Collaborative VR Essentials: A Guidebook and Toolkit for Developing 3D Applications in Unity and Unreal for the Immersion Studio

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M1NG

Introduction

We are a team of interdisciplinary 3D developers with a focus on inclusive learning using XR technology in education.Our backgrounds range from interior design, architecture, and digital media, and we have combined our skills to create a guide to 3D development focused on VR interactives that range from beginner to advanced 3D development. With this toolkit we hope to cover any essential features like 3D modelling software (Blender), and two interactive 3D applications using Unity and Unreal Engine to engage with Toronto Metropolitan University's Library Immersion Studio.

Michael Carter-Arlt is the Immersive Technology Specialist at the Toronto Metropolitan University (TMU) Library. In this role he utilizes his skills in Graphic Design, 2D Animation, Digital Media, and 3D Development to create XR (Extended Reality) projects related to pedagogy, SRC (Scholarly, Research and Creative)projects, as well as the creation of OER (Open Educational Resources). Michael also manages the Immersion Studio in the TMU Library, which is a 360° interactive projection cylinder designed for collaborative Virtual Reality experiences. He has worked on multiple projects related to XR in education, and has worked on projects for the Aga Khan Museum, the German Consulate of Toronto, and the USC Shoah Foundation.

Ava, as an architect with a master's and bachelor's degree in Architectural Technology and Architecture and a master's degree in Digital Media, I provide innovative design solutions for a variety of applications. My experience covers cutting-edge technologies, such as Virtual Reality and Computational Design, with a focus on sustainability. I specialize in creating dynamic, user-friendly, and productive design solutions while

managing projects from initial concept through entire life-cycle implementation. She has an eye for leading-edge design and strive to create buildings and spaces that are aesthetically and ecologically pleasing while maintaining their timeliness and relevance.

Michelle, an interior design student skilled in design, photography and production of various collaborative projects, with a passion and a creative curiosity in all things design. Her creative interests are guided by multidisciplinary design and learning about new design and how design disciplines can be interconnected. She has worked on numerous collaborative design competitions, community design projects, and entrepreneurial spaces, including designing an MVP and developing marketing products for online engagement. In her recent role as a Research Assistant with PARA Lab, she has collaborated on a community design project (Planting Imagination) where she co-designed a community garden and led the digital design platform development.

3D DEVELOPMENT

Overview

What is 3D Modelling

3D modelling is a computer-generated process that allows creatives like you to create three-dimensional objects and scenes that can be manipulated in a virtual space. It is a powerful tool that enables creative professionals to bring their ideas to life, and it has become an essential part of industries such as gaming, film, architecture, animation, product design, and 3D printing.

In 3D modelling, designers use software to create digital models of objects or environments. These models are typically made of polygons, which are simple shapes such as triangles, squares, or circles that are combined to form complex shapes. By manipulating these shapes, designers can create highly detailed and realistic models.

3D models can be classified as either low poly or high poly. High poly models are those that have a high polygon count, meaning that they are highly detailed and contain a large number of polygons. These models are typically used for high-end applications where realism is a top priority. However, rendering times for high poly models can be very lengthy, and they require powerful hardware to create and manipulate.

Low poly models, on the other hand, have simplified polygons, meaning that they have less detail than high poly models. They are easier to load, view, and edit, and they can be worked on faster with minimal lag. Low poly models are typically used for applications such as mobile games, where performance is a top priority.

3D Modelling Softwares

- Maya: A licensed software mainly for animation, motion graphics, virtual reality, and character creation.
- Cinema 4D: A licensed software specialising in 3D modelling, animation, and rendering software. Cinema 4D is often used in the film and broadcast industries for its integration with Adobe After Effects and other software.
- 3DS Max: A licensed software for modelling, architecture, engineering, and construction development. It has a wide range of modelling and texturing tools, as well as tools for animation, simulation, and rendering
- Blender: A free open source software primarily used for animation and visual effects
- Sketchup: A popular licensed software for architects, interior designers, and engineers because of its ease of use and quick modelling capabilities. Sketchup's 3D Warehouse allows users to access a library of free 3D models
- Rhinoceros 3D: A licensed software for creating 3D models, rendering, and fabrication. Rhino supports NURBs (Non-Uniform Rational B-Splines) geometry modelling. Rhino's Grasshopper plugin allows users to create complex algorithmic designs using visual programming

Game Engines

Game engines are game development softwares used to create 3D and 2D interactive games. They are used to make virtually every video game that is currently available, and can be used to develop 2D side scrollers, 3D First Person games, or VR simulations.

Two of the most popular game engines that are open source are Unity and Unreal, both of which will be showcased in this

guide. Although both Unity and Unreal function in similar ways and can both be used to create similar end products, there are slight differences between them that make them unique.

Unity Vs. Unreal

Unity is known for its user-friendly interface and fast development process, making it a popular choice for indie developers and small studios. It also supports a wide range of platforms, including mobile devices, consoles, and PC.

Unreal Engine, on the other hand, is known for its powerful graphics capabilities and advanced features, making it a top choice for AAA game development. It also has a strong community and support for creating immersive experiences in virtual reality.

Below is a chart that shows the differences between the two game engines, and will help you understand which would be the best game engine to use for your content.

Source: https://hackr.io/blog/unity-vs-unreal-engine

BLENDER

Why Blender?

Blender is a popular free to download, cross- platform compatible and open-source 3D modelling, animation, and rendering software application used by many artists, designers, architects, and game developers. It can allow users to create complex 3D models, animations, and visual effects, and it supports a wide range of features, including 3D modelling, UV unwrapping, texturing, rigging, animation, simulation, rendering, compositing, and motion tracking.

Blender is known for its user-friendly interface, powerful tools, and flexible workflow. It also supports various file formats, including 3D models, textures, animations, and videos, making it a versatile tool for 3D modelling and animation projects. Additionally, it has an active and supportive community that provides helpful tutorials, add-ons, and resources to users.

- For beginners – user-friendly
- Open source software
- Free to download
- Easily accessible
- For 3D modelling and animation
- Cross platform compatible (Windows, Mac OS, or Linux)

Blender and Rhino 3D are both popular 3D modelling software with their unique strengths and limitations. Blender is a free and open-source software primarily used for animation and visual effects. It has a steep learning curve but offers a vast range of modelling tools and a highly customizable interface. On the other hand, Rhino 3D is a licensed software designed primarily for NURBs (Non-Uniform Rational B-Splines)

geometry modelling. Rhino 3D can be highly precise. Rhino 3D also allows users to create complex organic shapes with ease and is well-suited for 3D printing and prototyping.

Blender Tips

Hardware Requirements

Minimum

- 64-bit quad core CPU with SSE2 support
- 8 GB RAM
- Full HD display
- Mouse, trackpad or pen+tablet
- Graphics card with 2 GB RAM, OpenGL 4.3
- Less than 10 year old

Recommended

- 64-bit eight core CPU
- 32 GB RAM
- 2560×1440 display
- Three button mouse or pen+tablet
- Graphics card with 8 GB RAM

*Tip! Use a 3-button mouse to make your Blender navigation easier

Source: https://www.blender.org/download/requirements/

File Types, Which Ones Should I Use?

What file type to use?

Blender offers a wide range of different file formats for importing and exporting. The versatile file formats allow you to store various data types depending on your project. For use

with the Immersion studio, 3D assets are imported into Unity/Unreal.

When creating your 3D projects ensure to always save your work and export your model with the compatible file type for unity/unreal. We have constructed a simple table that lists the most used file formats that are currently associated with or are compatible with Blender 3D and Unity/Unreal Engine.

File Type	Compatible with Unity/ Unreal Engine	Description
.blend	N	Native file format used by Blender. These files contain all the information needed to create and edit 3D models, such as mesh data, texture information, animation keyframes, lighting, and camera settings. Blend files can only be opened and edited within Blender. However, Blender can export models to various formats such as FBX, OBJ, and Collada, which can be opened in other 3D software or game engines.
.fbx	Y	FBX is developed by Autodesk3D file formats used for exporting and importing 3D models across different software programs and is widely supported. FBX files are best texture preservation and 3D data conversion between softwares. They also support animation for 3D models.
.obj	Y	A standard 3D file format used for exporting and importing 3D models across different software programs and is widely supported. Obj files are the most compatible 3D file across most softwares but do not support animation.
.glb/.gltf	Y	GL Transmission Format (glTF) is an open-source and royalty-free 3D file that supports static models, animation, and moving scenes. glTF is used in games, native web applications, AR, VR, and 3D ads. It is designed to be compact and efficient for use on the web.
.usdz	N	USDZ is developed by Apple and is optimized for use on iOS devices, designed specifically for web and AR applications and may have limited compatibility outside of web and AR applications. The USDZ format is only compatible with iOS platforms.
.stl	Y	3D file format used for 3D printing. It is a surface-based format that defines the geometry of a 3D object using triangular facets.

Blender, How to Get Started

How to Get Started?

When it comes to creating in Blender, it's important to keep several things in mind. First and foremost, you need to approach your work from a three-dimensional perspective, as Blender is a 3D modelling software. This means considering factors such as camera angles, lighting, materials, and gravity.

To get started with 3D modelling in Blender, it's helpful to have a basic understanding of the software's interface and navigation tools. There are many existing helpful tutorials, here are a few popular "Blender Basics for Beginners" conveniently found here (Please take note of the Blender version when watching these tutorials).

However, if you're new to Blender and want to get started with 3D modelling, there are a few steps you can follow:

1. Download and install Blender: Blender is a free and open-source software available for download from the official website.
2. Familiarize yourself with the interface: Blender's interface can be overwhelming at first, but there are many tutorials and resources available online to help you get started.
3. Start with basic shapes: Blender allows you to create basic shapes like cubes, cylinders, and spheres, which you can use to create more complex models.
4. Learn the modelling tools: Blender has a wide range of modelling tools, including extrude, bevel, and boolean, which you can use to modify and shape your objects.
5. Practice and experiment: 3D modelling takes time and

practice, so don't be afraid to experiment and try new things. There are also many online communities and forums where you can get feedback and support from other Blender users.

Additional Blender Resources:

Blender Download: https://www.blender.org/

Blender Basics: https://youtu.be/6FaLHFJ2kKI

Blender Tutorial 1: https://www.youtube.com/watch?v=UXqq0ZvbOnk

Blender Tutorial 2: https://www.youtube.com/watch?v=X4MXWcx4jUA

CGCookie: https://cgcookie.com/lessons/welcome-to-the-blender-basics

Blender.org tutorials: https://www.blender.org/support/tutorials/

Blender HotKeys that Might be Helpful?

When working in 3D modelling software, having a 3 button mouse is highly recommended. While creating 3D models, using shortcuts make your modelling process just a bit faster.

