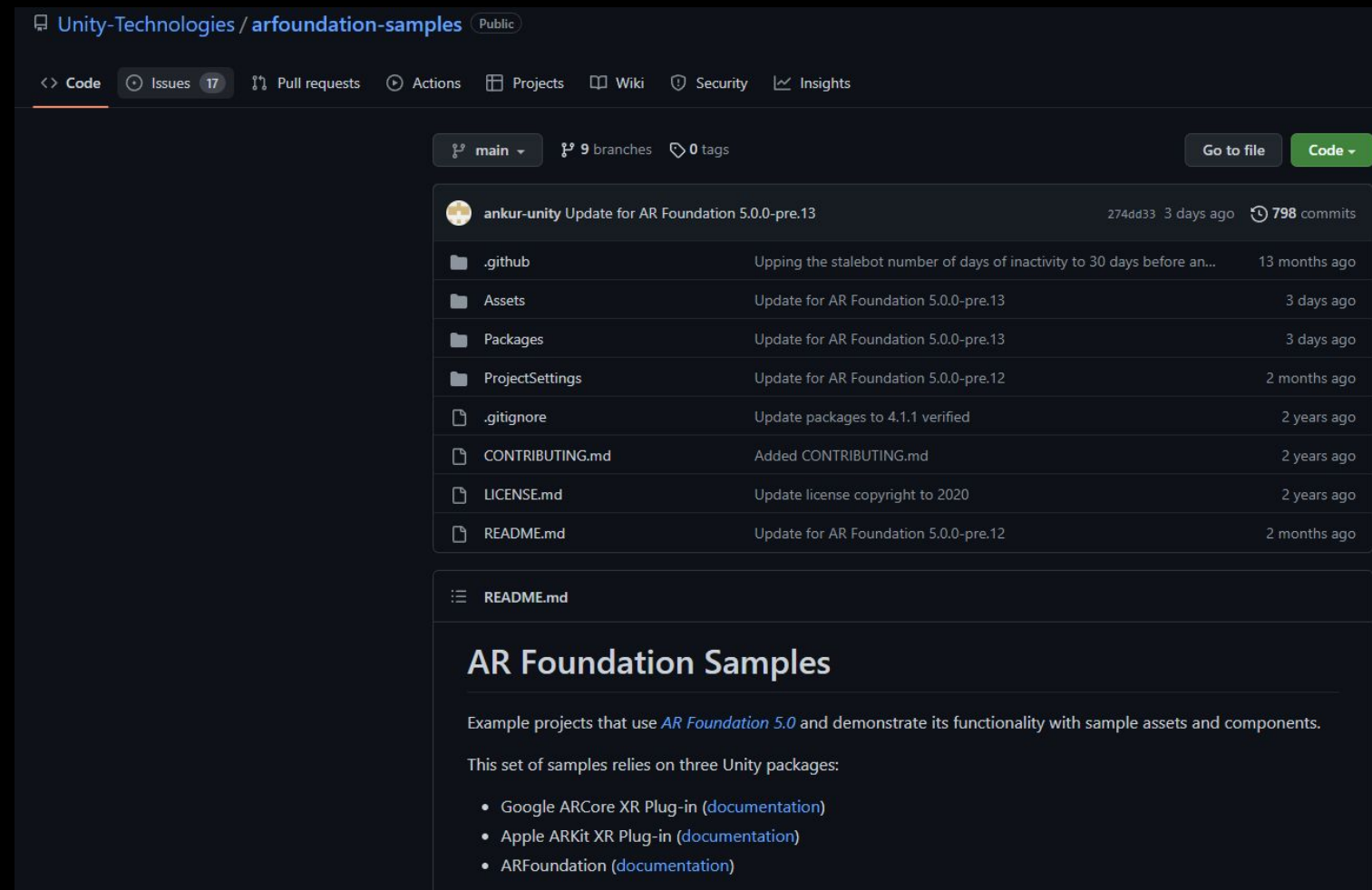
- Get Project [Here](#)
- Clone or download this repository to a workspace on your drive
  - Click the ↓ Code button on this page to get the URL to clone with Git or click Download ZIP to get a copy of this repository that you can extract
- Open a project in Unity
  - Download, install, and run Unity Hub
  - In the Installs tab, select Locate or Add to find or install Unity 2019.4 LTS or later
  - In the Projects tab, click Add
  - Browse to the VR folder within your downloaded copy of this repository and click Select Folder
  - Click the project which should now be added to the list to open the project
- To run the AR Foundation sample on a headset, go to File > Build Settings and build the app. 1

[Samples \(v4.2\)](#)

[Samples \(v5\)](#)

[Building for iOS](#)

[Building for Android](#)





PTC

# Vuforia

## Vuforia Engine Package

SDK for mobile devices that enables the creation of **AR** applications. Available on the Unity Asset Store [here](#)

### Vuforia Features:

- **Image Tracking**
- **Model Tracking**
- **Area Tracking**
- **Ground Plane Detection**

### Resources

- [Project Set Up](#)
- [Docs](#)







# Niantic Lightship ARDK

Create persistent and realistic experiences. ARDK's meshing feature translates the colors produced by the user's camera, runs them through a neural network, and builds a mesh of tessellated triangles that create a machine-readable representation of the physical world.

[website](#) | [video](#)



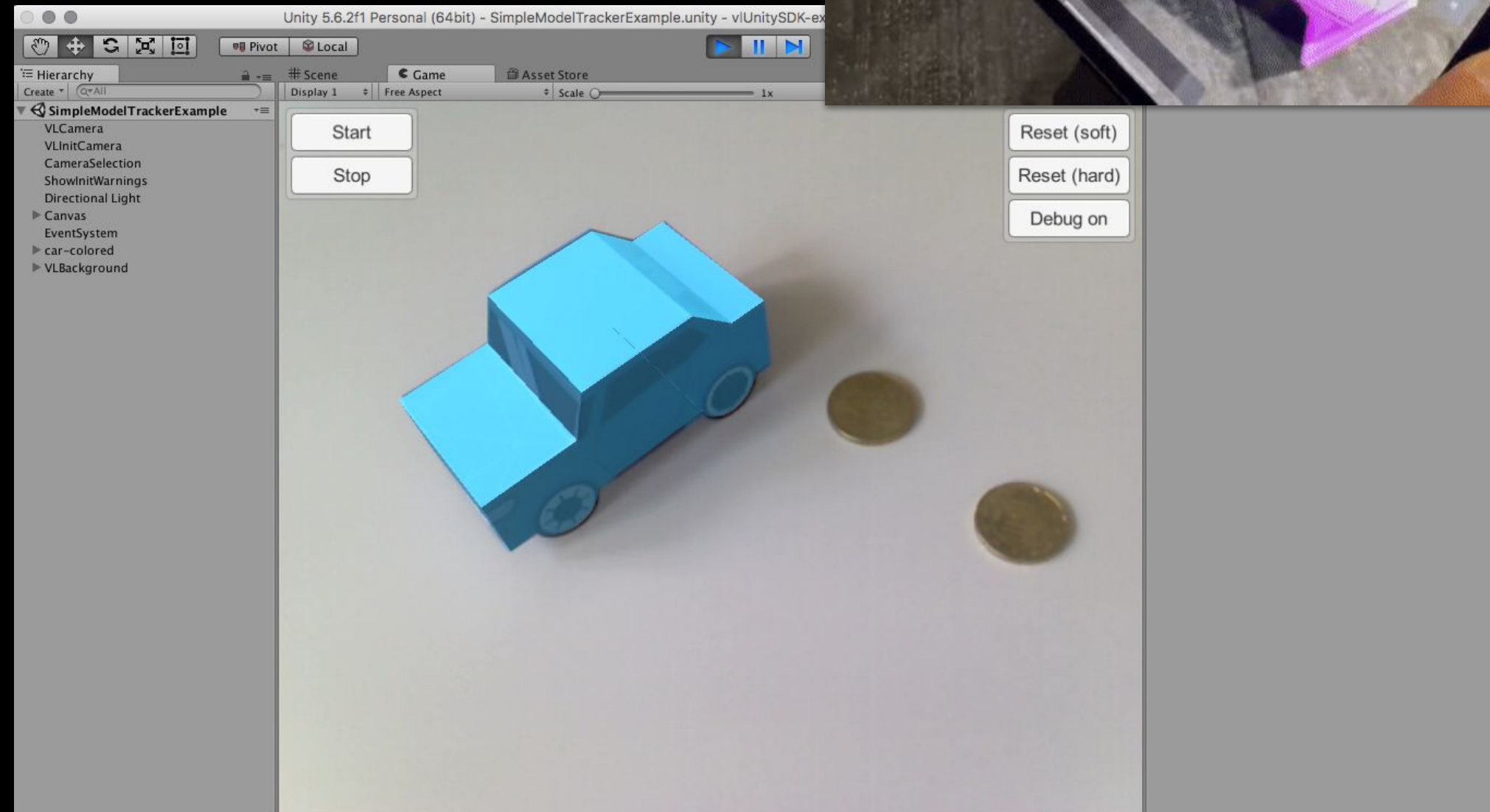
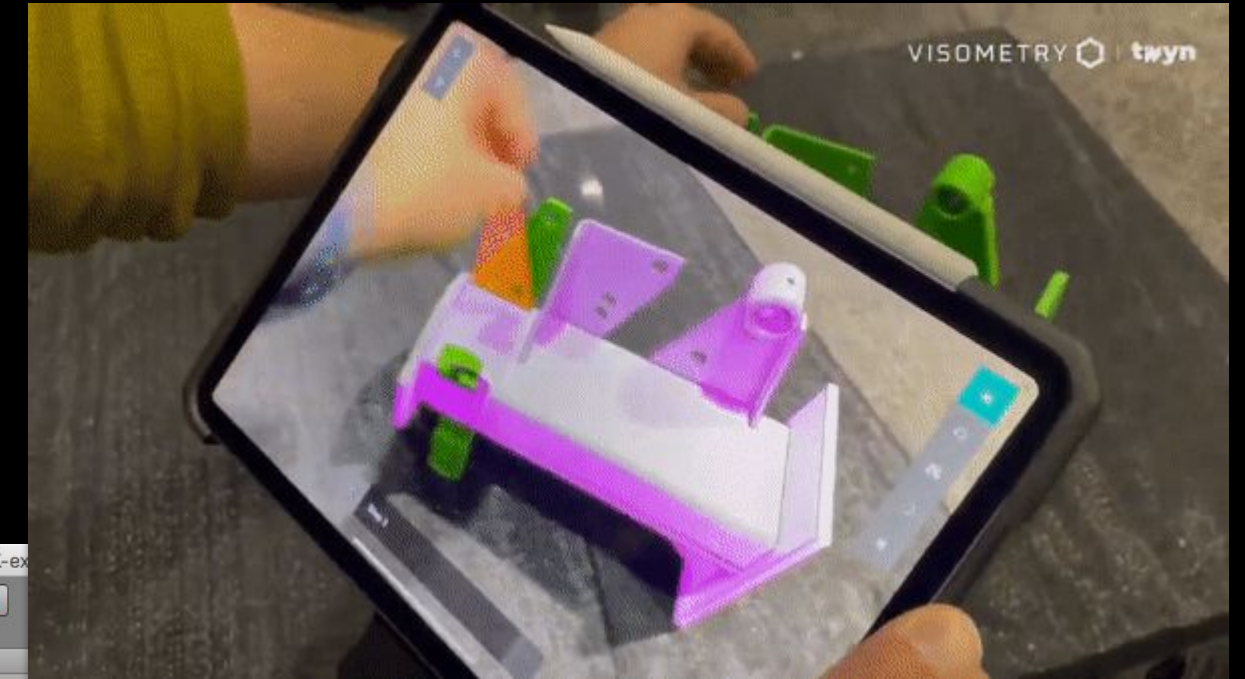


Visometry

# VisionLib

VisionLib enables 3D object tracking for augmented reality apps on computers, smartphones, tablets, and mixed-reality headsets like HoloLens.

