RePort

Immersion Conversion from Rhino to Unity
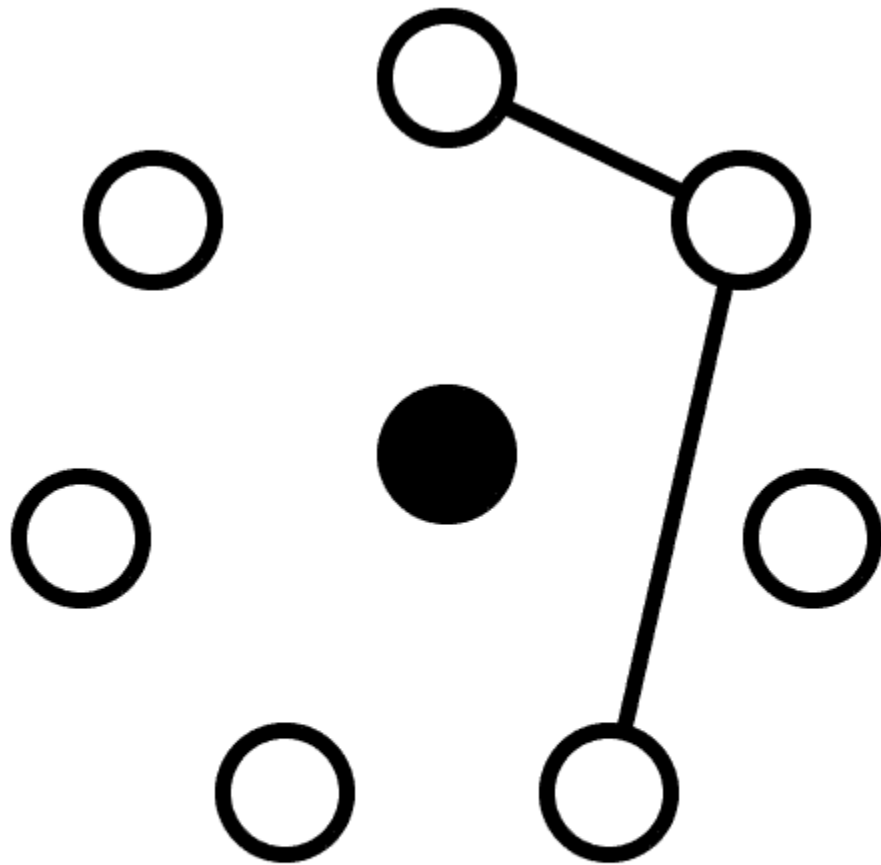
Version 0.3.0
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Download the latest version from: https://github.com/Reification/RePort
Contact us at: support@reification.io

Set Up

RePort is a collection of tools for converting Rhino building designs into Unity games. These tools are a work in progress - let us know how you are using them!

The RePort.zip folder contains this RePort_Guide.pdf documentation, the RePort_for_Rhino.rhi installer, and the RePort_for_Unity.unitypackage installer.

Rhino

Rhino 7.0 can be downloaded here. (Versions 5, 6 and 7 have been tested.)

After installing Rhino, the RePort_for_Rhino.rhi tool can be added by opening Rhino & dropping the file into the application window. This will open the Rhino plugin wizard which will add the RePort exporter. Select "Just Me," then click Next to install.
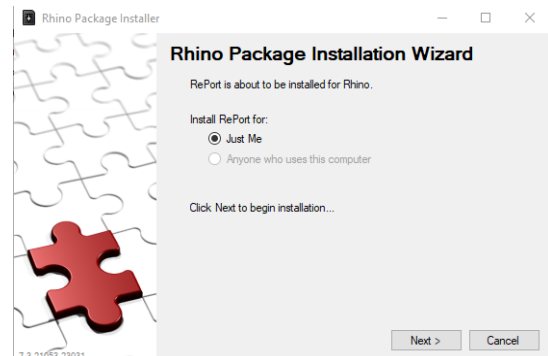
Unity

Unity 2019.4 LTS can be downloaded here for free. (Only version 2019.4 has been tested.)