Below is a list of Common Blender shortcuts

Toggle “Edit Mode”	Tab
AddMenu	Shift + A
Select All	A
Deselect All	A x2 or Alt + A
Delete Selection	X
Grab/Move	G
Join Selected Objects	Ctrl + J
Extrude	E
Scale	S
Inset	I
Rotate	R
Loop Cut and Slide	Ctrl + R

For a more in depth list of HotKeys, visit the Blender Hotkey Reference PDF, https://download.blender.org/documentation/BlenderHotkeyReference.pdf

Navigation:

- Hold the middle mouse button to navigate
- Hold shift+ middle mouse button: Pan

Shortcut:

- Edit-> Preferences: To create new shortcuts
- F3: Search Bar-> Change that into space for easier use
- G: Move- G+Z: Move in Z direction, G+Y: Move in Y direction, G+X: Move in X direction
- R: Rotate- R+Z: Rotate in Z direction, R+Y: Rotate in Y direction, R+X: Rotate in X direction
- S: Scale- S+Z: Scale in Z direction, S+Y: Scale in Y direction, S+X: Scale in X direction
- (G, R, S) + Shift+(X,Y,Z): To exclude that direction
- Alt+G: put the object in the center
- Shif+A: Adding objects to your scene, you can use the search bar instead
- Shift+D: Duplicating objects
- 0: Camera View, 1: Front View, 7: Top View
- /: Isolating an object (Local View)
- Shift+S-> Cursor to Selection

Modelling:

- Search bar-> Add a Cylinder, Add Camera, (Change the vertices if you need before doing anything else!)
- Transform Tab: change the dimensions.
- Edit Mode (Top left): To edit the objects (Vertex, Edge, Surface)
- P: Select the face, Vertices, or edges you want and separate them from your model
- Ctrl +R: Add Edge Loop
- E: Extrude
- S: Scale
- F: Close the Gap
- X: Delete
- Alt+Click: select all
- Modifier Properties(In the right Menu): Add a Modifier

  1- Solidify: To give a bit of shell to a surface, Check Even Thickness—>Apply Scale after!
  2-Boolean
  3-Bevel
  4-Subdivision
  5-Smooth/ Shade Smooth

  - Remember to apply your modifiers after editing

  6- Screw
  7-Array

- To hide an object: Obj Properties (In the right menu)-> Uncheck Render and Viewport display

Material:

- Material Tab(In the right menu)-> Create a new material-> Change the base color to grey, reduce the specular 0.16, and increase the roughness.
- Ctrl + L: to assign your material or create a link between your selected objects and the material

Blender Modelling Tutorial

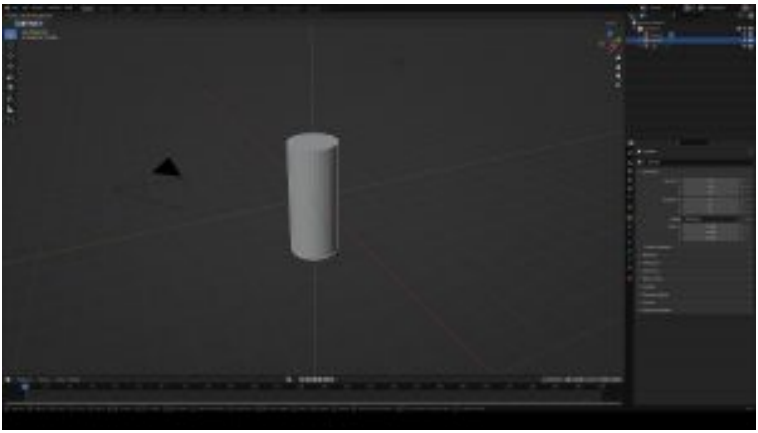
Blender's 3D modelling features allow users to create a wide range of objects, from simple geometric shapes to complex models with intricate details. We will go through a brief tutorial on 3D modelling.

To create a basic lamp, we can start by using basic geometric shapes such as cylinders to create the lamp's body and shade. You can then add textures and colours to create a more realistic look. Once completed, the lamp can be saved as a .blend file, which includes all the meshes, textures, and materials used to create it. The finished model can then be imported into game engines like Unity or Unreal and used in 3D projects by adding lights and adjusting its scale to fit the scene.

1. First, download Blender and start up a "New File" > General
2. Add a cylinder, by pressing Shift + A (AddMenu)

3. Select the newly added cylinder by left clicking, LMB

4. Extrude selected Cylinder by pressing E, and scale by the Z-axis, by pressing Z immediately after



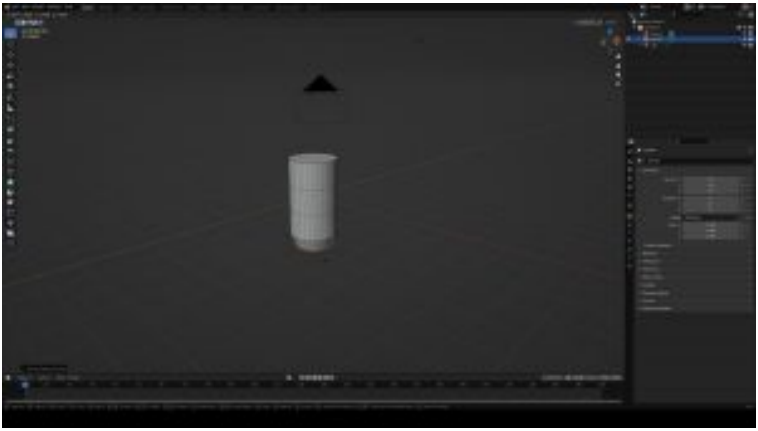
4a. Extruding without Z-axis, will scale all sides of the model equally

5. Toggle Edit Mode by pressing Tab to edit individual vertices, edges, and faces of the model

6. In Edit Mode, create a loop cut by pressing Ctrl + R and using your middle scroll wheel to scroll how many cuts you want to create in your model

7. Ensure that you have selected vertices as your selection mode, to select all vertices in one line press Shift + Alt + LMB

8. Scale the selected row to create a tapered base



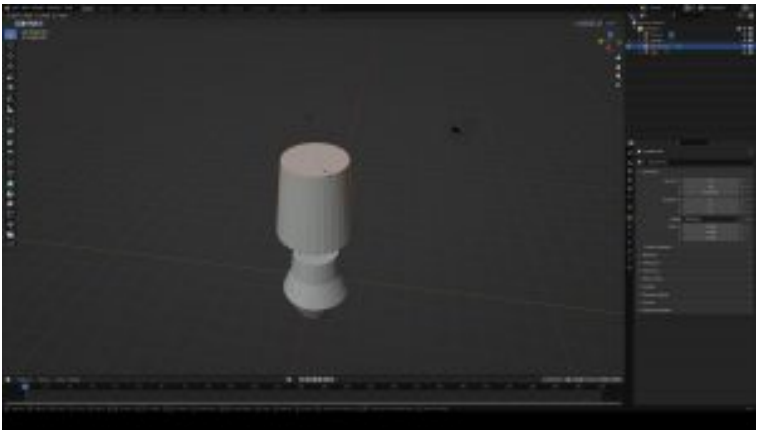
9. Continue step 7 and 8 for the corresponding lines to create a unique lamp body shape

10. Add a new cylinder model for the Lamp shade, Shift + A (AddMenu)

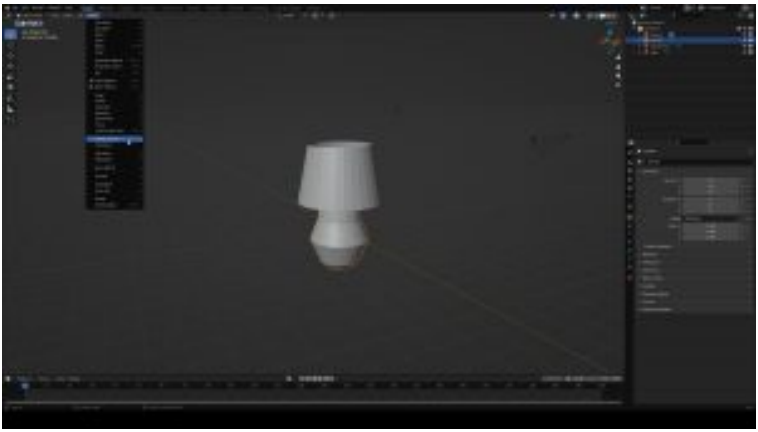
11. Scale the lamp shade to size, Move the new cylinder to the top of the lamp body by pressing G then Z to move along the z axis

12. Select all vertices in one line press Shift + Alt + LMB, scale down the top lamp shade to create a tapered lamp shade shape

13. Select faces of the top and bottom of the cylinder, press x to delete the two faces



14. Once happy with the shape of your lamp, select the lamp body and go to Object> Shade Smooth to smoothen all the edges of the model



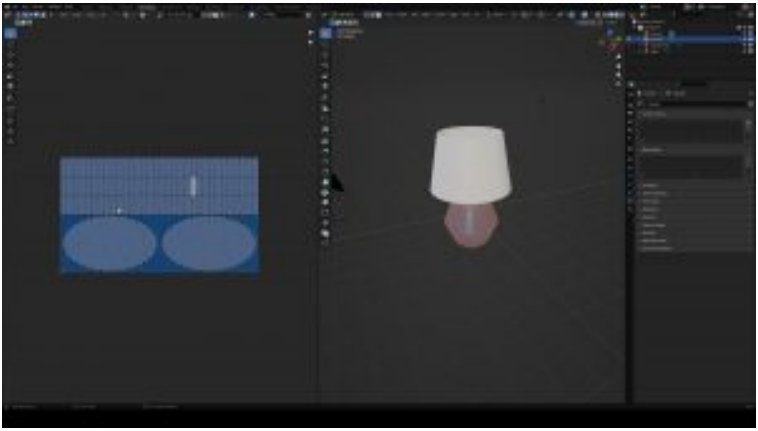
15. Add textures to your model, Open the material editor, shaped as a red circle

16. Add a NEW material on your selected object. In this case the lamp body. Create a new Image Texture

17. You will be prompted to import a file, select your jpg/png file as your texture image

18. Select UV Editing, to start editing the texture you apply to your mesh model.

19. Ensure you are in Edit mode, select a face on the body of the lamp. Press A to select all faces of the body lamp.

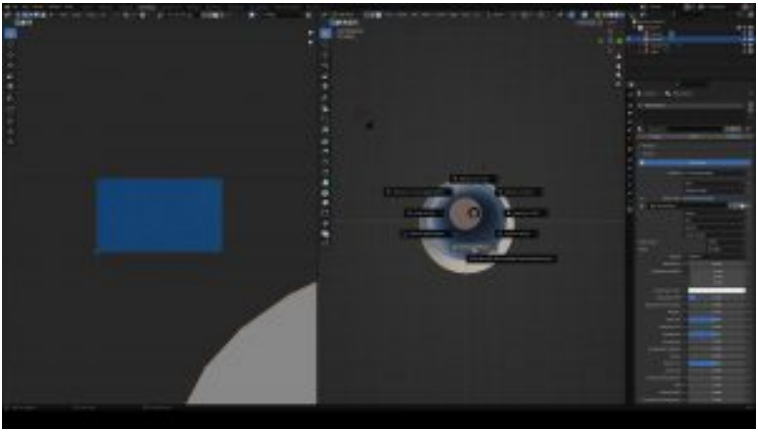


20. Once all faces are selected, Press S to scale the faces of the model in order for the scaling of the texture to look accurate

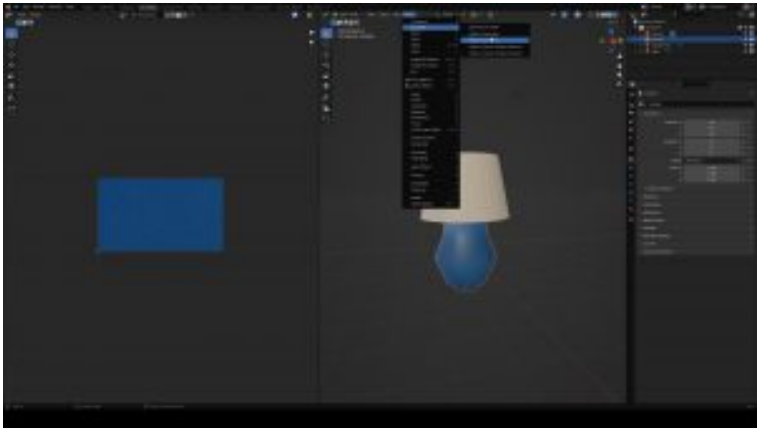
21. Repeat step 21, for the lamp shade, and your lamp shade texture of your choice

22. Move your lamp object to the origin by selecting the bottom face

23. With the face still selected, Press Shift + S, then select “Cursor to Selected”



24. Next, Go to the “Object” dropdown menu and select “Set Origin” > Origin to 3D Cursor



25. To scale your object, first parent the object, to group your separate objects together

26. Then scale your object 1:1 by pressing S, to the desired size

TMU LIBRARY IMMERSION STUDIO

Immersion Studio Overview

The Immersion Studio is a resource located in the TMU Library for faculty and students to create research and teaching projects using collaborative virtual reality (VR) experiences and immersive media. The space is a full 360° projection cylinder that is 6 meters in diameter and 2.3 meters tall that utilizes 5 ceiling mounted projectors to stitch images together to create a seamless 360 image. Because the Immersion Studio is an open space that does not require the use of any peripherals or headgear to interact with the content, it is an attractive alternative for faculty and students wishing to create and experience 360° and VR content. The Immersion Studio can accommodate people who are either standing or seated, and can accommodate up to 10 people.