- Highly accurate 3D object tracking
- Use 3D or CAD data to create trackers
- Multi Model Tracking
- URP support



[Docs](#)

[HoloLens Tutorial](#)



## Metaverse Platforms



### AltspaceVR

Unity version **2020.3.18f1**

[AltspaceVR Uploader](#)  
[Mobile Performance Guide](#)



### VRChat

Unity Version **2019.4.31f1**

[Setting up the SDK](#)



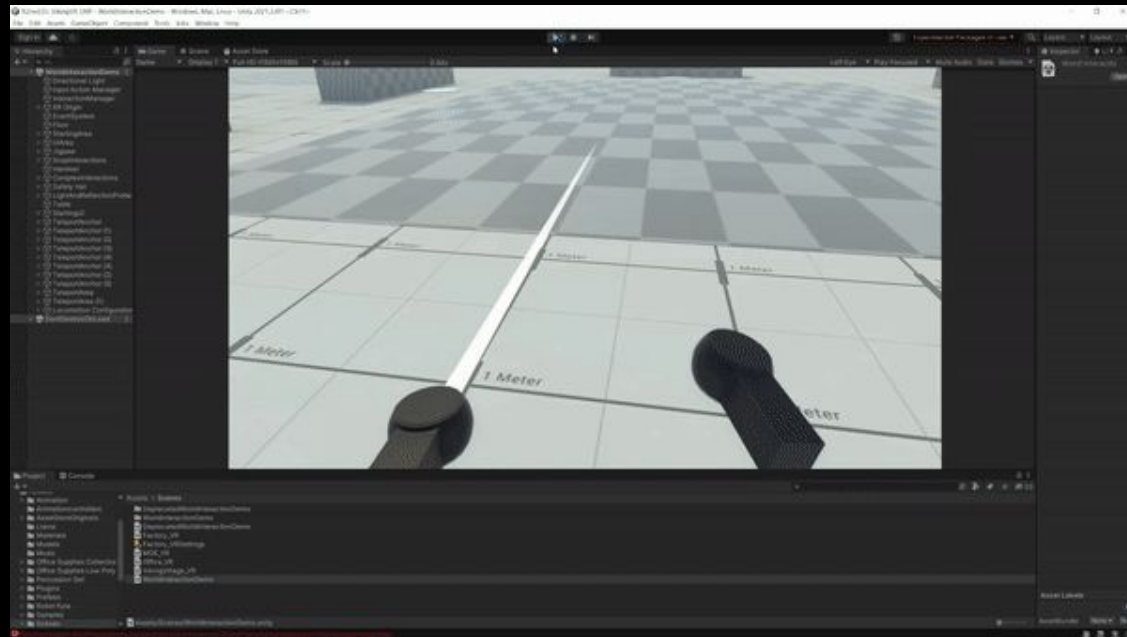
### Breakroom

Unity Version **2018.4.36f1**

[Installing Unity and the Breakroom SDK](#)

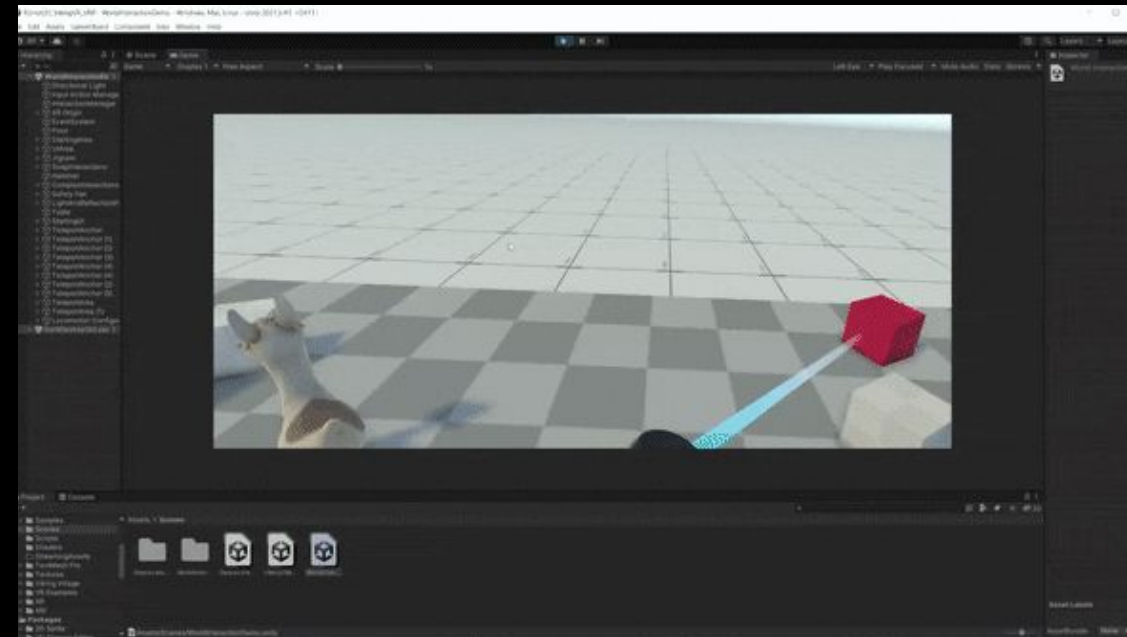


# XR Interaction Toolkit Features



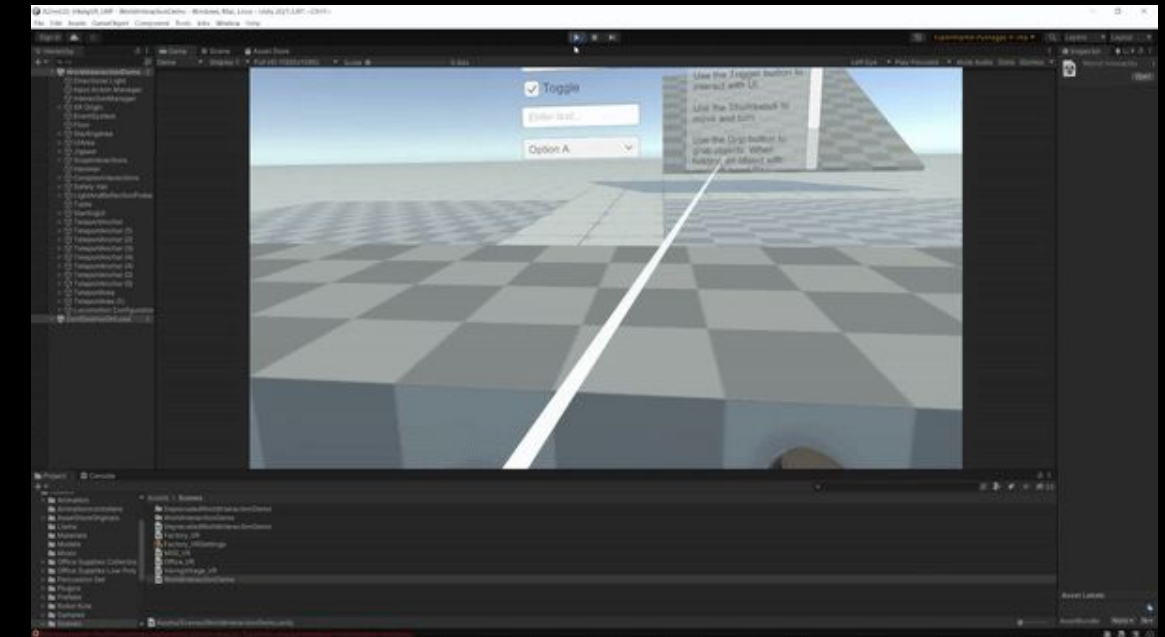
## Locomotion

Teleport around a space with support for unique angles and snap to turn.



## Physics Interaction

Grab and throw objects with tracked controllers in VR. There are multiple configurations for grabbing and tracking objects.



## Native UI Support

Interact with all UI elements built in Unity, including buttons, scroll windows, and more.



# Let's jump in!

## XR Interaction Toolkit Demo

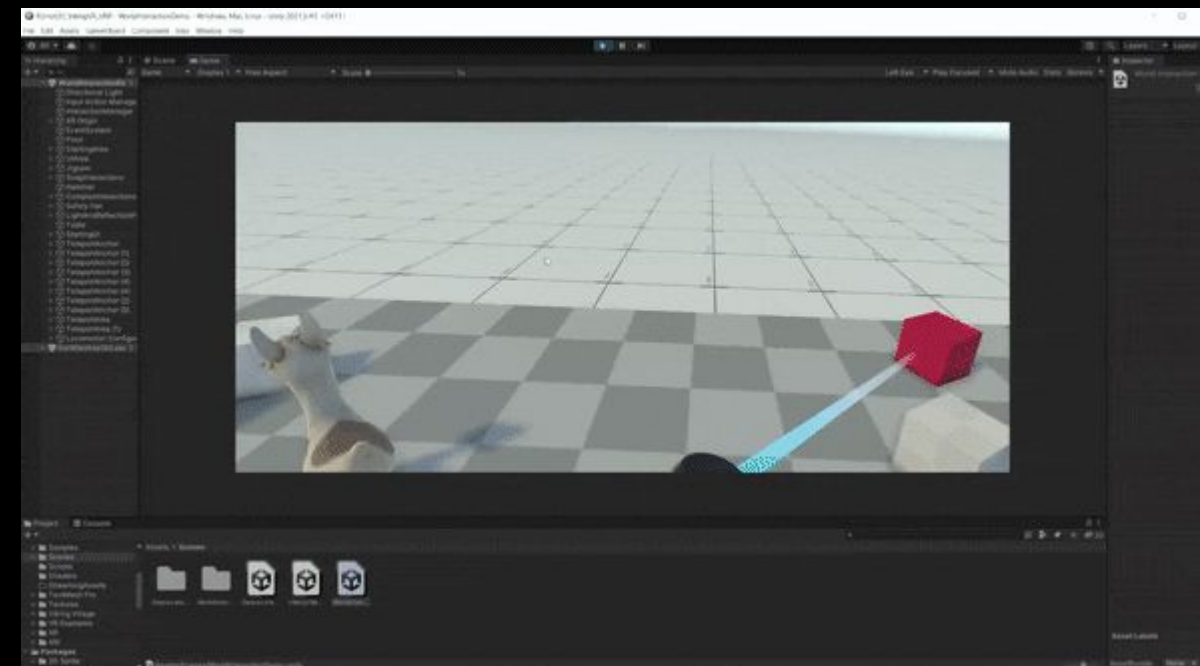
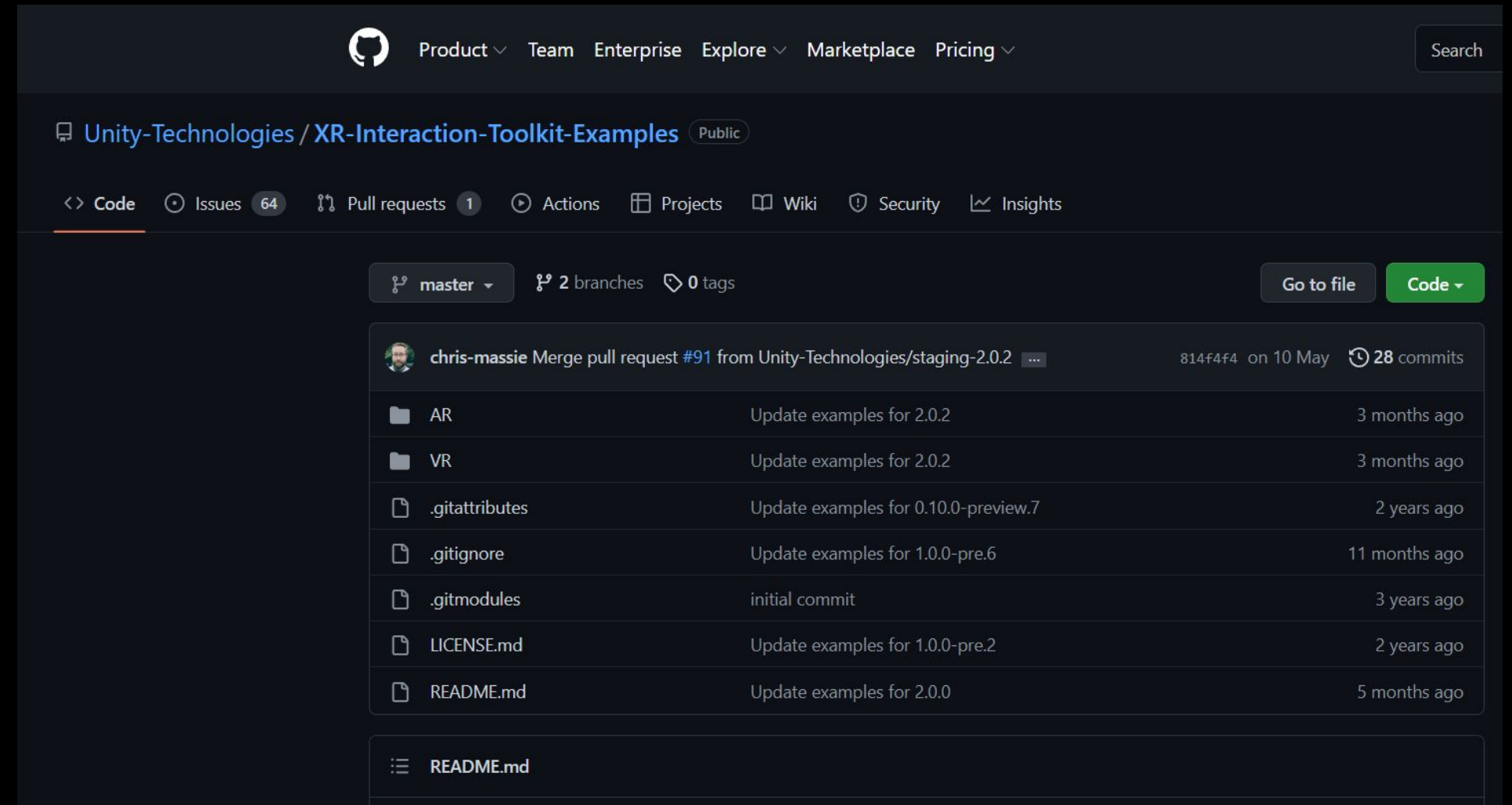