After installing Unity, open Unity Hub and create a new "3D With Extras" project (or open an existing one and add the "Post Processing" package). The RePort_for_Unity.unitypackage tools can be added to a project by dropping the file into the Project panel of the application window, which will open an import dialogue window. Click the "Import" button (bottom right) to add the tools to the open project. This will add the RePort and Reification directories in the Assets directory, and will add the Reification menu to the Unity editor application.
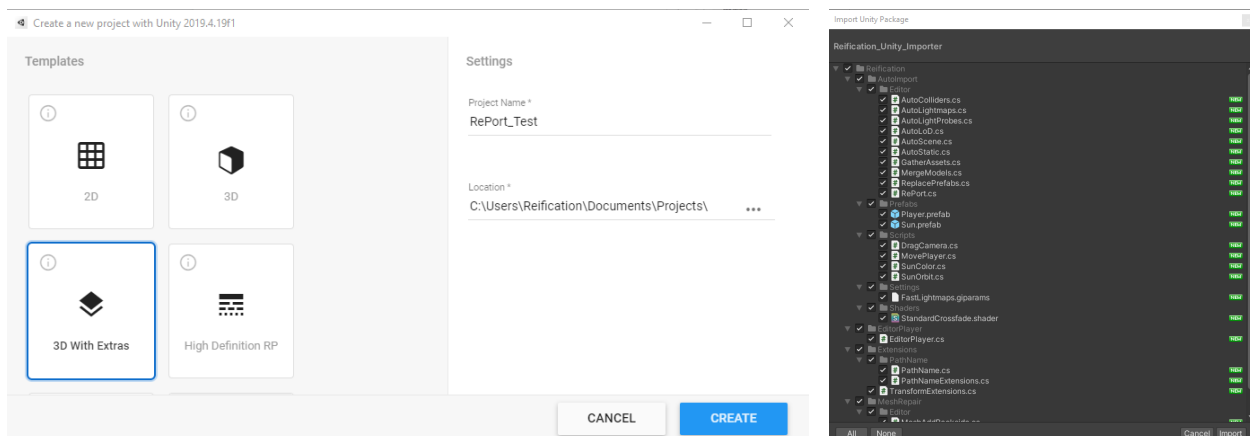
Export & Import

Rhino Export

Open the document that you want to export. Enter the command "-RePort" to export your current doc into an adjacent folder with the same name. This will create a folder adjacent to your document, with the same name as your document.