The Immersion Studio is designed for students and faculty looking to explore new forms of collaborative, immersive experiences whether that be simulations, visualizations or immersive exhibitions. Although traditional VR headsets may be considered more accessible due to headset availability, the Immersion Studio enables collaborative, immersive, and shared VR applications that can be experienced by multiple people at the same time. Certain drawbacks of traditional VR headsets include an isolating individual experience, eye strain from HMD lenses, and frequent cleaning for safe use between multiple people. The Immersion Studio provides a more attractive alternative for viewing VR content in these specific areas, making it a more viable solution for research projects related to collaborative/ shared VR, 360° media, or immersive installations.

The most common forms of content creation for the Immersion Studio are 360 images, 360 video/audio, and 3D applications developed in Unity or Unreal. Below are the optimum file requirements for each type of media.

- 360 Photos: 8000px x 1000px (Jpeg or PNG)360
- Video: 4k (3840 × 2160) 360° Video (Either as Mp4 or Youtube link)
- VR/3D Content: Packaged Unity OR Unreal Projects

For more information on the Immersion Studio, you can visit the TMU Library website here: https://library.torontomu.ca/services/facilities/immersion/

Immersion Studio Hardware Specifications

Immersion Studio	**AV System**
Full 360° projection 6 meters in diameter Wireless control via Parsec application Maximum occupancy: 15 Image aspect ratio = 8:1 Curved, lockable door to complete 360° fabric screen Dartex blackout cap with integrated HVAC ducts for AC Unit	5 x full HD (1920 X 1080) 3500 lumen ceiling mounted projectors 7.1 surround sound speaker system with 5 JBL speakers and 1 subwoofer Windows 10 PC media server with 2 NVIDIA Quadro RTX-5000 Graphics Cards Apple iPad (8th Generation) for wireless control of 360 images and video 2 HTC Vive Base Stations (1.0) + 2 Vive Controllers & Steam Controller for VR and motion controls Microsoft Kinect V2 for hand and body tracking

Immersion Studio Layout

VR PROJECTS

VR Projects In Unity

The Unity Game Engine developed by Unity Technologies and can be used to create 2D and 3D interactive games. Unity uses the C# scripting language to handle interactions, and has one of the largest communities of developers in the 3D development industry. This is especially the case with indie game studios and mobile app developers. In addition to creating 2D and 3D games, Unity can also be used to create VR games and VR experiences, which is what we will be focusing on specifically

A VR project can be created in a number of different ways in Unity, but in order for the project to work in the Immersion Studio, it will need to have the SteamVR plugin installed and enabled. Please note that Open XR is currently not supported in the Immersion Studio as of March 2023.

Resources

Unity Game Engine: https://unity.com/

SteamVR Unity Documentation: https://valvesoftware.github.io/steamvr_unity_plugin

SteamVR Plugin: https://assetstore.unity.com/packages/tools/integration/steamvr-plugin-32647

Unity VR Development Tutorial: https://youtu.be/gGYtahQjmWQ

Immersion Studio Unity VR Template Project: https://drive.google.com/file/d/1H8-BP1_HjHWcj2r-cywCS76TNcDG3bj6/view

Working With The Unity VR Template Project

The Unity VR Template project can be downloaded in the resources link provided, and has everything you need to get started working with VR projects in Unity. The project contains the assets from the blender tutorial, along with additional royalty free 3D models. It also contains the necessary plugins to run VR interactions for SteamVR, and the required plugins to make the project compatible with the Immersion Studio. You can either work with the assets available in the assets folder, or you can upload your own assets by dragging them into the open Unity project. There are two important interactions needed in order to achieve an engaging VR experience. These two interactions will be outlined below.

VR Navigation & Interactions

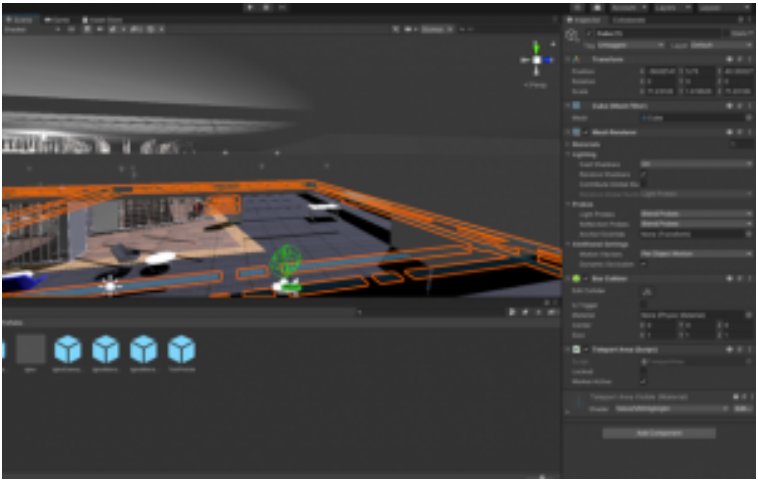
In order to navigate through a 3D scene, you will need to have some form of navigation that enables locomotion. In traditional VR and in the Immersion Studio, it is important to note that traditional omnidirectional movement using the arrow keys and mouse is not the ideal way of locomotion. This is because omnidirectional movement has a tendency to cause motion sickness in most forms of VR. Instead, the main navigation system in VR through teleportation, as in pointing the VR controller in a direction and warping to that location in VR. The result looks like the screenshot below.

By default the template VR Unity project that is provided will have VR navigation and interactions already enabled. You can place your 3D object onto the navigation floor of the 3D scene to enable navigation for your own project without the need to add additional movement components to your scene. If you are importing a separate project and you want to enable VR navigation and interaction, you can follow the steps below to do so.

VR Navigation

1. Select the 3D object in your scene that you would like to enable as an object used for navigation (ex. floor)

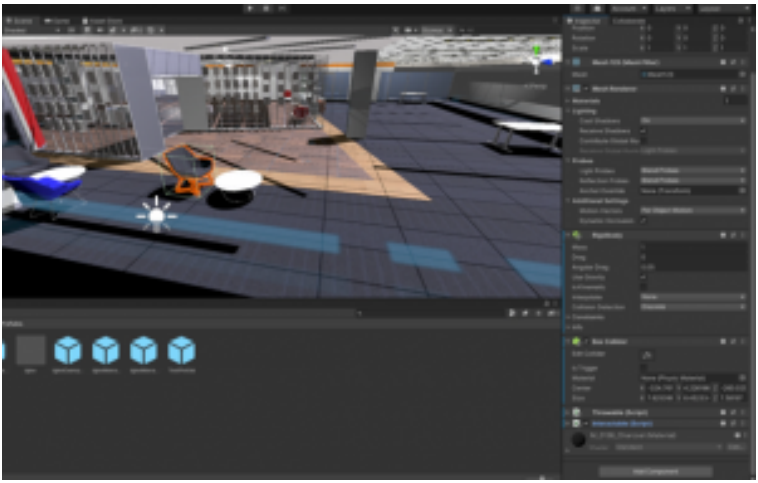
2. Duplicate that object by copying and pasting it in the same location
3. Select the cloned object from step 2 and in your inspector panel, click on the “Add Component” button\
4. Search for the “Box Collider” component and add it to your object
5. Next, search for the “Teleport Area” script and add the script to your object
6. The object should not have teleport navigation enabled. If done correctly, the inspector panel for your object should look similar to the inspector panel on the right in the image below.



VR Grab Interaction

1. Select the object you want to be interacted with
2. In the inspector panel, click the “Add Component” button
3. Add the Rigidbody component

4. Once the Rigidbody component is added, check the “Use Gravity” box
5. Next, add the Box Collider component
6. After the Rigidbody component and the Box Collider component have been added, you can add the “Interactable” script and the “Throwable” script to the object
7. If done correctly, the object should now be grabbable and throwable in your scene. The inspector panel for your object should look similar to the inspector panel on the right in the image below.



Immersion Studio Unity Plugin

In order for a Unity project to work in the Immersion Studio, we need to import the IglooUnityToolkit asset package on the TMU Library website found in the link above. When the package is imported to an existing project and the IglooManager prefab has been added to an open scene, the project should be

compatible with Unity via the Igloo Warper program. Please also note that The Unity plugin was tested and working for Unity 2020.3.0f1 and below. It is not guaranteed that this plugin will work for versions of Unity beyond the year of 2020.

Resources:

Unity Igloo Plugin Documentation: https://360igloo.atlassian.net/wiki/spaces/IG/overview

Immersion Studio Resources: https://library.torontomu.ca/services/facilities/immersion/resources/

The steps to importing and setting up a unity project are as follows:

1. Download the Unity Plugin from the Immersion Studio Resources link above
2. In your open Unity project, click on Assets in the navigation bar at the top
3. Hover over Import Package and select Custom Package
4. Find the Unity Plugin folder that was downloaded in step 1 and select IglooUnityToolkit-Dev-v1.2.1-1.unitypackage
5. Select “Import” from the pop up window in Unity
6. In the project window in the Unity editor, you should now see a folder called “IglooTools”
7. In the IglooTools folder, find the IglooManager prefab by navigating to Resources – Prefabs
8. Drag the IglooManager prefab into your open Unity scene
9. Your project should now be compatible with the Immersion Studio

Running Unity In The Immersion Studio

1. Open your Unity project

2. Once the Unity scene is running, open the Igloo Warper UI window and select Layers – External Application Inputs, then check the Igloo Unity box and make sure it is Enabled. Your Warper UI window should look like the image below

3. The Unity scene should now be running in the Immersion Studio, and you can navigate around the 3D scene by holding up on the circular touchpad on either controller

Troubleshooting In Unity

- If the Unity scene does not display in the Immersion Studio after following the above instructions, close the Igloo Warper app and repeat steps 4 – 5
    - The Igloo Warper app has a known issue where the inputs of the projectors will not properly refresh when going between Unity and Unreal. As a result, you may see the last visual of Unreal if it was previously open, or vice versa if Unity was previously open before Unreal.
- If the VR controllers are on but not displaying in the Immersion Studio
    - Double check that SteamVR is open and running
    - Make sure the green light is on for both controllers
    - If the above statements are true, restart the SteamVR app and play the Unity Scene again. If necessary, close

Unity and restart the application

VR Projects In Unreal

The Unreal Engine was developed by Epic Games and acts in a similar fashion to Unity, but relies more on a visual scripting language called Blueprints. Instead of using C# scripts found in Unity, Unreal uses its node based blueprint visual scripting system to create interactions. It is also important to note that the blueprint coding system in Unreal is based off of a C++ scripting language. This is important in case you decide to use custom scripts that are not available in the existing Unreal packages.