# XRI Toolkit Examples

Download sample project via the **github**

- Get Project Here:  
<https://github.com/Unity-Technologies/XR-Interaction-Toolkit-Examples>





## Free Sample Assets to Get Started



### Viking Village URP

Unity version 2020.3.33 or higher

[Asset Store Link](#)



### Snaps Prototype | Sci-Fi / Industrial

Unity Version 2018.4.0 or higher

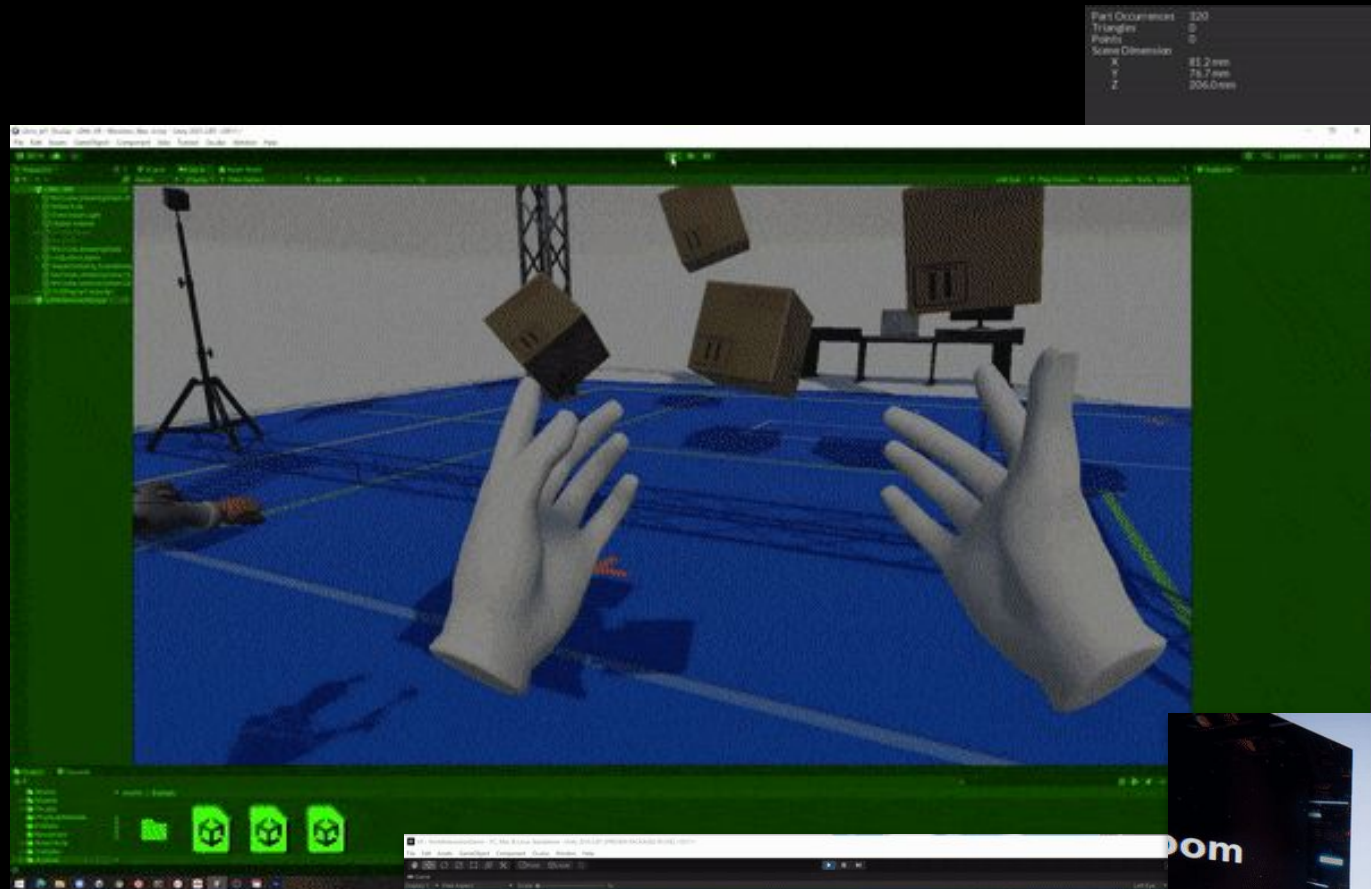
[Asset Store Link](#)