Unity Import

Open the "RePort" folder in the "Projects" panel of the Unity application. Drop only the folder created by the Rhino export process into the "RePort" folder in the Unity application to begin the import process. (Moving or copying in the OS also works. Importing will not begin until Unity is the active application, so multiple imports can be enqueued.)
WARNING: The import process can take over an hour for a complex model. During this time, Unity will be non-responsive. Individual import progress steps are indicated by the Unity icon, and by pop-up messages.
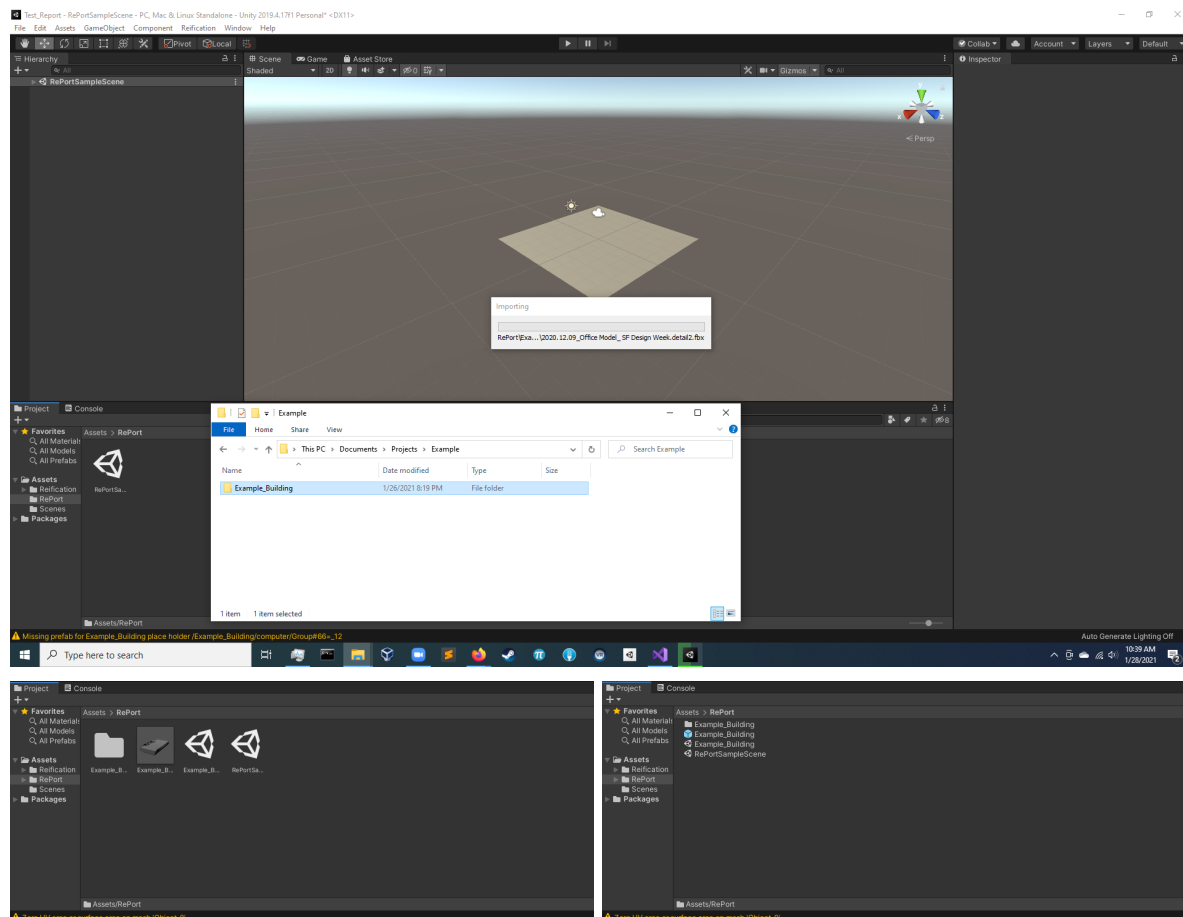

NOTE: To see a list view of folder contents in the "Project" panel, drag the size slider (bottom right) all the way to the left.

Reviewing Your Building

When the model import is complete, the "RePort" folder will contain 3 items with the same name as your original document: a sub-folder, the imported model, and a playable scene.
You can open the scene by double-clicking on it. With your scene open, click the Play button (top center of the application window) to begin exploring your model in the Game panel.
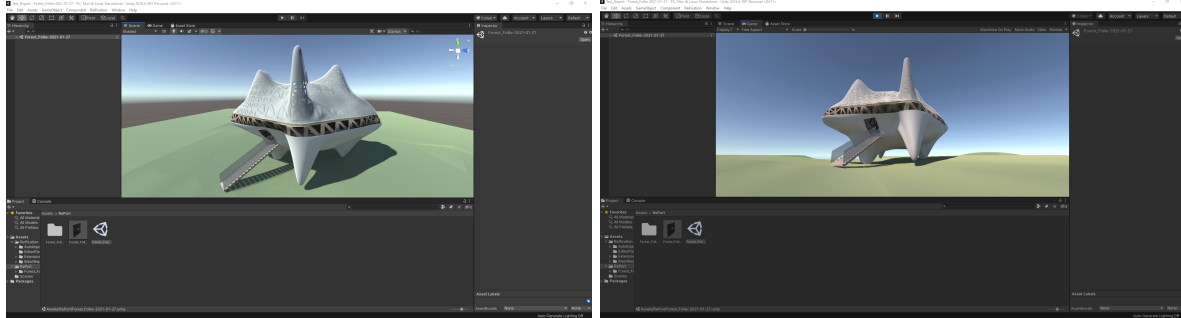
NOTE: When playing, the Game panel can be made to fill the Unity editor window by enabling "Maximize On Play." To maximize while playing, click on the "Maximize On Play" button (top right of Game panel), then pause and unpause the game.
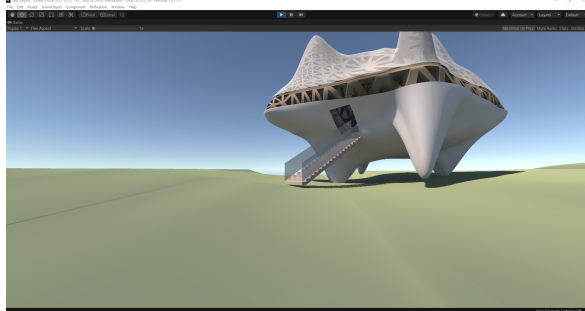
Desktop