The main advantage of using Unreal to Unity is the visual quality of the rendering engine. Unreal and Unity have very different rendering engines for their 3D environments, which is especially notable with lighting. In almost all cases, Unreal tends to look better in terms of visual aesthetics compared to what you would see in Unity.

Resources:

Unreal Game Engine: https://www.unrealengine.com/en-US/

Unreal SteamVR Documentation: https://docs.unrealengine.com/4.26/en-US/SharingAndReleasing/XRDevelopment/VR/SteamVR/

Unreal VR Development Tutorial: https://youtu.be/DiGh6MxDFds

Immersion Studio Unreal VR Temple Project: https://drive.google.com/file/d/1Kp3oGRn9yFkhYCrPCFKa7RdWqQz9mB5m/view

Working With The Unreal VR Template

Project

The Unreal VR template project can be downloaded from the resources link, and contains everything you need to create a VR experience for either a VR headset or for the Immersion Studio. More specifically it contains 3D royalty free assets, an interactable 3D environment, and the plugins required for SteamVR interactions and for the Immersion Studio. You can use the resources provided in the project folder as you wish, and add your own assets to the template project. It should be noted that if a VR project was created in Unreal using the Open XR plugin or Oculus plugins, these will need to be disabled in order to use the VR controllers that are compatible for the Immersion Studio.

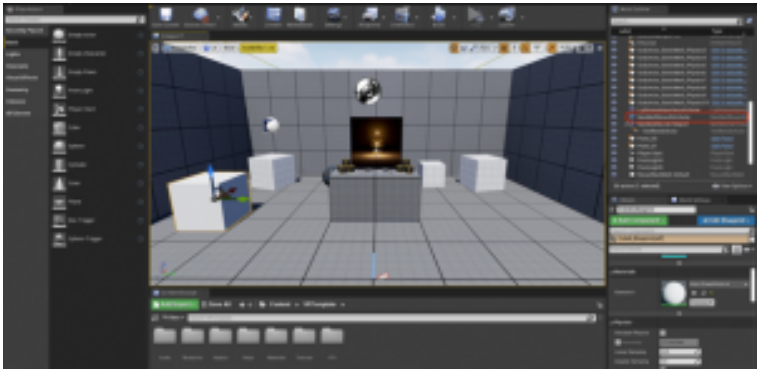
VR Navigation & Interactions

Similar to the navigation in Unity, locomotion will be handled through teleportation instead of omnidirectional arrow key movement. The teleportation works exactly the same way as it does in Unreal to how it works in Unity, with only slight visual differences. However, there are different ways of setting up the navigation in Unreal as opposed to Unity, which we will go into. The steps below will allow navigation and interaction with your own Unreal project by focusing on two main components that can be applied to your 3D objects.

If you are starting with your own Unreal project, you will need to follow the steps below to allow VR navigation. Please note that the VR controllers will not work if the proper plugin is not enabled. The Immersion Studio always uses SteamVR for VR interaction, so this plugin must always be enabled, with every other XR plugin (such as Open XR) be disabled.

VR Navigation

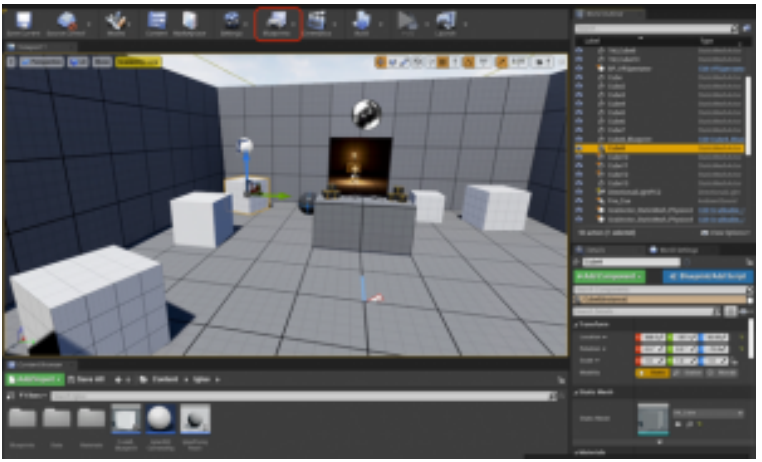
1. In your open Unreal project, make sure the “Place Actors” panel is open by enabling in the Window tab at the top of the editor
2. Once your place actors panel is open, find the “Nav Mesh Bounds Volume” using the search bar
3. Drag the Nav Mesh Bounds Volume into your open map. You will notice the object appears as a box outline. Anything within this box will be enabled for navigation.
4. After the component has been added to your map, you can enlarge and move the Nav Mesh Bounds Volume to fit the size of your 3D environment.
5. Your map should be enabled for VR controllers navigation, which can be tested by using the VR Preview play button at the top of the editor. If done correctly your map will look similar to the image below, and have the NavMeshBoundsVolume component in the World Outliner panel on the right side.



VR Grab Interaction

1. In the Place Actors panel, click and drag in an empty actor into your map

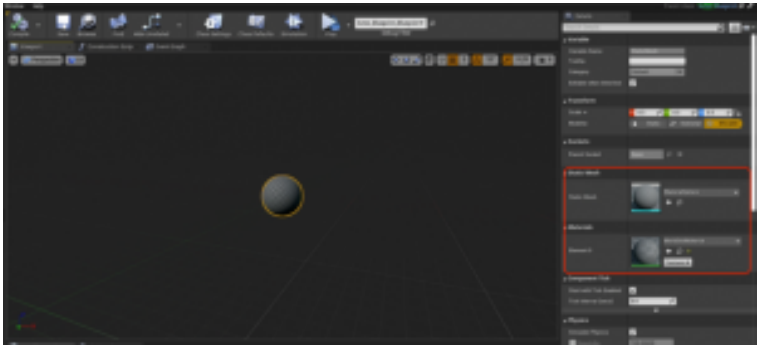
2. With the empty actor selected, click on the blueprints button at the top as seen in the image below



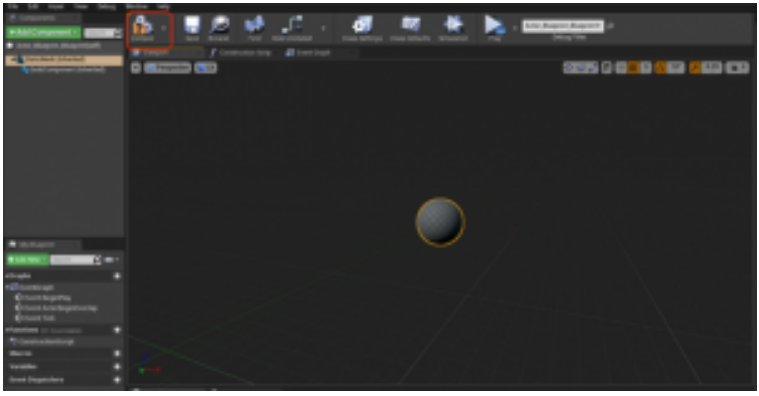
3. Click “Convert Selection To Blueprint Class”

4. In the popup window, search for the “Grabbable_SmallCube” and click select

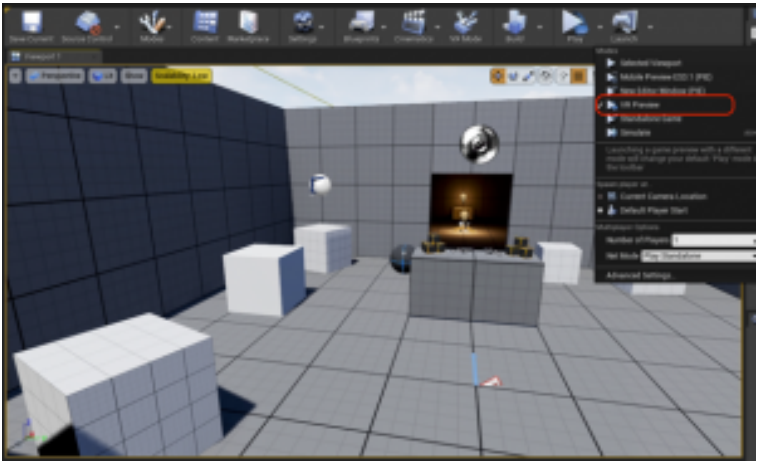
5. Next, navigate to the Details panel and change your static mesh and your material to the new object you would like to be interactable.



6. Click the compile button at the top of the window as seen in the image below



7. Your object should now be grabbable. You can test this by clicking VR Preview in the drop down of the play button see in the image below



Immersion Studio Unreal 4 Plugin

Similar to the Unity plugin, the Unreal plugin needs to be downloaded from the TMU Library resources page in the link above. Please note that before following the steps below, you must first quit any open Unreal projects or applications, otherwise the Igloo plugin will not work. Please also note that the Unreal plugin has been tested and working for Unreal 4.27. There are no guarantees it will work for versions beyond 4.27.

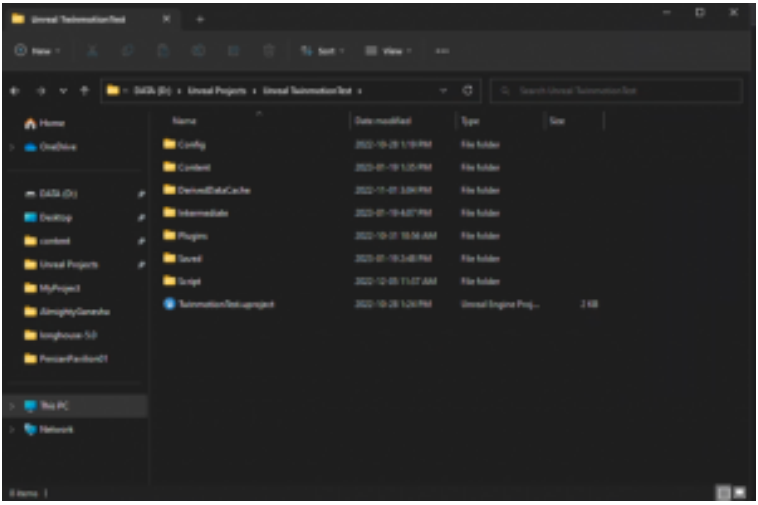
Resources:

Unreal 4.27 Igloo Plugin Documentation: https://360igloo.atlassian.net/wiki/spaces/IGLOOTOOLS/pages/28147732/First+Time+Setup

Immersion Studio Resources: https://library.torontomu.ca/services/facilities/immersion/resources

After closing down your Unreal project, follow the steps below:

1. Navigate to the root directory of your project folder. Your folder structure should look similar to the screenshot below.