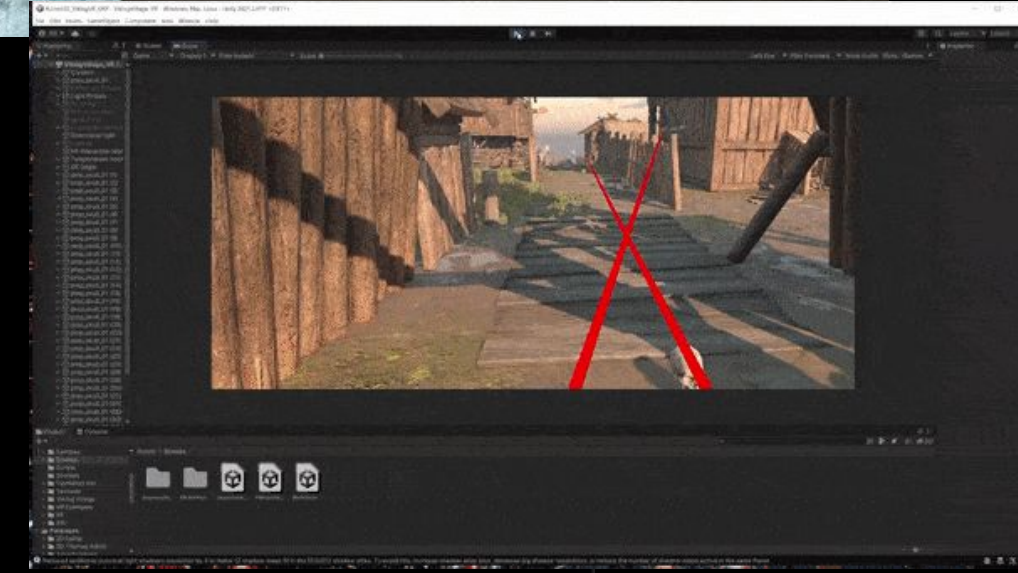
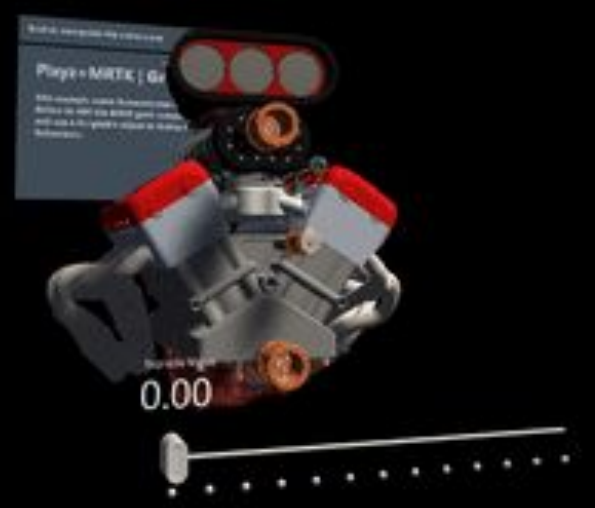
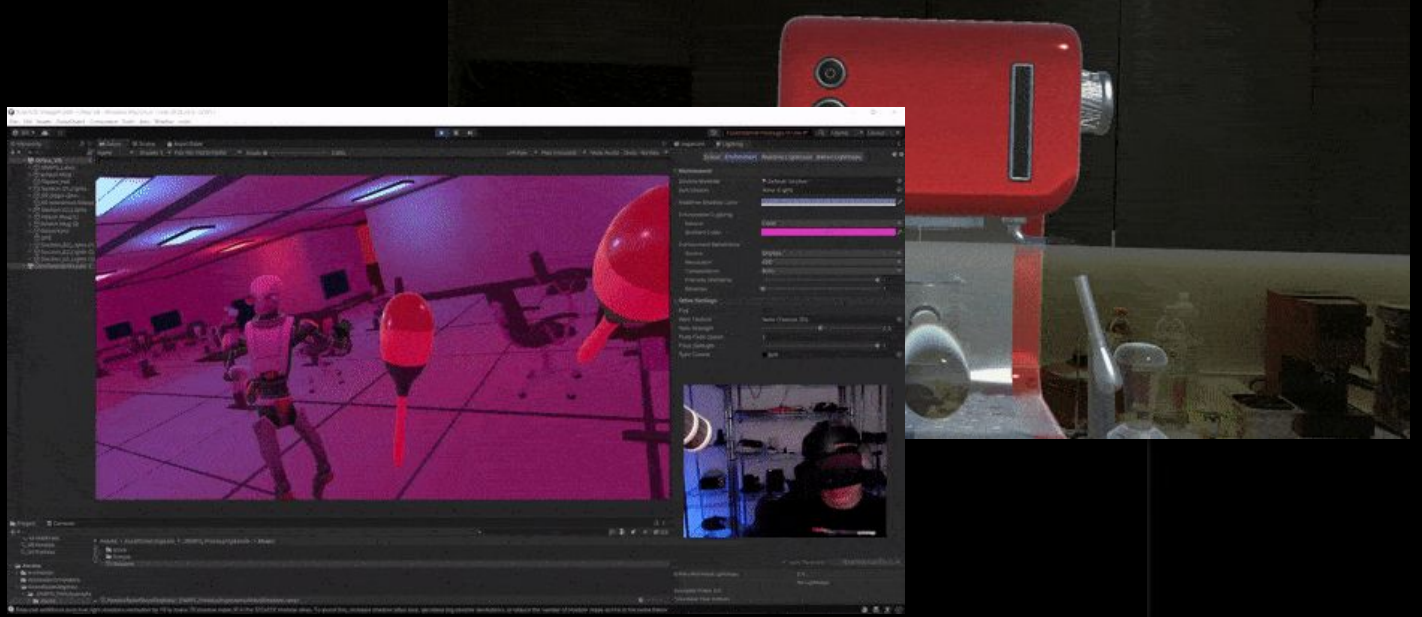
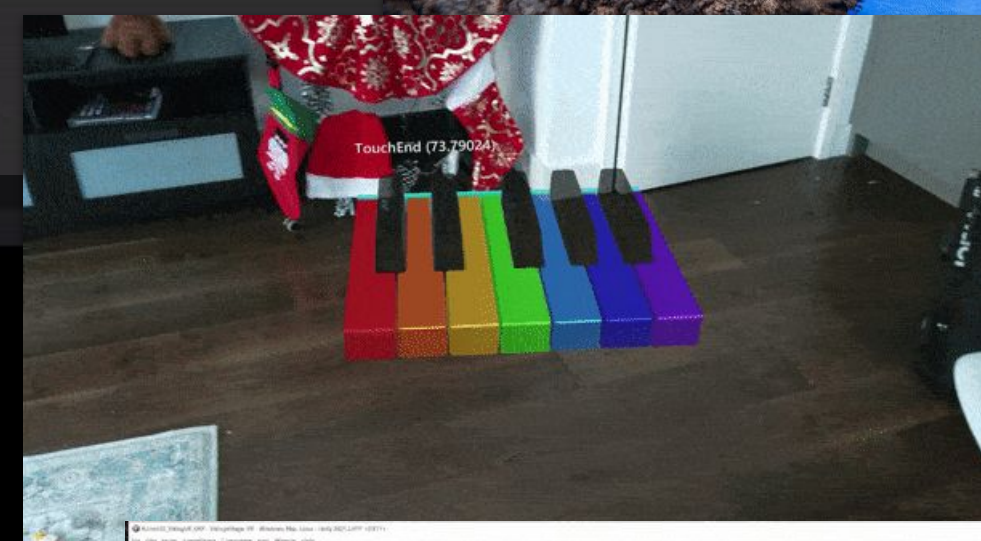
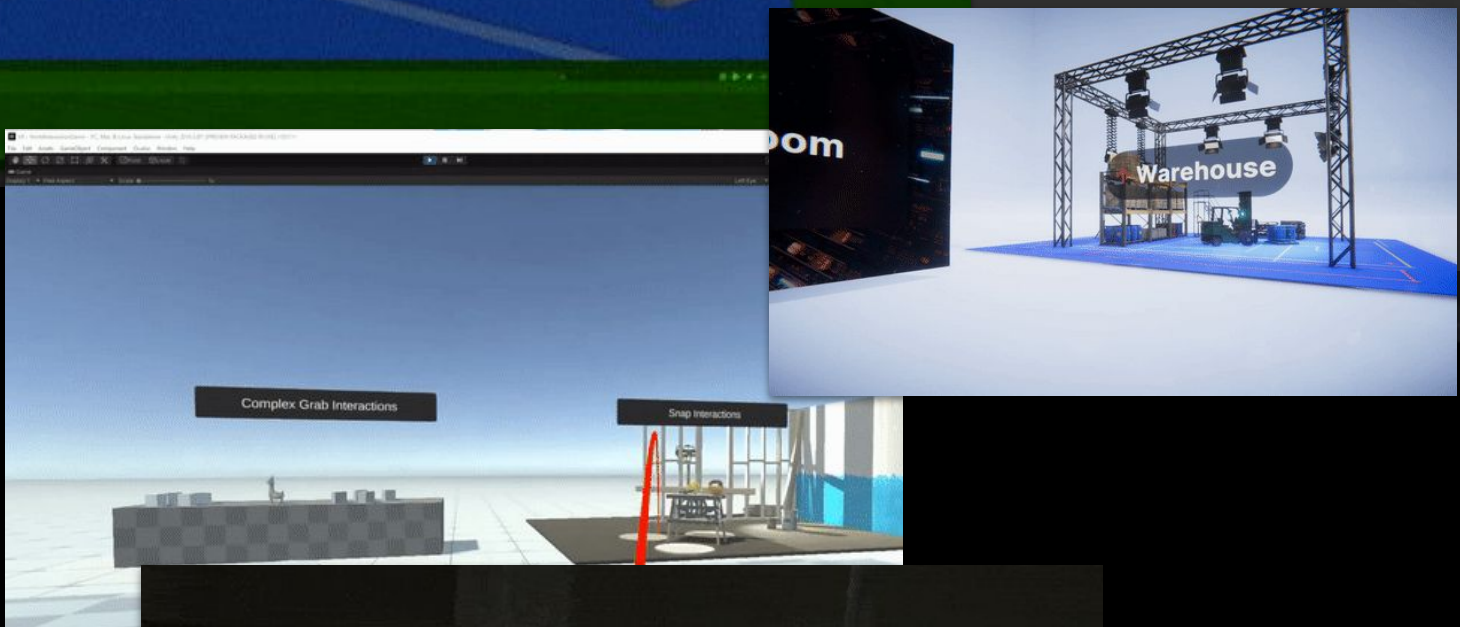
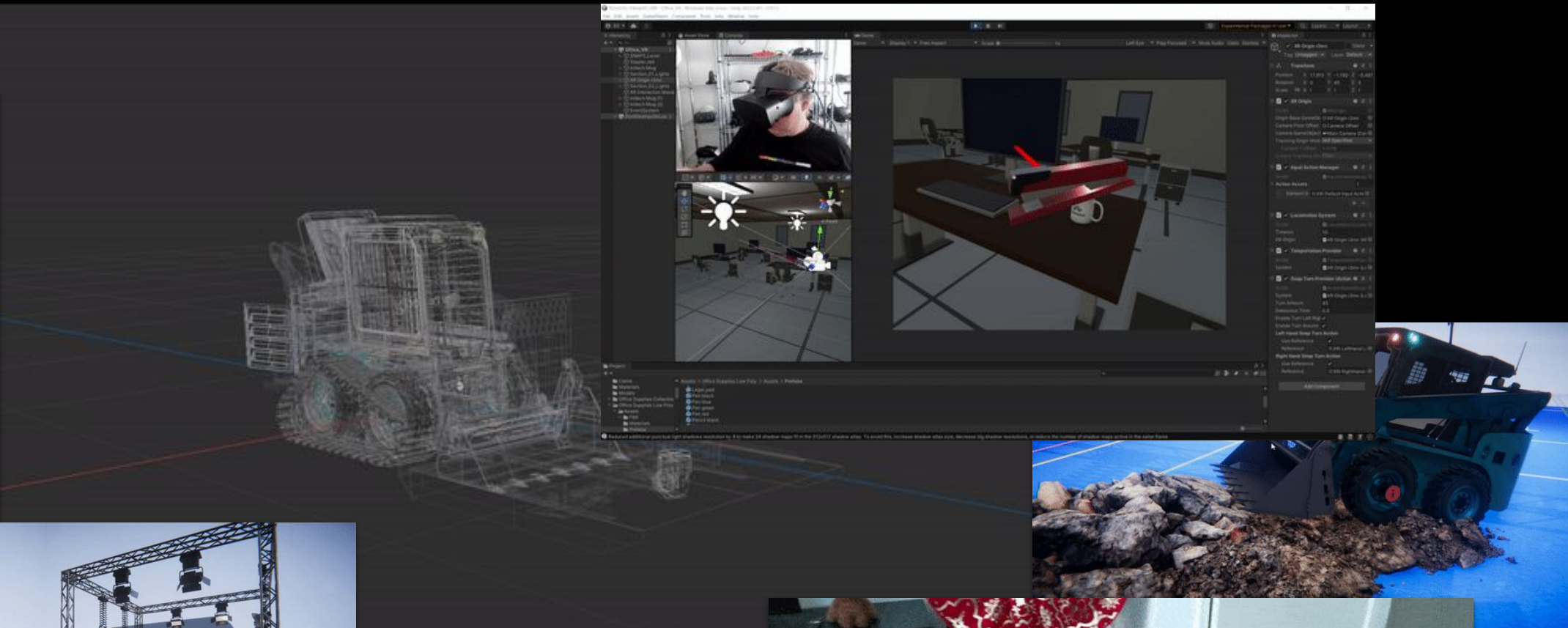
### Snaps Prototype | Office

Unity Version **2018.4.0 or higher**

[Asset Store Link](#)



Part Occlusion: 100  
Triangles: 0  
Scene Dimensions:  
X: 81.2 mm  
Y: 75.7 mm  
Z: 206.0 mm







# Workshops

<https://create.unity.com/road-to-metaverse>

April	Welcome to the Metaverse!
May	Bring your <b>digital</b> and <b>physical assets</b> into Unity
June	Add <b>interactivity</b> to your <b>immersive</b> experience
July	How to bring your <b>real-time 3D digital twin data</b> into Unity
August	Let's get real: An introduction to AR, VR, MR, XR and more
<b>September</b>	<b>Augmenting reality (AR): Bring digital objects into the real world</b>
October	Build <b>immersive worlds</b> in virtual reality (VR)
November	Improve learning retention with <b>immersive training</b> experiences
December	Build a Microsoft HoloLens experience for <b>training in AR</b>
January	Integrate <b>cloud-based IoT data</b> into your XR experience
February	Masterclass: Build a <b>collaborative multi user</b> experience
March	Build <b>geolocated</b> and <b>social</b> experiences in <b>AR</b>



## Road to the metaverse

The metaverse is here and it is being powered by real-time 3D technology. Our new series of talks and workshops for decision makers and creators will inspire your journey.

Register now

Notify me of future sessions

### Monthly sessions for creators and decision makers

Get access to curated sessions designed for creators and decision makers.

As a leader in real-time 3D technology, Unity is poised to prepare its community for new modes of interaction to enable data discovery and insight. Explore strategies and get training on the tools required to build connected immersive experiences across industries.



#### Creator series

Build a strong foundation and develop your skills with Unity experts during these monthly sessions. Ranging from beginner to advanced, these deep-dives are curated specifically for creators looking to gain the knowledge and skill to succeed in the metaverse.

View all sessions



#### Executive series

Journey with Ryan Peterson, Unity's VP of professional services, as he and special guests tackle the why and how behind this new era of consumer and social experience. These intimate chats are designed to spark your imagination, and will end with a live Q&A.

View all sessions



# Learn Live

<https://learn.unity.com/project/road-to-the-metaverse-live>

March	Prototyping and world building.
April	Intro to <b>Visual Scripting</b>
May	<b>Animation</b>
June	Intro to <b>Universal Render Pipeline</b>
July	Intro to High Definition Render Pipeline
<b>August</b>	<b>Shader Graph</b>
September	<b>VFX Graph</b>
October	<b>Post Processing</b>
November	<b>UI Building</b>
December	Intro to <b>VR</b>
January	Intro to <b>AR</b>
February	Intro to <b>Spatial Audio</b>



## Live Learn: Road to the Metaverse

Project • Beginner • +0 XP • 10 Hours • 41

Unity Technologies

Overview

Skills

Live

Groups

### Summary

The road to the metaverse is paved in real-time 3D. But the challenges for creators are plenty – from capturing, transforming, visualizing and optimizing right-time data to creating, distributing and operating rich, interactive, immersive experiences that will engage stakeholders anywhere. Get ready to start your journey and learn the skills to thrive in the next era of computing.