You can look around by clicking and dragging in the Game panel. You can move using the arrow keys or WASD keys. When moving, you can walk up stairs, but will be obstructed by larger obstacles and narrow openings. Your height can be adjusted by rolling the scroll wheel, and can be reset by pressing the scroll wheel.

You can also change the sun orientation and movement. The speed with which the sun moves in the sky can be changed using the - and + keys, and stopped using the backspace key. The axis on which the sun rises and sets can be rotated using the [and] keys. The sun position can be reset using the \ key. (The sun follows a simple arc - it does not correspond to any location on earth.) If you need additional lighting press Enter or Return to turn a personal light on or off.

NOTE: Navigation permits falling off of cliffs…so be careful! Clicking the Play button again will stop play and reset all changes to your scene.

VR Headsets

Unity 2019 can support [Oculus](#) and [SteamVR](#) desktop services. Windows Mixed Reality is supported by using [Windows Mixed Reality for Steam](#). (Oculus Quest headsets require a link cable to be used.)

To install support for these systems from the Edit menu, choose "Project Settings…" to open the Project Settings panel. Then open the Player tab (*not* the XR Plugin Management tab), unroll the "XR Settings" section, and check "Virtual Reality Supported."
(IMAGES)

RePort scenes are also compatible with VR headsets. You can look around by…looking around. The controller joysticks are used to move with the directions corresponding to arrow keys used in desktop mode. The controllers are not shown - in fact, no part of your body will be shown in VR.

Reification has developed a framework for virtual reality that can support multiple users and a variety of interaction modes. This framework is compatible with RePort scenes and will be released separately.

Multiple Users

If you choose to [create stand-alone builds](#) of your design, be aware that Windows and MacOS operating systems will refuse to launch unsigned builds without admin permission.

Reification can provide signed builds with multi-user support via dedicated servers. If you choose to use this service you will receive copies of the built programs that you can deploy and share as needed. This service will make use of Reification's full framework, which includes lighting, acoustics, networking, and permissions management.

To share your building with Reification, in the Project panel, right-click on your scene and choose "Export Package…" from the pop-up menu. This will create a .unitypackage file that you can share with Reification for conversion to a full build. To get started just [contact us](#) - we will share pricing information, terms of use, and will create an upload location for you.

Model Fixes

Rendered objects are described by meshes. Design programs often do not distinguish between the front and back sides of a mesh when rendering a view. However, Unity rendering, and physics, will see only the front side of a mesh. The RePort package provides tools that can be used to fix problems arising from mesh orientation.

After making any changes to the model, the scene lighting will need to be re-generated.

Single-Sided-Surfaces

A single sided surface will be visible from one side, and invisible from the other. To fix this, in the Scene panel, select the surface, then from the Reification menu choose "Add Backside."

Inverted Surfaces

An inverted surface can be recognized as an unexpectedly concave part of an object. It may also appear incorrectly illuminated due to the inward facing surfaces. To fix this, in the Scene panel, select the surface, then from the Reification menu choose "Invert."

Re-Generating Lighting

The default lighting configuration for RePort scenes uses Enlighten to enable dynamic bounced lighting. To regenerate the RePort default lighting, from the Reification menu choose "Fast Lightmaps." To generate higher fidelity results, from the Reification menu choose "Good Lightmaps" and expect a much longer wait.

To customize lighting, from the Window menu choose "Rendering" > "Lighting Settings" to open the Lighting panel, then click the "Generate Lighting" button.