2. Create a new folder in this directory called “Plugins” if the folder is not already created.

3. From the Unreal zip file that was downloaded from the TMU Library resources, open the “Plugins” folder, which can be found in the Igloo Unreal 4.27_Plugin folder

4. In this folder you will find three more folders (Igloo, IglooOSC, and IglooSpout)

5. Copy those folders and paste them into the Plugins folder you created in your Unreal project directory from step 2

6. After the folders have been pasted, open the content folder in your Unreal project directory

7. Next, open the content folder in the Unreal plugin folder (you should find a single folder labelled “Igloo”)

8. Copy that Igloo folder and paste that folder into the content folder within your Unreal project folder

9. Launch your Unreal project and find the Igloo360 Camera Rig actor in the Igloo folder within your Content Browser

10. Drag the Igloo360 Camera Rig into your open map

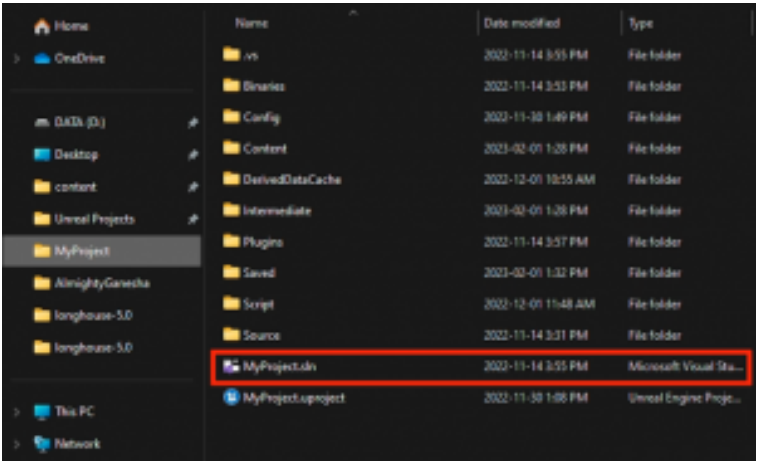
11. Your project will now be setup to run in the Immersion Studio

Immersion Studio Unreal 5 Plugin

First download the Unreal 5 plugin zip file from the Immersion Studio resources link below.

Immersion Studio Resources: https://library.torontomu.ca/services/facilities/immersion/resources/

Note: Before installing the Unreal 5 plugin, you must first make sure that your Unreal 5 project has a .sln file in its directory such as in the screenshot below.



If your project does not have a .sln file in the project directory, you need to create one first before installing the Igloo plugin. To do that, please follow the instructions found in the Igloo documentation below.

Unreal 5 Igloo Plugin Documentation:
https://360igloo.atlassian.net/wiki/spaces/IGLOOTOOLS/pages/3233087489/Installing+the+Igloo+Camera+System

After you have created a .sln file for your Unreal 5 project, you can install the Igloo plugin by following the steps below:

1. In your project directory, create a folder called “Plugins” if the folder is not there already
2. Next, copy and paste the IglooUnrealToolkit from the downloaded zip file into the Plugins folder in your project directory
3. Start your Unreal project
4. In the top right corner of the Unreal editor, click “Settings” then click “Plugins”
5. Make sure the Igloo Unreal Toolkit plugin is installed and is enabled. You should see a similar window to the screenshot below.
6. 

Close the plugins window and find the Igloo Camera Rig BP class located in the plugins folder within the Content Browser
7. Drag the Igloo360 Camera Rig into your open map
8. Your project will now be setup to run in the Immersion Studio

Running Unreal 4 & 5 In The Immersion Studio

1. Navigate to your project and open it in Unreal

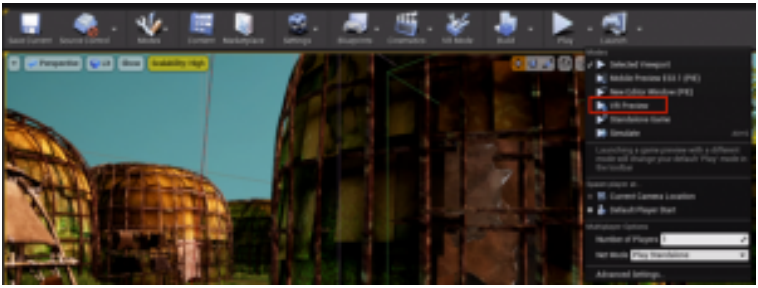
2. Navigate to the top of the game window and press Play Button
3. After the scene plays, hit the escape key on the keyboard to exit the simulation
4. Open the Warper UI application and in the navigation bar, select Layers – External Application Inputs and check the box next to Igloo Unreal to make sure it is enabled. Your Warper UI window should look like the image below.
5. 
   Go back to Unreal and click the Play button again to ensure everything is working, and the VR controller is tracking

    - Note: You will notice only one controller is currently enabled in the scene when you move it around the Immersion Studio. The other controller is disabled by default, and will not be shown in the Immersion Studio. The other controller can be left to the side when the demo is running

Troubleshooting in Unreal

Troubleshooting In Unreal

- If the Unreal demo is not displaying (either because it is displaying a Unity scene or nothing at all), close the Igloo Warper app and restart it
- If the Unreal demo is running but no controllers are showing up in the Immersion Studio, wait 30 seconds to one minute then try holding the controllers up again
    - ○ You should see at least one controller display in the Immersion Studio, but not the other. This is because of the way the current Longhouse demo is set up. This may change in the future.
- If the same problem above persists, try restarting the SteamVR app
- If the Unreal demo is running and the controller is displaying but you cannot navigate or interact with the 3D environment, you are most likely in PLAY mode in the Unreal editor. To fix this, stop the Unreal simulation and select the down arrow next to the play button and select VR Preview. See the image below for reference.



- If the above methods do not work, and the Unreal project is running but you cannot interact with anything in the scene, restart Unreal and relaunch the Longhouse project

Side Notes:

If the room setup has been reset, or if the VR controllers are tracking in the opposite direction in Unreal, check the following:

- In the VR Pawn BP, make sure the Igloo camera manager is 180 degrees on the z axis
- In the scene, make sure the player start component is adjusted so that the player is oriented forward from the start
- Make sure the camera in the VR Pawn BP is located in the center to insure accurate tracking in the middle of the Immersion Studio

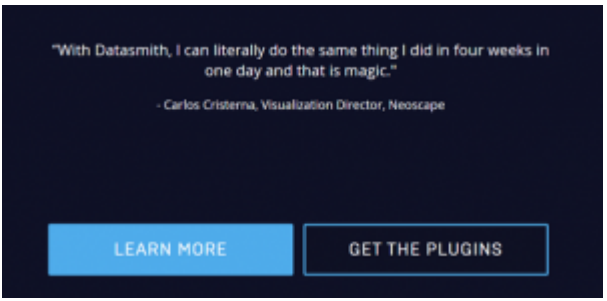
INTRO TO ALTERNATE WORKFLOWS

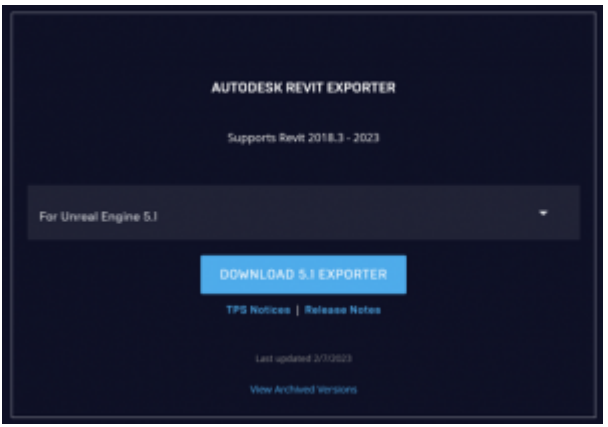
The below workflows provide alternative options of going from various 3D softwares to Unreal 5. It is important to note that for any project that is intended to have interaction or is intended to be visualized in the Immersion Studio, it must first be imported to either Unreal or Unity to create a compatible link between the 3D scene and the Immersion Studio. Below are some examples of how you can use software such as Revit, Twin Motion, or Unity Reflect to create interactive visualisations with game engines.

Revit and Unreal Engine 5:

1. To download the Datasmith plugins for various CAD software, such as Revit, 3Ds Max, Rhino, and SketchUp, follow the link provided and click on the “GET THE PLUGINS” button. Then, download the Autodesk Revit Exporter and install the file.

https://www.unrealengine.com/en-US/datasmith





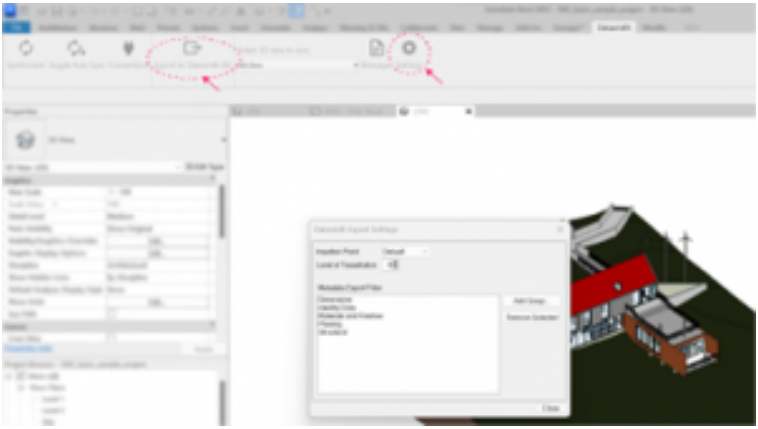
2. Open your Revit file. You will see a new tab called Datasmith in your top panel. From settings, you can change the Level of Tesselation and Insertion point. You can bring your

file into Unreal using two methods: exporting your project as a Datasmith file or using the real-time connection. If you're done editing your file, export it as a Datasmith file. However, if you're still updating it, use the real-time connection instead.

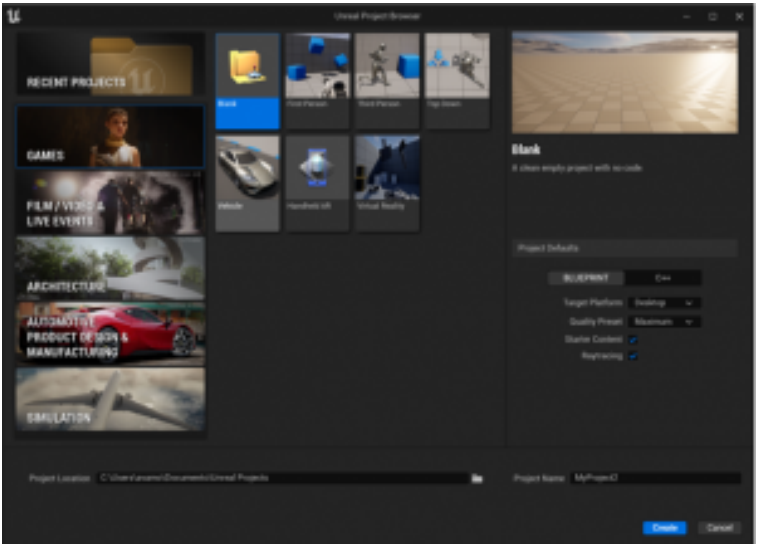
OPTION A: EXPORTING AS A DATASMITH FILE

3. To export your file, click on the "Export to Datasmith File" button, create a new folder for your exported file, open it, and save your export in that folder. Wait for the exporting process to finish.

IMPORTANT: purge your file before exporting and delete anything that you can add in Unreal later, such as the plants or furniture objects with low quality.

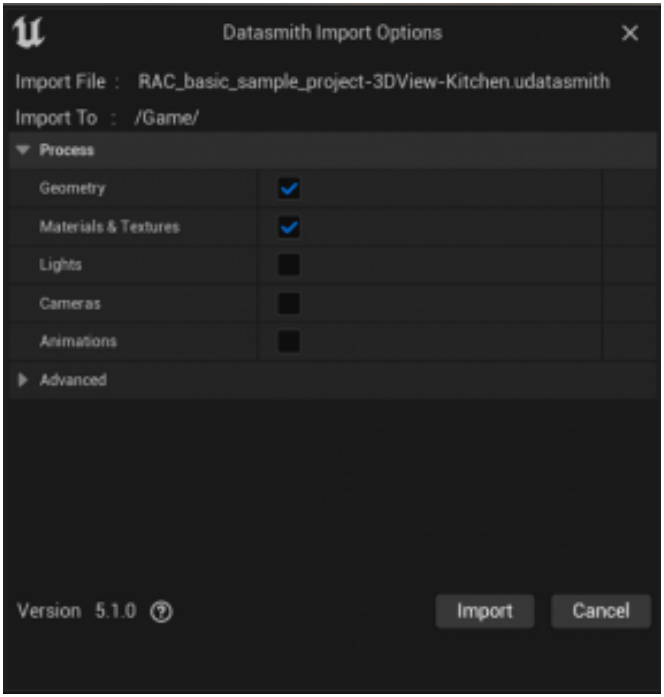


4. Go to **Epic Game Launche**r and launch a blank **Unreal Engine 5** project. To do this, select "Game Mode", and then "Blank". Alternatively, you open a Virtual Reality scene, which already has blueprints for many interactions in the starter content. Select blueprint, and click create.