### Project Objective

By the end of this series, you should understand the following topics:

- Intro Unity
- Polybrush
- Probuilder

UPCOMING LIVE LEARN

Live Learn: Road to the Metaverse - Intro

Associated project: [Road to the Metaverse](#)

April 20, 2022

5:00 - 7:00 pm BST

Learn More

Select your version

Last updated: March 21

2022.1

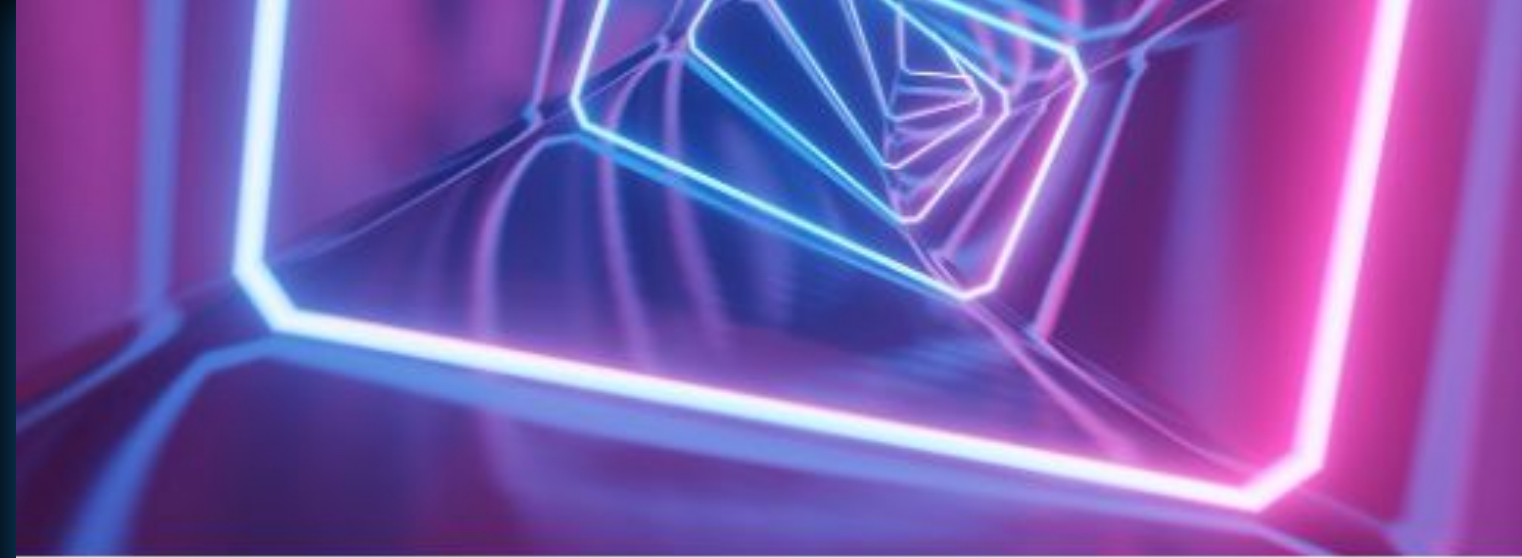
Language

English



# Executive series

<https://create.unity.com/road-to-metaverse#executive>



EXECUTIVE SERIES

## Building successful B2C brands in the metaverse

August 25, 2022

9 am PT / 12 pm ET / 5 pm BST

Duration: 60 minutes

Join Ryan and [Media.Monks](#)' SVP, Tim Dillon, as they discuss what it's going to take for B2C brands to make it in the metaverse. Hear from Tim as he shares lessons he's picked up from working with large consumer brands and walk away with strategic tips on how to get started, how to leverage real-time 3D technology to make an impact, and much more.



# The Metaverse Minute

<https://blog.unity.com/topic/metaverse-minute>

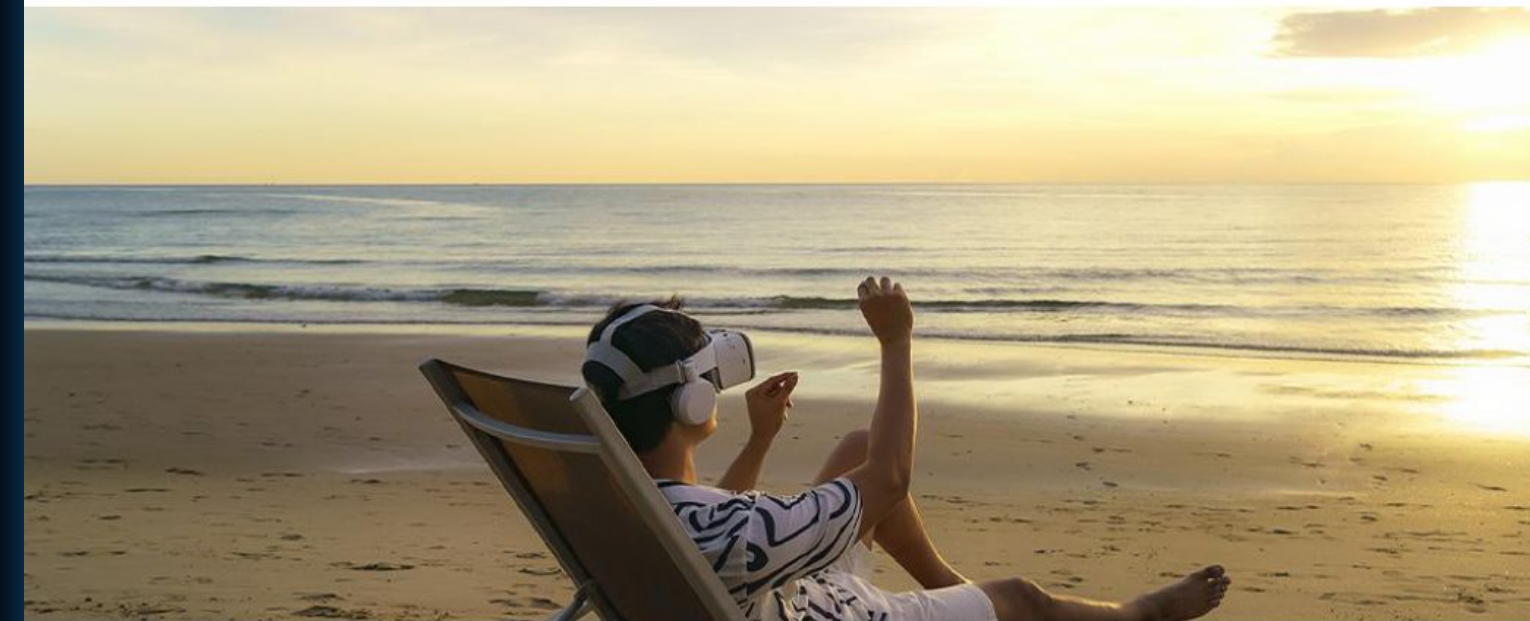


## Metaverse Minute: Reimagining summertime travel



By Community Team

July 28, 2022 in Manufacturing | 4 min. read



Topics covered

Manufacturing

Digital Twin

Metaverse Minute

Share



### Metaverse Minute: Reimagining summertime travel

It's July, which means it is time for summer holidays! We hope you're reading this edition of the Metaverse Minute from the beach with a piña colada, but if you're not, we have some options for you. Here are four ways to travel with Unity.



# Road to the Metaverse: Forums!

<https://forum.unity.com/forums/road-to-the-metaverse.798/>



## Road to the Metaverse

Filter by tag:

Title	Start Date	Replies	Views	Labels
<input type="checkbox"/> <b>Official</b> Welcome to the Road to the Metaverse Unity-Gehan, Jun 9, 2022	🗄️ 📌 🏠	Replies: 3 Edit Views:	469	
<input type="checkbox"/> <b>Official</b> Frequently Asked Questions Unity-Gehan, Jun 9, 2022	📌 🏠	Replies: 0 Edit Views:	284	
<input type="checkbox"/> <b>Official</b> Welcome to News and Updates Unity-Gehan, Jun 9, 2022	📌 🏠	Replies: 0 Edit Views:	262	
<input type="checkbox"/> <b>Official</b> Learn Live: Prototyping & Worldbuilding Unity-Gehan, Jun 9, 2022	🗄️ 📌	Replies: 2 Edit Views:	384	je
<input type="checkbox"/> <b>Official</b> Learn Live: Intro to Visual Scripting Unity-Gehan, Jun 9, 2022	📌	Replies: 0 Edit Views:	307	
<input type="checkbox"/> <b>Official</b> Learn Live: Animation Unity-Gehan, Jun 9, 2022	📌	Replies: 0 Edit Views:	327	
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<input type="checkbox"/> <b>Official</b> Workshops: How to bring your real-time 3D digital twin data into Unity Unity-Gehan, Jun 9, 2022	🗄️ 📌	Replies: 7 Edit Views:	406	je Yes
<input type="checkbox"/> <b>Official</b> Workshops: Let's get real: An introduction to AR, VR, MR, XR and more Unity-Gehan, Jun 9, 2022	📌	Replies: 0 Edit Views:	277	



# Social

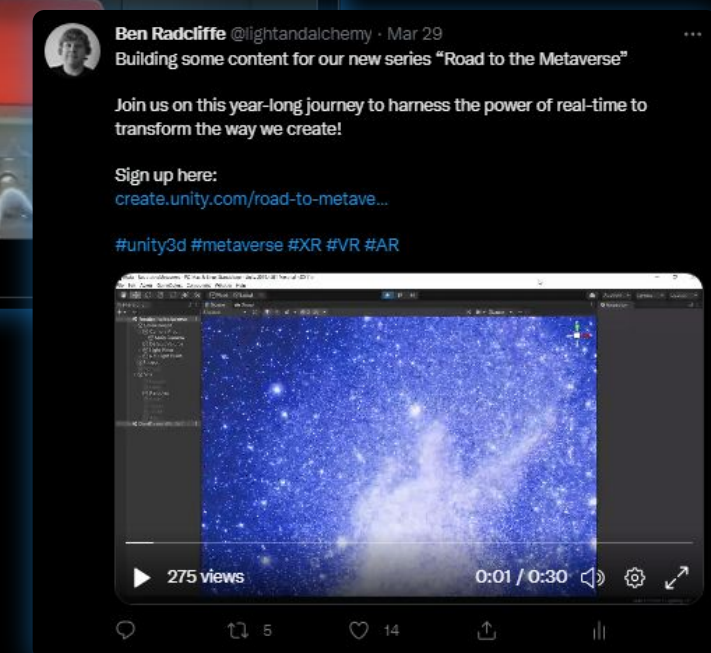
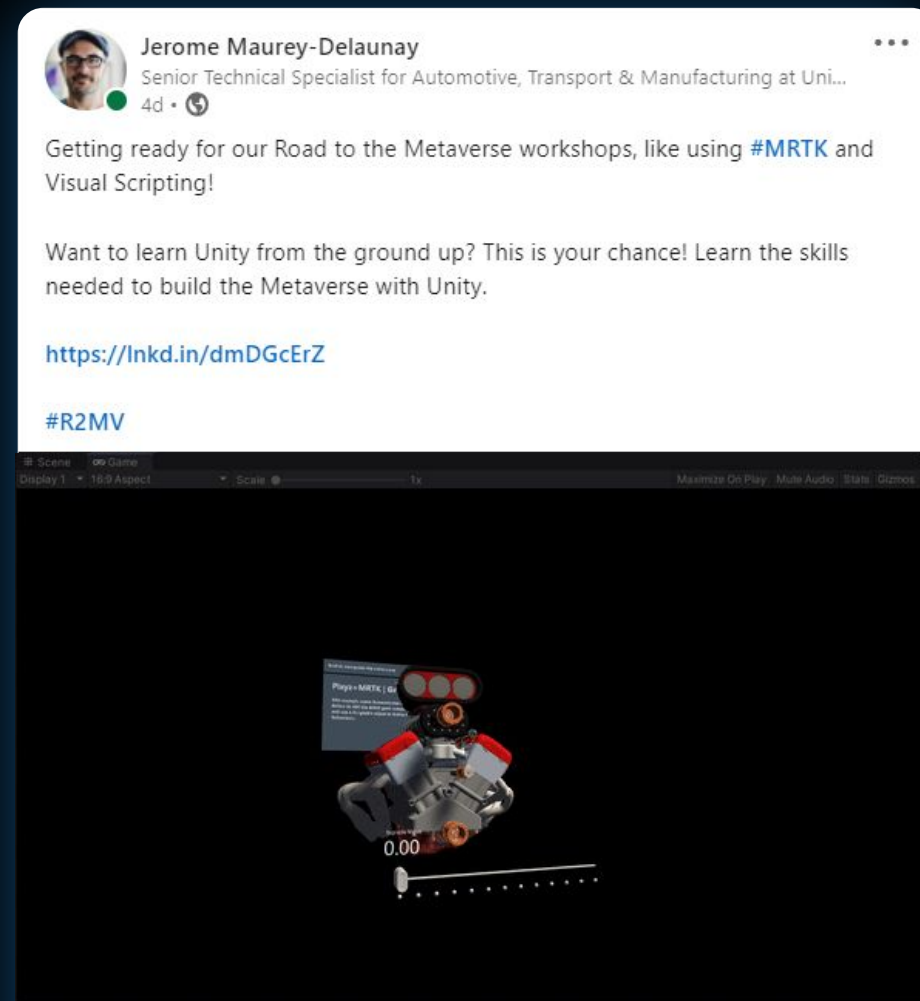
→ Please use **#R2MV**



**Jerome Maurey-Delaunay**  
[@jeromemaurey](#)



**Ben Radcliffe**  
[@lightandalchemy](#)





# Q&A

Any questions?