NOTE: Generating lighting can be a very slow process, but it only needs to be run once, after all model changes have been made.
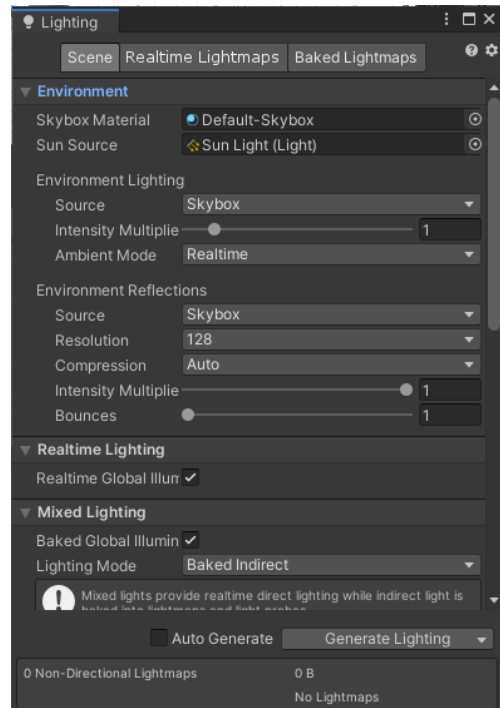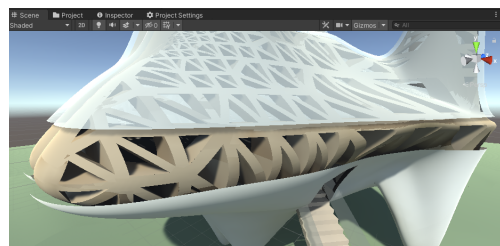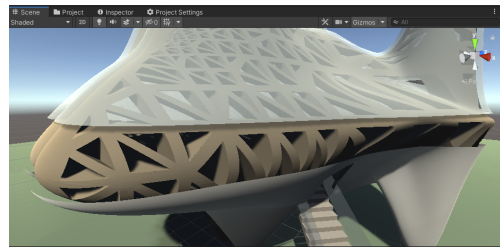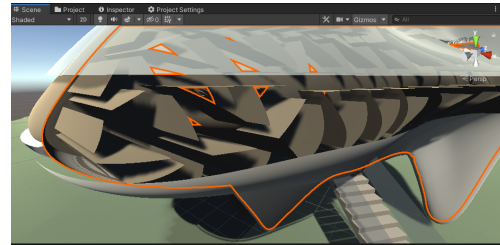
Player Location

Your location in the scene is represented by the Player object in the Scene panel. Before playing, you can select the Player object in the Hierarchy panel to reveal your location, then in the Scene pane press F to center your view on that location. To change your starting position, in the Scene panel with the player selected, press W to reveal the positioning arrows, then drag the position arrows to move the player's starting location.

Doors

Doors are not (yet) automatically identified when imported. The simplest way to enable passing through a door is to disable it's collider. To disable an object's collider, in the Scene panel select the object, then in the Inspector panel find the object's Mesh Collider component and disable it by clicking on the check-box (top left button on the component).
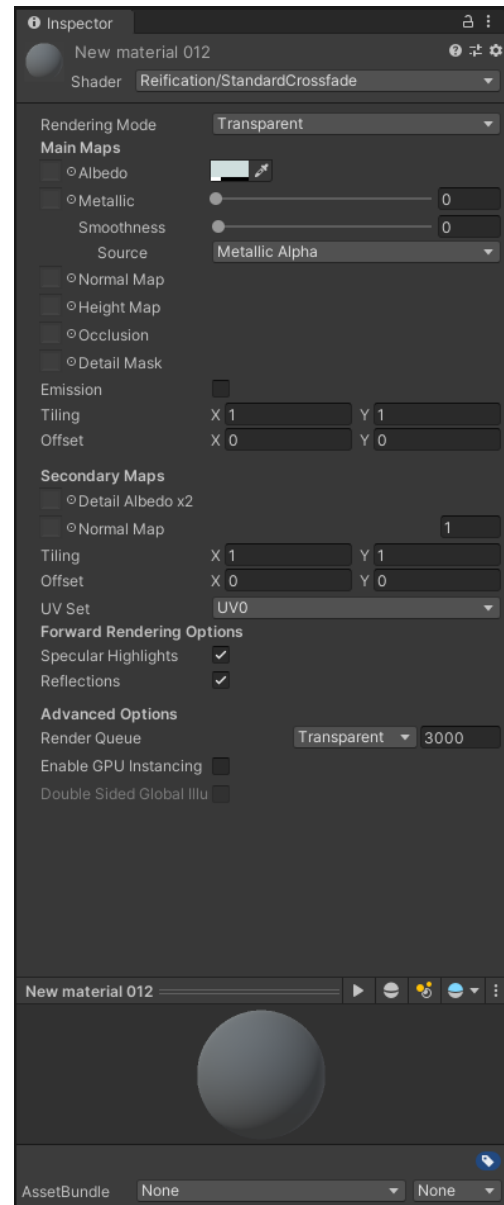
Materials