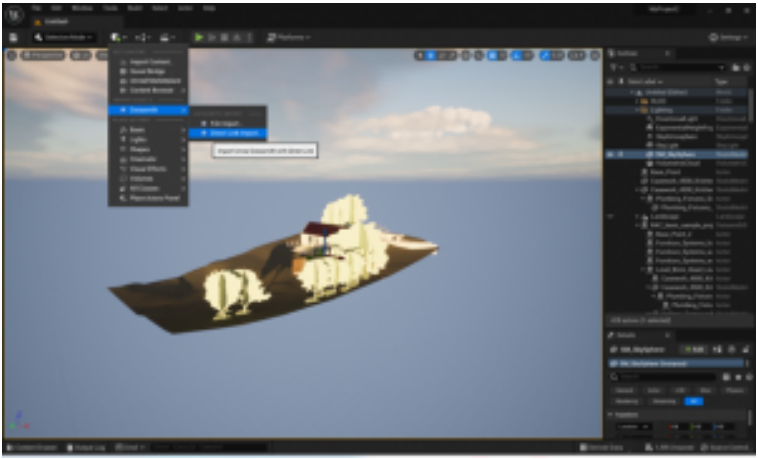
5. For Unreal to read the Datasmith file, activate the plugin within Unreal. To do so, go to “Edit” from the top menu and select “Plugins”. In the search bar, search for “Datasmith”. A list of relevant Datasmith plugins will appear. Select the “Datasmith CAD Exporter” checkbox and click the “Restart Now” button.

6. Once Unreal has restarted and reopened, click on the “Add” button from the top dropdown menu and select Datasmith. From here, you can choose the “File Import” option. Then, locate the folder you created before and open the exported Datasmith file. Choose the “Content” folder as the location for the import and in the next window, deselect “Lights”, “Camera”, and “Animation”, then click on “Import.”

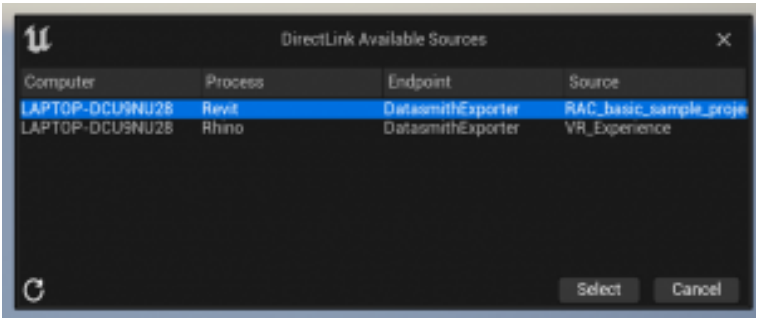


OPTION B: USING REALTIME CONNECTION

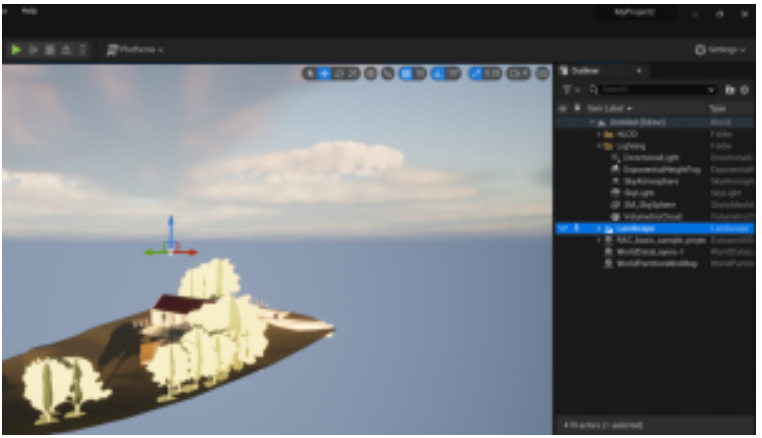
7. To use the realtime connection instead of importing files, you can use Directlink Import in Unreal. To generate the link, first select the connection button in Revit. Then select the “Direct Link Import...” from the dropdown menu to import your project.



8. If you have different projects open in both Rhino and Revit or different Revit files, you may see different available sources in the opening import pop-up window. Make sure to select the correct source to import the correct file into Unreal.

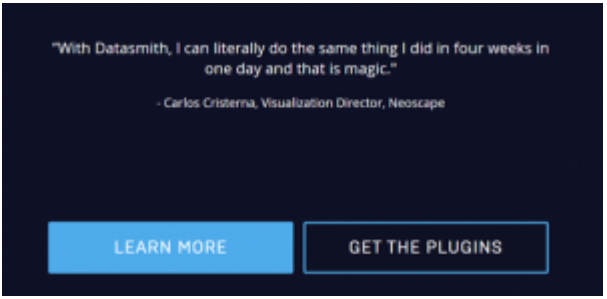


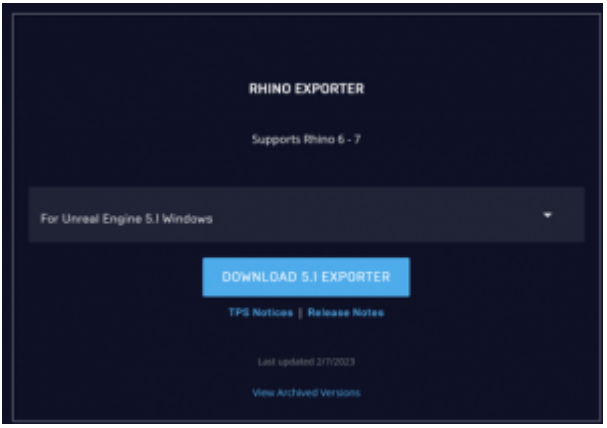
9. In the blank Unreal project, there is already a landscape layer. To clean and organize your scene, you can hide or delete the layer from the right window.



Rhino and Unreal Engine 5:

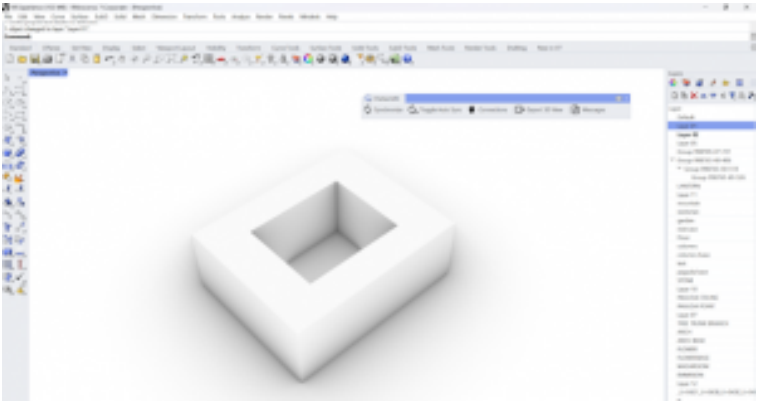
1. Download the Datasmith plugins for various CAD software including Rhino, Revit, 3Ds Max, and SketchUp using this link: https://www.unrealengine.com/en-US/datasmith. Click the “GET THE PLUGINS” button, and then download and install the Rhino Exporter.





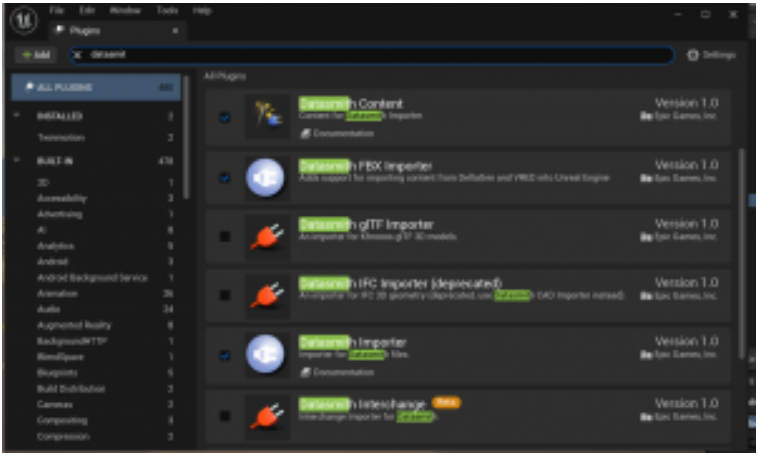
2. Open your Rhino file and find the new menu called Datasmith. You can bring your file into Unreal using two methods: exporting your project as a Datasmith file or using the real-time connection. If you’re done editing your

file, export it as a Datasmith file. However, if you're still updating it, use the real-time connection instead.

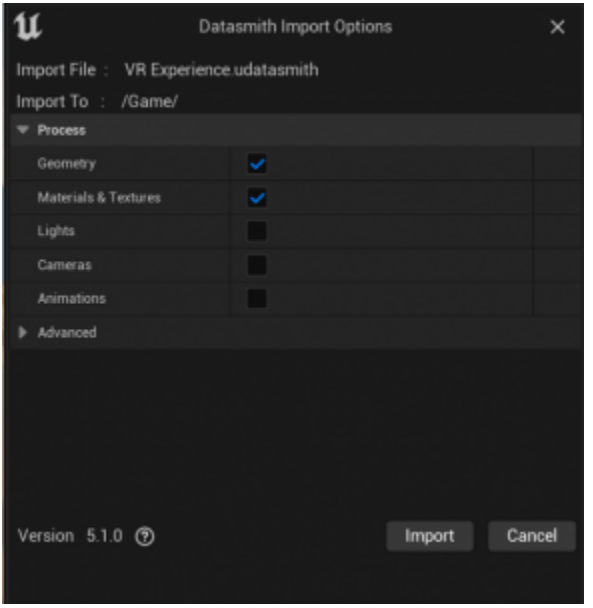


OPTION A: EXPORTING AS A DATASMITH FILE

3. To export your file, use the Export3D view option. Then open Unreal Engine 5 and create a new blank project in "Game Mode". First, install the Datasmith plugins by selecting "Plugins" under the "Edit" tab on the top menu, searching for "Datasmith", and selecting the "Datasmith importer". Then restart Unreal and wait for it to reopen.



4. In Unreal, click the “Quick Add” button and select “Datasmith” and “File Import”. Find your exported file and open it. In the “DataSmith Import Option” window, choose the options you want to import, such as “Materials & Textures” and “Geometry”, for a Rhino file. Then import and wait for your project to open in Unreal.



OPTION B: USING REAL TIME CONNECTION

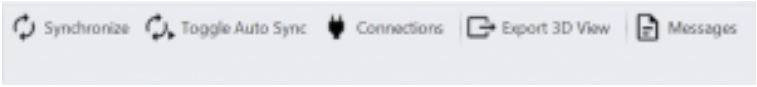
Alternatively, to preview changes to your Rhino scene in Unreal Engine 5 in real-time, use a Datasmith DirectLink.