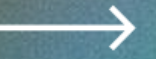
# Thank You

2022

Survey available here →



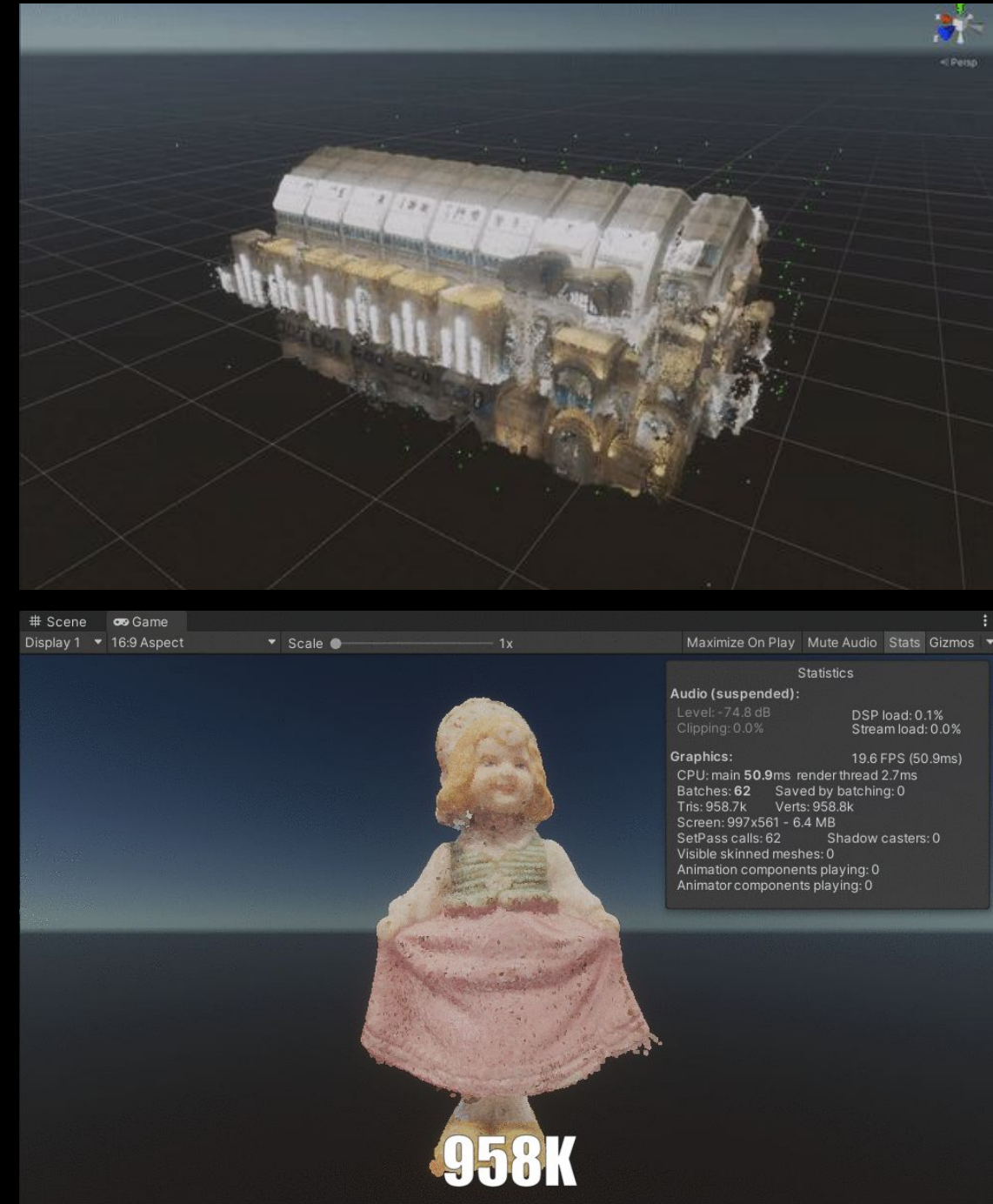




# Overtime



# XR Best practices





## Hololens 2

	Low-scene complexity	Medium-scene complexity	High-scene complexity
Objects per scene	1-3	4-10	10+
Triangles	<100,000	<30,000	<10,000
Materials	1-2 per object		

## Magic Leap

	Light Simulation	Medium Simulation	Busy Simulation
CPU Budget	14ms		
GPU Budget	12ms		
Triangle count	200k to 400k		

### → Windows Mixed Reality

- [Performance recommendations for Unity](#)
- [Optimize your 3D models](#)

### → Magic Leap

- [High Performance Graphics Optimizations in Tónandi](#)

### → Quest

- [Performance and Optimization](#)

## Quest

	Light Simulation	Medium Simulation	Busy Simulation
Draw Calls	200-400	150-250	50-150
Triangle count	350k to 500k		

## Quest 2

	Light Simulation	Medium Simulation	Busy Simulation
Draw Calls	400-600	200-300	80-200
Triangle count	750k to 1.0m		

## Desktop VR Headsets

	Low-scene complexity	Medium-scene complexity	High-scene complexity
Objects per scene	1-3	4-10	10+
Triangles	<15,000,000	<500,000	<150,000
Materials	1-2 per object		



## Best Practices

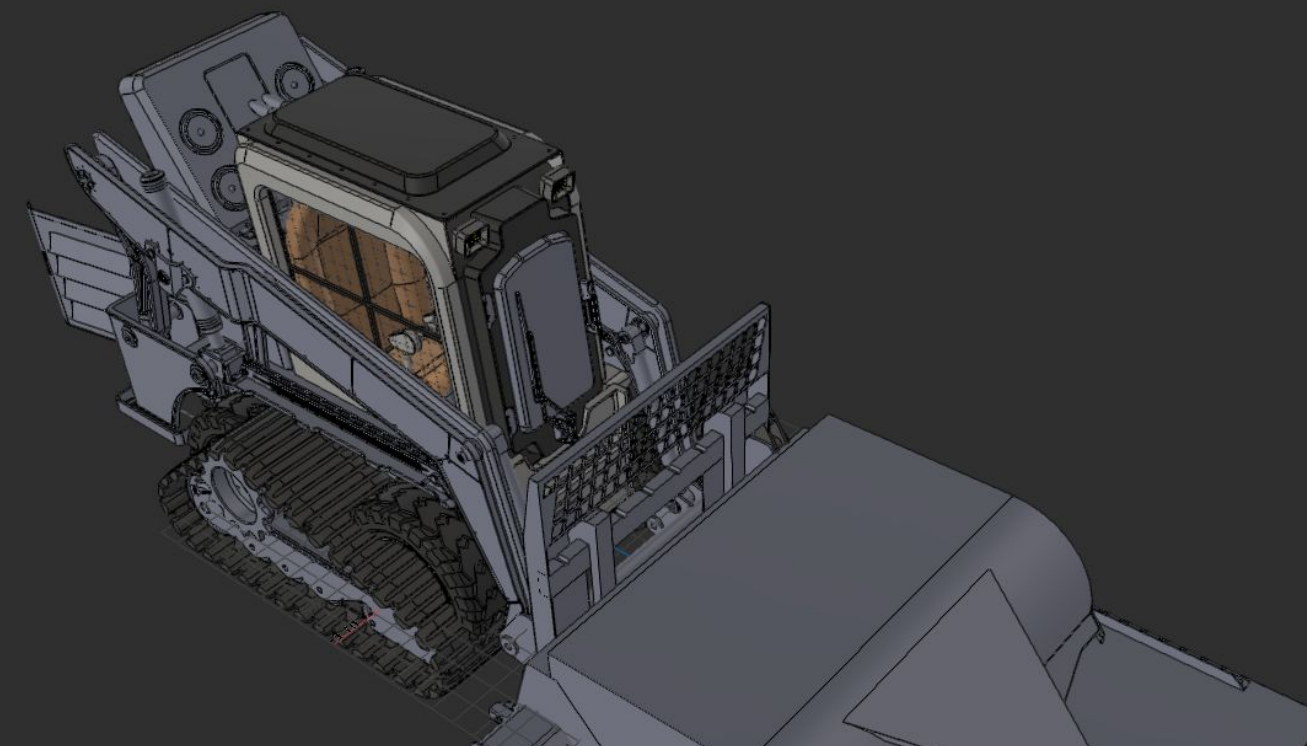
- Reduce materials and surfacing
- Reduce textures size
- Remove hidden and unused data
- Reduce triangles
- Reduce draw calls
- Reduce hierarchy complexity
- Bake!
  - Ambient Occlusion
  - Normal Maps
  - Cookies!

### Resources:

- [Best practices for converting and optimizing real-time 3D models](#)
- [Use Pixyz Studio to prepare 3D models](#)

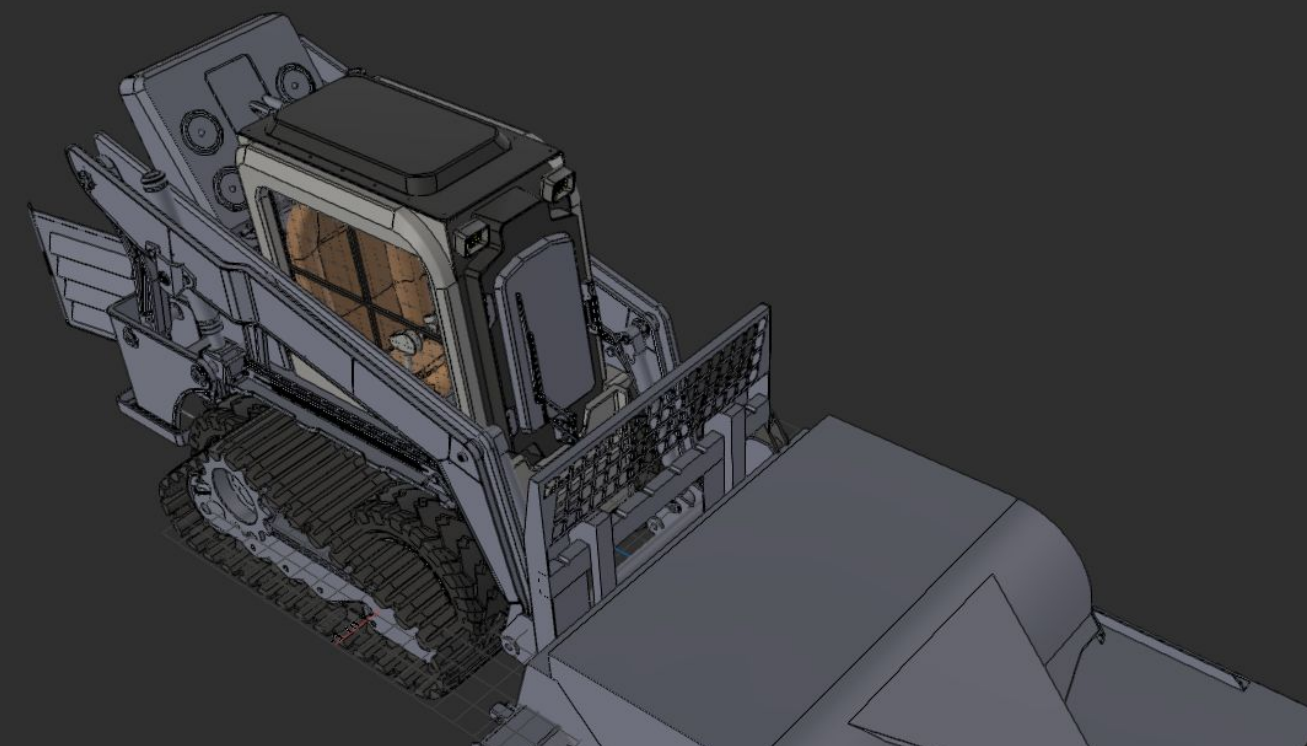
Part Occurrences 320  
Triangles 4 369 418  
Points 0  
Scene Dimension  
X 2.0m  
Y 1.9m  
Z 5.2m