In most cases, textures and normal maps will be imported and correctly associated with materials. If this appears to have failed, in the Scene panel select the object, then in the Inspector panel find the MeshRenderer component, unroll the Materials section and click on the material to highlight it in the Project panel. Click on the material in the project panel to view it in the Inspector panel, find the missing texture in the Project, and then drag it into the corresponding material property box (e.g. Albedo).

Lights

This release of RePort imports lights from Rhino, including shape parameters. Visible light sources are added, and post-processing is used to adjust gain and bloom so that the sources appear luminous.

Lights in models from other sources may use physical intensity units making them incompatible with Unity's standard rendering pipeline, so they will not be imported.

Rhino Blocks = Unity Prefabs

Every Rhino block used in your model will be converted into a Unity prefab. These prefabs will appear in the imported model subdirectory. Each will have associated subdirectories for textures, materials, and meshes.

Presently, the RePort system supports only Euclidean transformations. If shear or inversion transformations are applied to blocks, the imported model will not be correct.

Staging

The Unity Asset Store provides a searchable selection of assets. This store is also directly accessible within the Unity editor. To access the Unity Asset store, from the Window menu choose "Asset Store." The publisher page of ArchVizPro offers both individual assets and scenes which showcase the full capabilities of Unity.

Vegetation

Organic material is geometrically complex…and can be computationally expensive to render, resulting in a low frame rate. Replacing modeled plants with assets designed specifically for real-time rendering can alleviate this problem. Plant models can be purchased from SpeedTree, which offers a free starter pack.

If your Rhino document includes block models of vegetation they will become prefabs in Unity. Open the prefab from your model, drag the replacement plant model into the prefab, match the position and scale of the original, then delete the original model. Every instance will be replaced with the optimized plant model.

Importing vegetation in the RePort folder may be slow. This is because the plant models will be prepared for lighting generation by generating lightmap UVs. This can be avoided by separately exporting vegetation from Rhino, and then importing it outside of the RePort folder. In Rhino, if each plant is a block instance, then in Unity each plant can become a prefab instance. Select the model constituent prefab whose name ends in .places and from the Reification menu choose "Replace Prefabs" to replace all placeholder tetrahedra with the corresponding plants. This vegetation model can then be added to your imported scene. (This process will be automated in an upcoming release.)

Manual Exporting & Importing

In some cases - in particular, vegetation and large landscapes - it may be helpful to control each step of the import process. The RePort toolkit provides interfaces for manual control of each step of this process. In Unity, every step of the import process is listed in order in the Reification menu.

Reimporting

If you made a mistake that you cannot undo, you can always reimport your model. Delete the broken asset (e.g. a Mesh or a Material) then right click on the imported model folder (or in the case of a single file model, the imported model FBX) and select "Reimport". This process will recreate any missing assets, and will preserve any existing modifications.

Multiple Imports

Importing begins automatically only when the Unity application has focus. To enqueue multiple imports, open the RePort folder in your operating system. Copy each file or folder to be imported into the RePort folder. Switch back to the Unity application to begin the import process.

Exporting from Rhino

In Rhino, only visible objects will be exported. This makes it possible to break a single design into multiple exported components that can be imported individually.