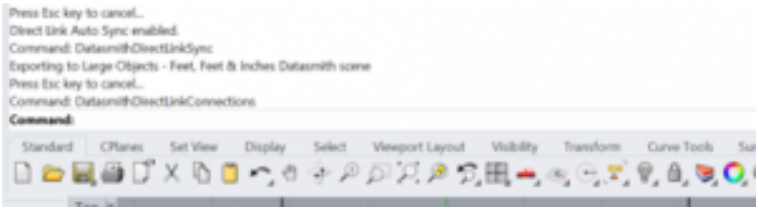
This way, you don't need to manually re-import the entire scene into UE5 every time you want to make a change. First, ensure that you have installed Unreal Engine version 5.0.3, as the Datasmith Exporter does not work on previous versions.

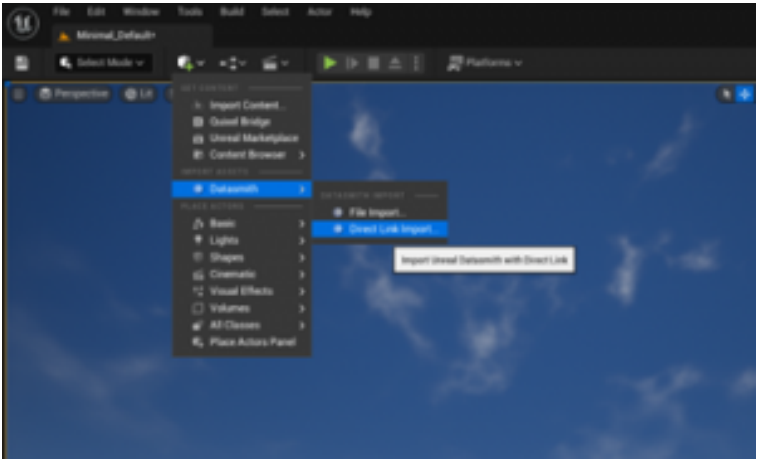
Next, go to Edit > Plugins in Unreal and search for "Datasmith" in the Search bar. Select both "Datasmith Importer" and "Datasmith Runtime Beta", then restart and open Unreal.

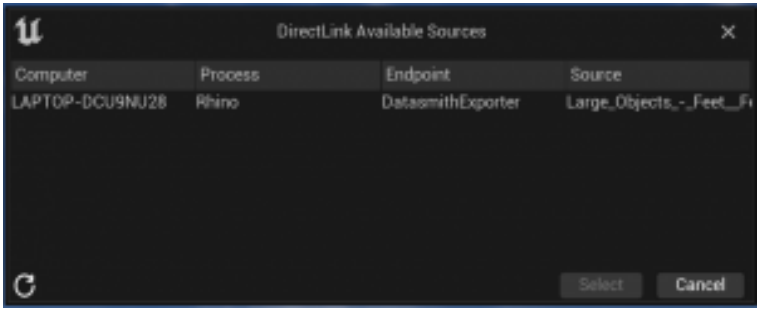
Now, in Rhino, toggle Auto Sync and in the command window, you will see the command: "Direct Link Auto Sync" enabled. Then "Synchronize". And then click the "connections" button. Go to your Unreal file, from the "Quick Add" button

drop down menu, select “Datasmith”, and then “Direct Link Import.”









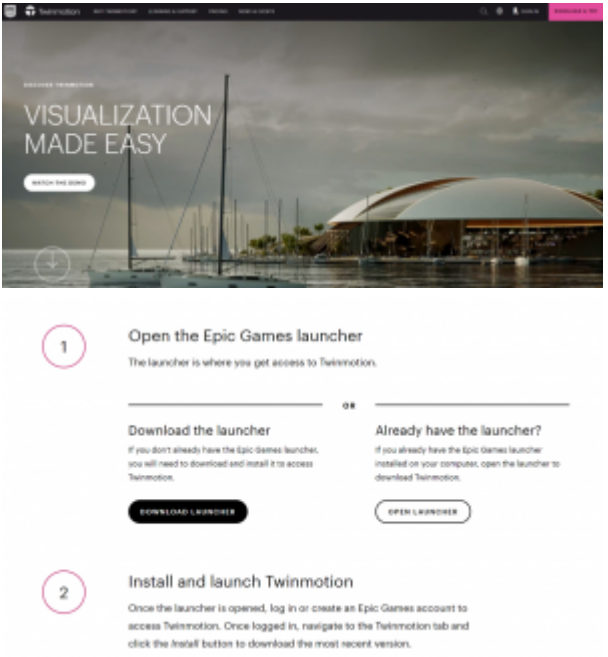
Now you can select your file from the list and import your file directly from Rhino into UE5. Similar to the previous method, specify the location and the options you want to import such as Geometry and Material.

Rhino/Revit and Twinmotion Workflow:

Twinmotion is a powerful software for creating high-quality visualizations for various industries, such as architecture, consumer products, and transportation. You can update the model in real-time without any loss of detail and add materials, high-resolution assets, and lighting to your scene. It works well with Unreal Engine, as both softwares belong to Epic Games. You can also export and share your project and create 360 videos and animations for presentation in the Immersion Studio. Additionally, you can use VR mode to navigate through your scene. However to use Immersion Studio for the VR experience you need to simply transfer your model from Twinmotion to UE.

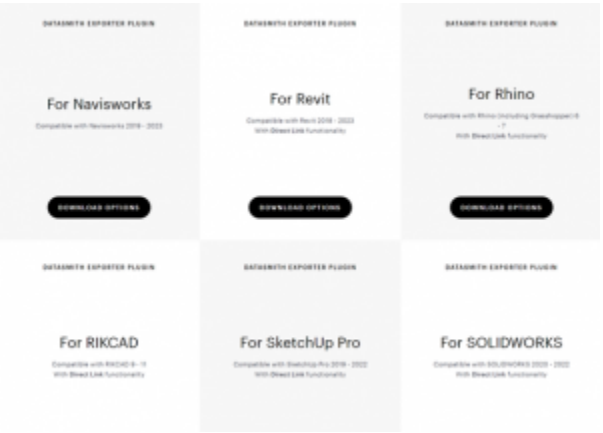
More detail about the Revit-Twinmotion Workflow
https://www.youtube.com/watch?v=fjBEUkYWUuc&ab_channel=Twinmotion
Learn more about Twinmotion:
https://www.twinmotion.com/en-US/learning-resources

1. Download Twinmotion from https://www.twinmotion.com/en-US and create an Epic Games account or log in if you already have one. The free trial version works fine. Then, download and install the software.

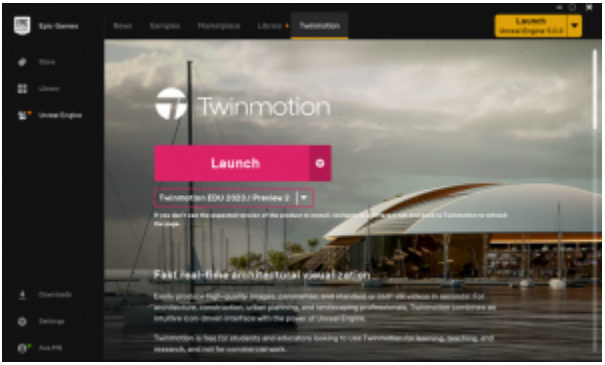


2. Download the plugins. From the Twinmotion page you can find the section for plugins and download the desired plugins depending on which software you want to work with. For now we focus on Rhino and Revit. Download and install the plugins based on your operating system.

https://www.twinmotion.com/en-US/plugins



3. Launch Epic Games launcher and select Unreal Engine from the vertical list on the left. You can then find Twinmotion on the top menu. If you haven't installed Twinmotion, click Install and launch the software.

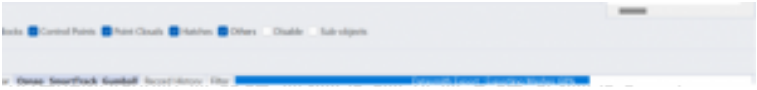


Bringing your assets from Rhino or Revit into Twinmotion is straightforward. Twinmotion supports various formats,

- FBX
- Sketchup
- Obj
- Cinema4D
- Other CAD formats such as 3ds, dae, dxf, iv, stl, and more

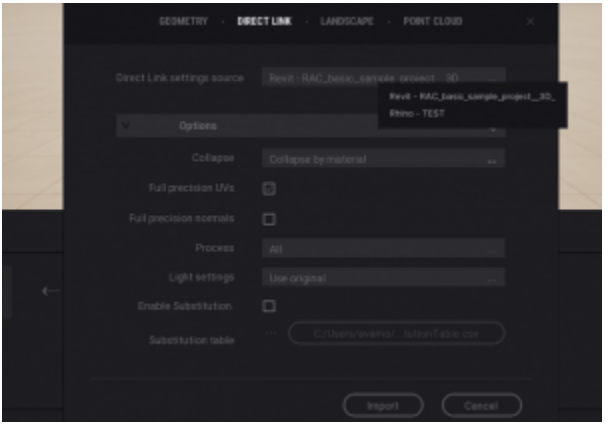
We are able to use direct links from various software such as Rhino, Revit, ArchiCAD, Sketchup, and more. Further information can be found on the Twinmotion webpage.

4. In both Revit and Rhino, you should first “Toggle Auto Sync.” In the command window, “Direct Link Auto Sync” should now appear and be enabled. Then “Synchronize”. And then click the “connections” button. Alternatively, in Rhino, you may simply type “Datasmith DirectLink Sync” in the command bar and your scene will be exported.



5. Launch Twinmotion, and from the “Import” button, select “Direct Link.”

6. In the “Direct Link settings source” you can choose your source software, choose your source software (Revit or Rhino) and import.



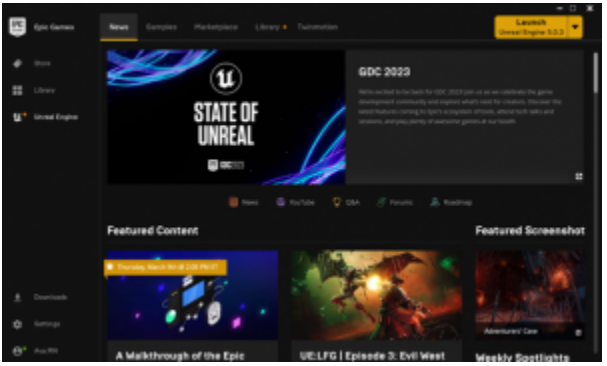
Twinmotion Unreal Workflow

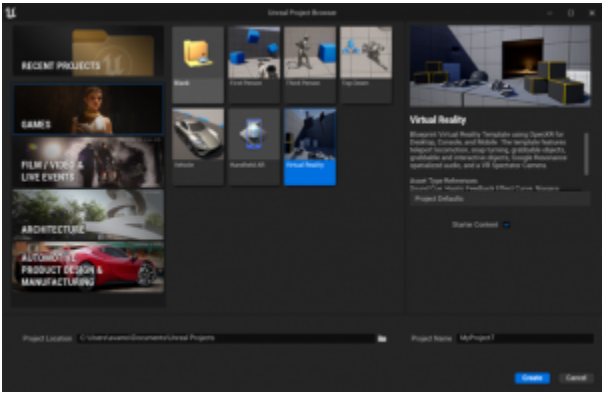
If you need to still add interactions to your project or you want to create an immersive experience using Oculus Quest or the Immersion studio, it is recommended to use Unreal Engine. Although Twinmotion has VR option which can be used with Oculus Quest, it is not as smooth as UE. For using the Immersin Studio, you definitely need UE.