FPS 6.18  
RAM usage 32.05 / 127.85 GB  
VRAM usage 3.16 / 24.00 GB



Part Occurrences 320  
Triangles 200 000  
Points 0  
Scene Dimension  
X 2.0m  
Y 1.9m  
Z 5.2m

FPS 1.53  
RAM usage 31.73 / 127.85 GB  
VRAM usage 2.96 / 24.00 GB

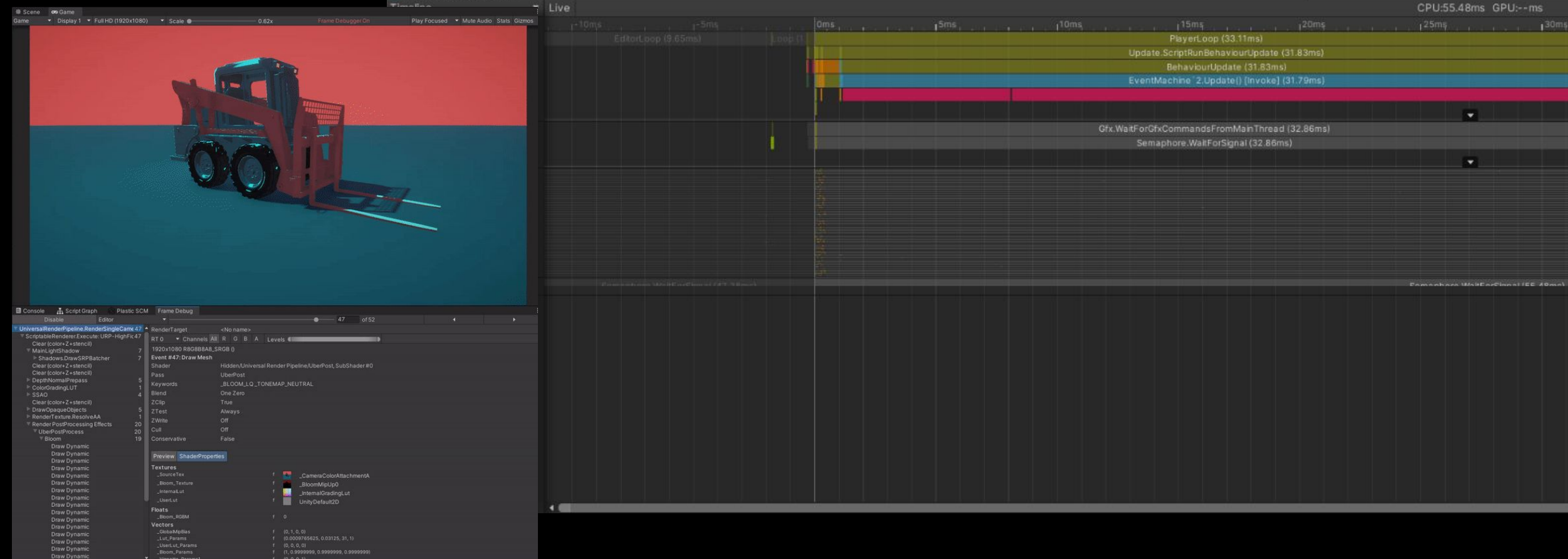
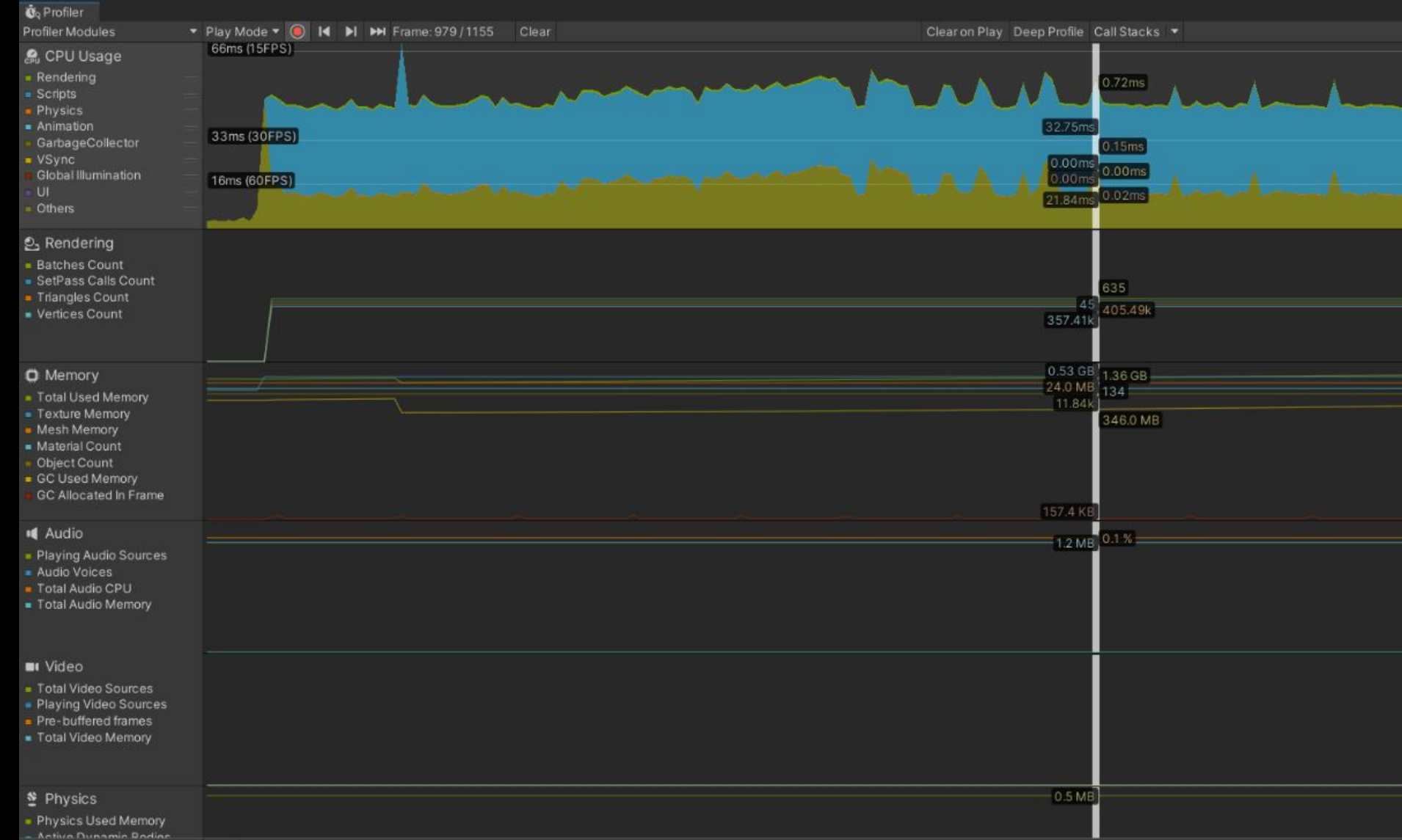




# Things to keep in mind

Use the **profiling tools** to keep track of poly count, draw calls, CPU time, GPU render, physics simulation, etc.

- [Profiler](#)
- [Profile Analyzer](#)
- [Memory Profiler](#)
- [Frame Debugger](#)
- [Physics Debugger](#)

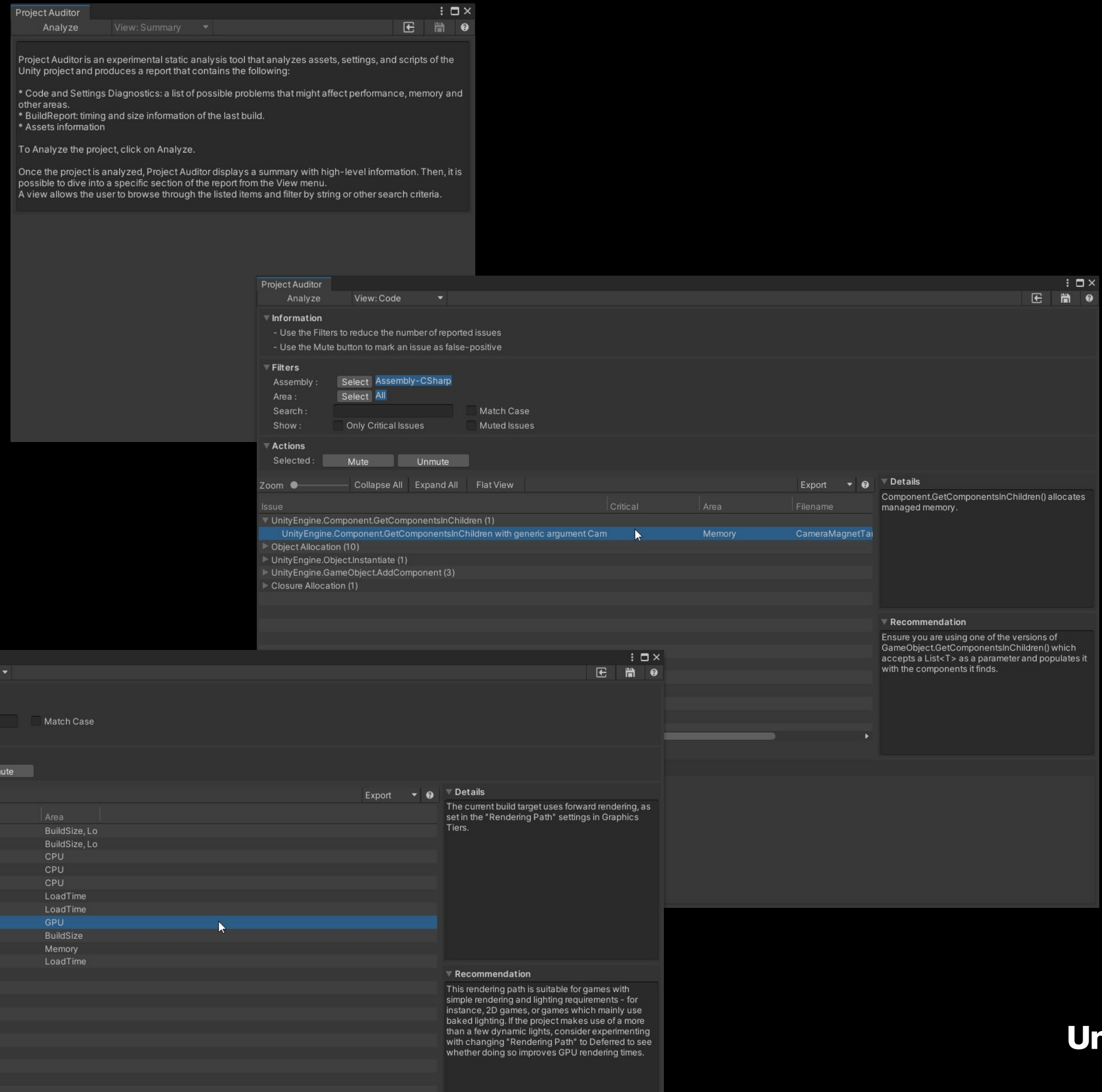




# Project Auditor

Project Auditor is an experimental static analysis tool that analyzes assets, settings, and scripts of the Unity project and produces a report containing:

- Code
- Assets
- Settings
- Last Build Report



## [Github](https://github.com/Unity-Technologies/ProjectAuditor.git)

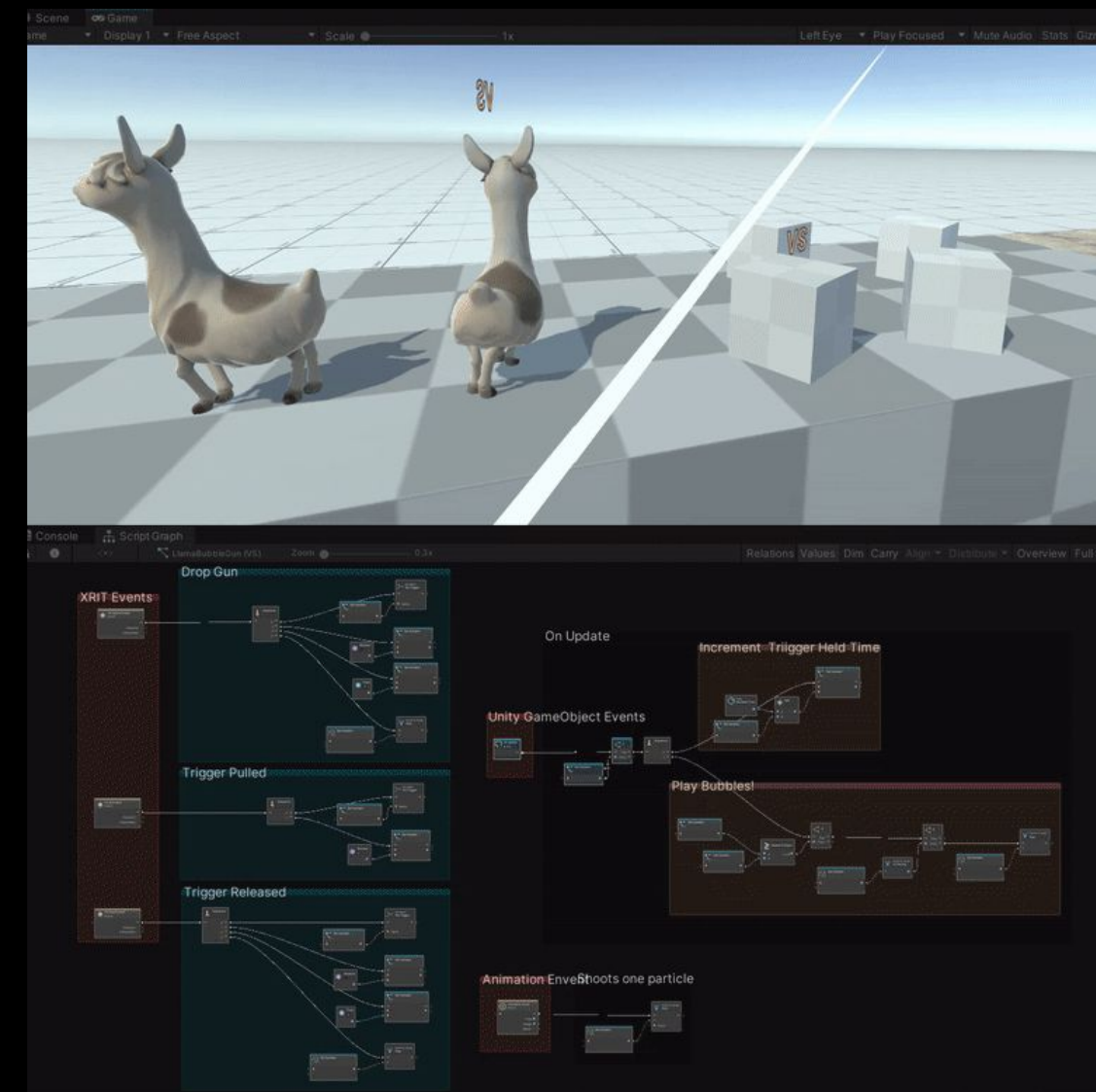
Package Manager → Add Package From Git URL

→

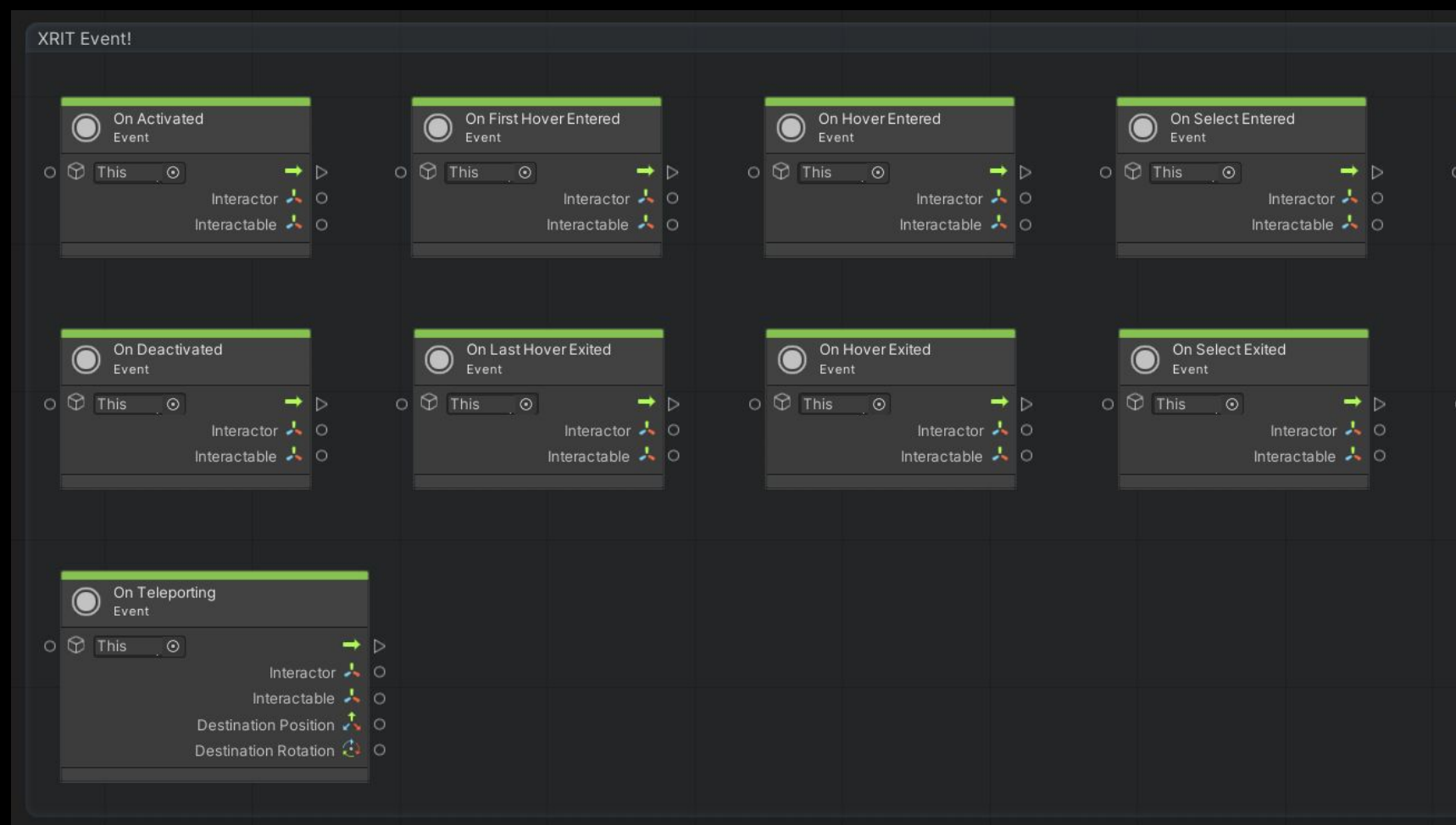
<https://github.com/Unity-Technologies/ProjectAuditor.git>

*Note that this package is not officially supported by Unity, and it is not on Unity's roadmap at this time.*

# XR Interaction Toolkit Visual Scripting Extensions



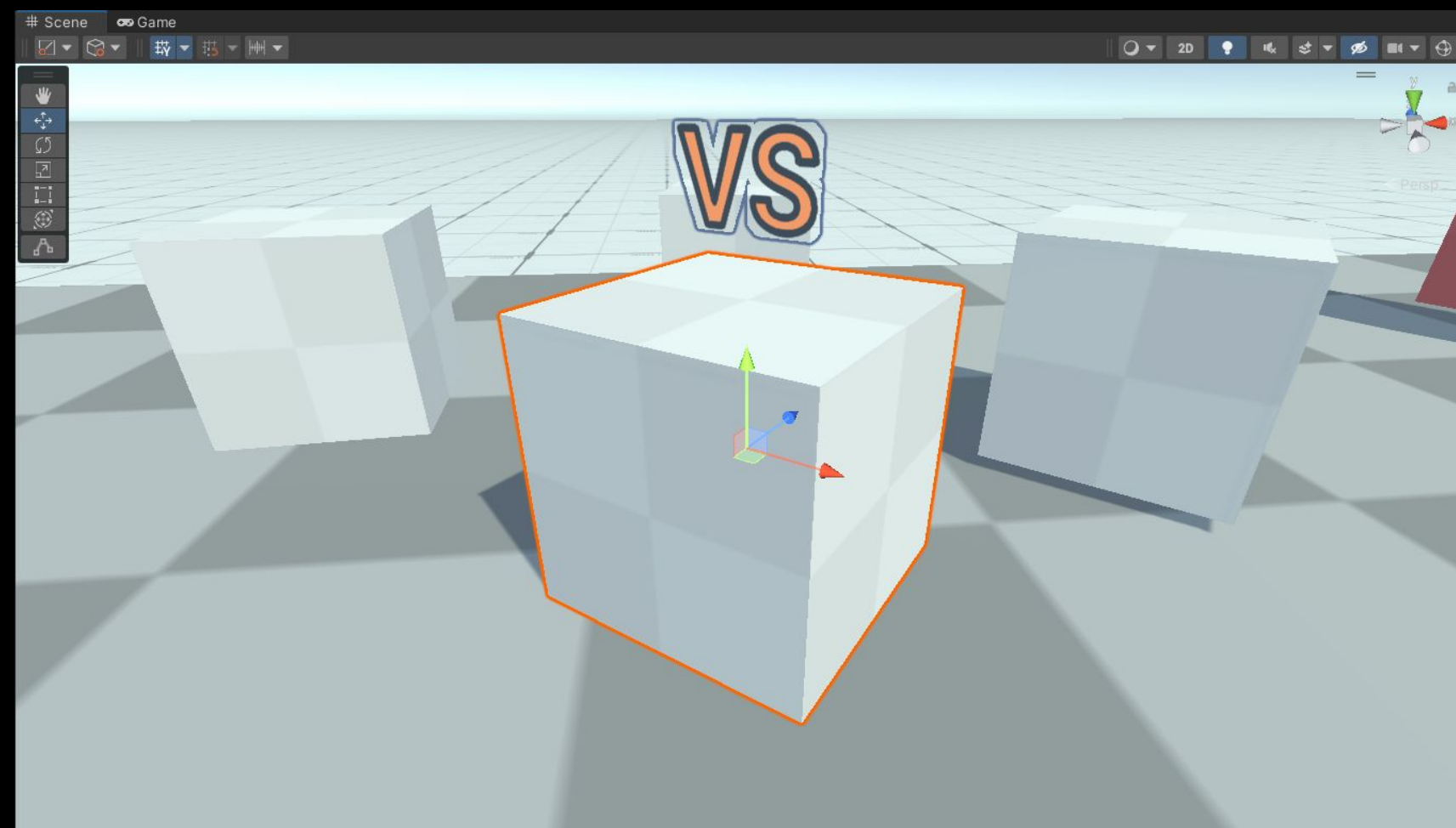
## Check them out on GitHub!



### Visual Scripting extensions for XR Interaction Toolkit

A set of custom nodes to handle XRI events in your Visual Scripting Graphs, hand wrapped in a convenient Package!

[GitHub](#)



### XR Interaction Toolkit Examples

A fork of the XRI Examples using the Visual Scripting extensions to test, and re-create the custom C# behaviors.

[GitHub](#)