Using the interactive "_RePort" command opens a pop-up window to choose the export location. This makes it possible to export a single model in separate parts. In Unity these parts can be reassembled by dropping their corresponding prefabs into the same scene.

Importing to Unity

In Unity, dropping a model or folder into any location other than the RePort folder will use a default import process. The default import process will be faster, but will not prepare models for lightmapping, and will not associate textures with materials. If necessary, you can address these issues by generating lightmap UVs and extracting textures using the import settings view in the Inspector panel. In the case of models exported from Rhino using the "-RePort" command, the default import process will not reassemble the constituent prefabs and levels of detail.

Default imported models will have limited mutability - in particular, meshes cannot be repaired. To make an imported model mutable, in the Project panel select the model, then from the Reification menu choose "Gather Assets."

Uninstalling

Each component of the RePort tools integrates with a different application. As such, each component will have its own removal process. This section describes every step needed to remove all files associated with each component - if these steps are found to be incomplete please [let us know](#).

Unity RePort Package

The RePort unity package is installed separately in each Unity project. All components of the package are contained within the Assets/Reification folder of the project, and creates no external cache files. The RePort package can be removed by deleting the folder: in the Project panel select the folder, right click and select Delete from the context menu.

After removing the package imported model materials may be rendered in Magenta. This can be avoided by moving the shader file from Assets/Reification/AutoImport/Shaders/StandardCrossfade.shader to a location where it will not be deleted. The StandardCrossfade.shader script is not copyrighted by Reification.

Scenes created by the RePort package import process will not be usable after the package has been deleted.

Rhino Package

The installed RePort command is managed by the IronPython plugin, and will be available in all documents opened by Rhino. To quickly check the installed RePort version, enter the interactive "_RePort" command and then cancel - the version will be printed as the command completes.

Unfortunately, Rhino does not provide any uninstallation interface. Uninstalling the plugin requires navigating to the install location and deleting the associated folder.
- For Rhino 7.0 on Windows enter the following path into a File Explorer window:
  - `%APPDATA%\McNeel\Rhinoceros\7.0\Plug-ins\PythonPlugIns`
- For Rhino 7.0 on macOS in Finder, from the Go menu select "Go to folder" and enter:
  - `/Users/~/Library/Application Support/McNeel/Rhinoceros/7.0/Plug-ins/PythonPlugIns`
- Then, delete the folder named:
  - `RePort (a59528fb-b452-4852-864c-6c8bacaa5049)`

If other versions of Rhino are installed the RePort plugin may have been copied into those directores ("6.0" for version 6, and "5.0" for version 5) and will need to be deleted there as well.

Unity 🫀 Documentation

First Steps:
How to change your view in the Unity editor:
https://docs.unity3d.com/Manual/SceneViewNavigation.html
How to position objects in the Unity editor:
https://docs.unity3d.com/Manual/PositioningGameObjects.html
How to edit prefabs:
https://docs.unity3d.com/Manual/EditingInPrefabMode.html
Next steps:
https://learn.unity.com/

Materials:
https://docs.unity3d.com/Manual/materials-introduction.html
https://docs.unity3d.com/Manual/shader-StandardShader.html

Lighting:
Enlighten example project:
https://assetstore.unity.com/packages/essentials/tutorial-projects/the-courtyard-49377
Enlighten optimization tutorial:
https://learn.unity.com/tutorial/precomputed-realtime-gi-global-illumination
Lighting configuration:
https://docs.unity3d.com/Manual/GI-Enlighten.html
Post processing:
https://docs.unity3d.com/Packages/com.unity.postprocessing@3.1/manual/index.html

Advanced Tutorials:
https://catlikecoding.com/unity/tutorials/

Why does RePort use deprecated lighting and XR systems?
In both of these cases Unity has chosen to deprecate a system without providing an equally capable alternative. In the case of Enlighten, the built in alternative (Unity's Progressive lightmapper) will not update bounced lighting as the sun moves. In the case of the Virtual Reality SDKs, the replacement (XR Plugin Management) does not support SteamVR. We will be assessing new solutions as they become available.

Planned Update:
As of 11 March 2021, the LTS version of Unity has been updated to 2020.3.0f1. We will be assessing an update to support this version in a future release.