1. To bring your assets from Twinmotion into Unreal and to create a VR experience, open UE from Epic games launcher.

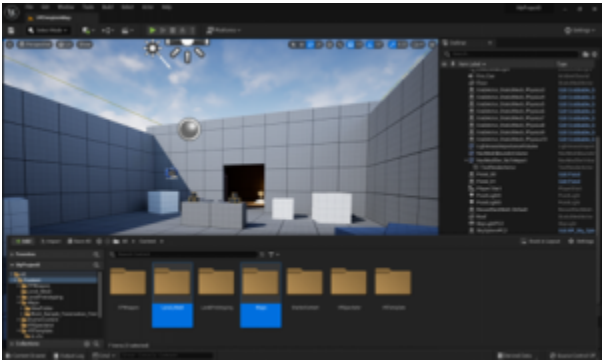
Then select the game mode, Virtual Reality. The reason that we use Game mode and not the Architecture mode is that most of the interactions and blueprints already exist in this mode.

You can also define your projects name and file location at this step.

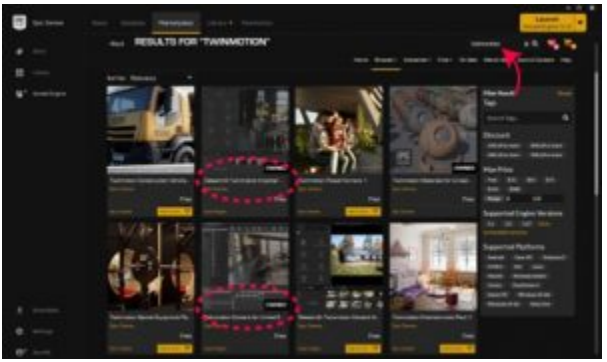




2. Once you open Unreal, you will see the following scene. It is a good practice not to create your scene in the VR template folder and create your own folder called Maps and then create your Levels within that folder. The word Levels here refer to the Game Levels and not the height or floors as commonly used in Architecture. Pay attention to create your folder within Content folder. Then create another folder called Level-Mesh. This folder will contain the mesh geometry you will import later to your project.



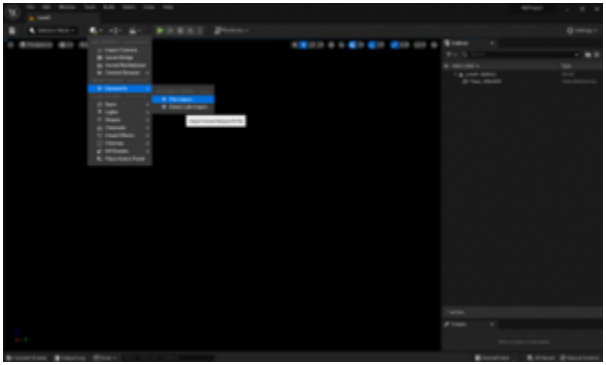
3. To bring your scene from Twinmotion into unreal you need to install the Datasmith plugins. To do so open the Epic game luncher. Tab on the Marketplace and search for “twinmotion”. Install both of the following plugins to your engine. Make sure to choose the correct engine version.

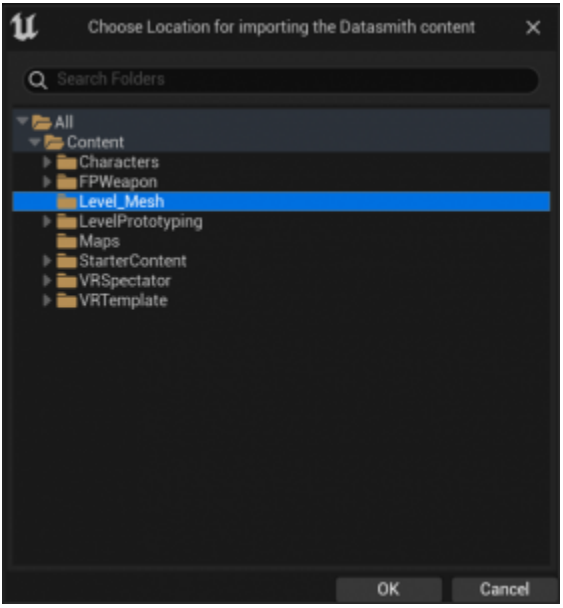


4. Open Unreal. Go to edit, plugins and search for twinmotion. Make sure to check on both Datasmith Twinmotion Importer and Twinmotion Content and then restart.

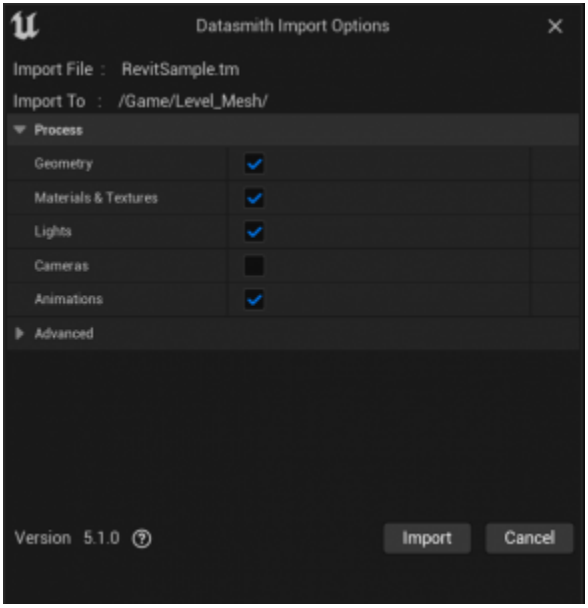
5. Save your Twinmotion file and close it. Once the Unreal

opens, go to your level by double clicking. Then from the Quick add button, go to datasmith tab, import file, and find your datasmith file. Choose the Level-Mesh folder to import your file in that folder.





6. Select the following options. You can change these options based on your projects.



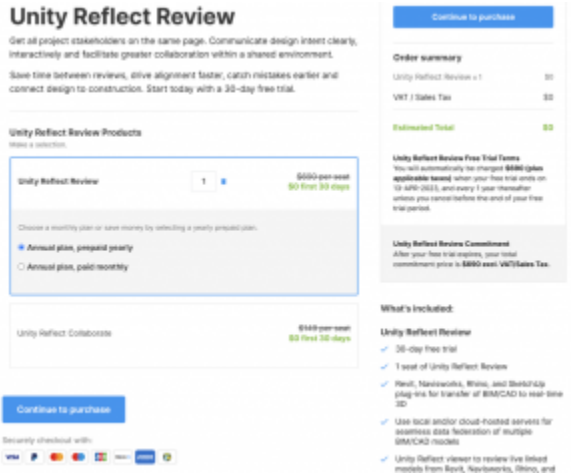
Revit, Unity Reflect Review

Unity Reflect enables designers, architects, and engineers in the AEC industry to easily create immersive real-time 3D experiences in a collaborative way.

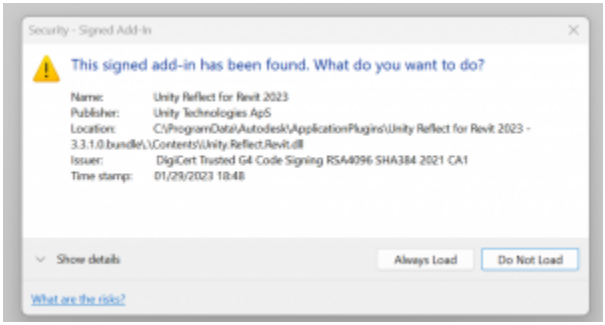
You can use Unity Reflect Review to transfer BIM/CAD to real time 3d and it has plugins for Revit, Navisworks, Rhino, and SketchUp. Also you can use local and/or cloud-hosted servers for data federation of multiple BIM/CAD models

You can find the link here:

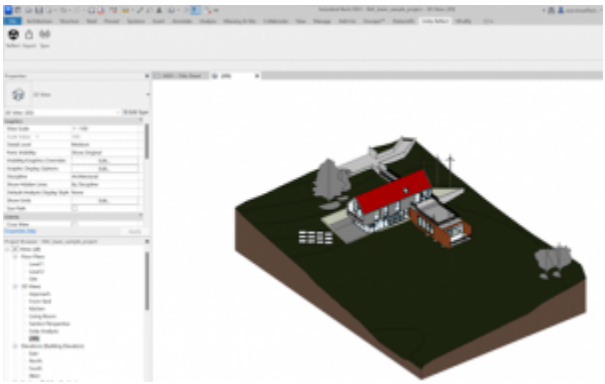
https://store.unity.com/configure-plan/unity-reflect-review-trial?free_trial_product=true&check_logged_in=1



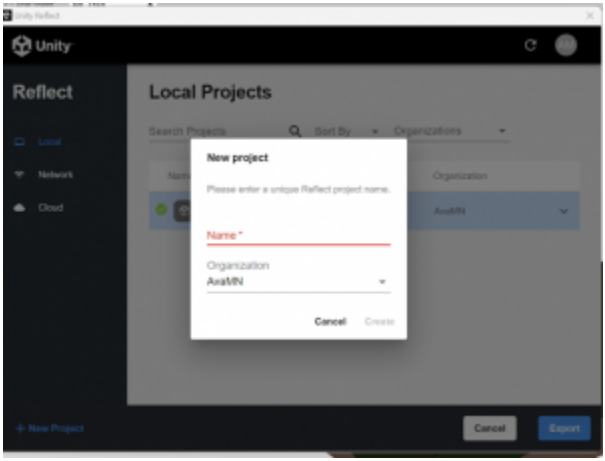
After installing the Unity Reflet Review, open your revit file. It will ask you to load the related plugins. Choose Always Load.



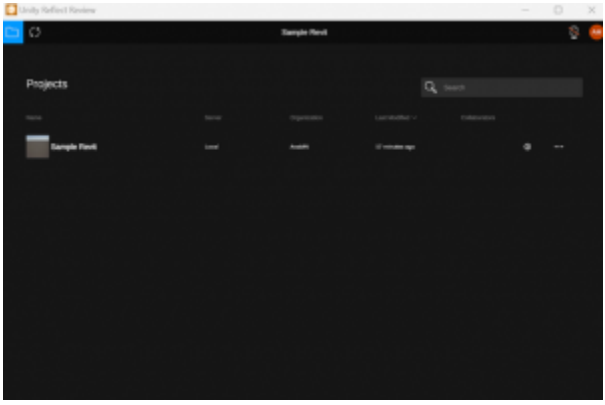
After opening your file, you can see a new tab called Unity Reflect in your top menu.

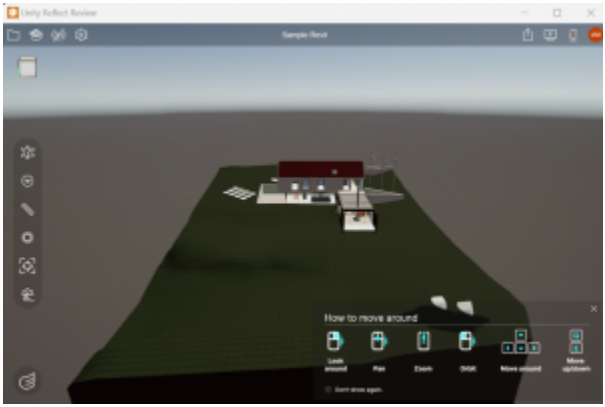


You can either export or use the direct link. To export your file push the export button. Choose whether you want to use the Reflect oon your system or a shared Netork or Cloud. For now the Cloud option is not available. Then define a new project.



Once you created your file, open Unity Reflect and select the file you have created. Your file is ready to use.




How to move around