

RePort

Immersion Conversion from Rhino to Unity

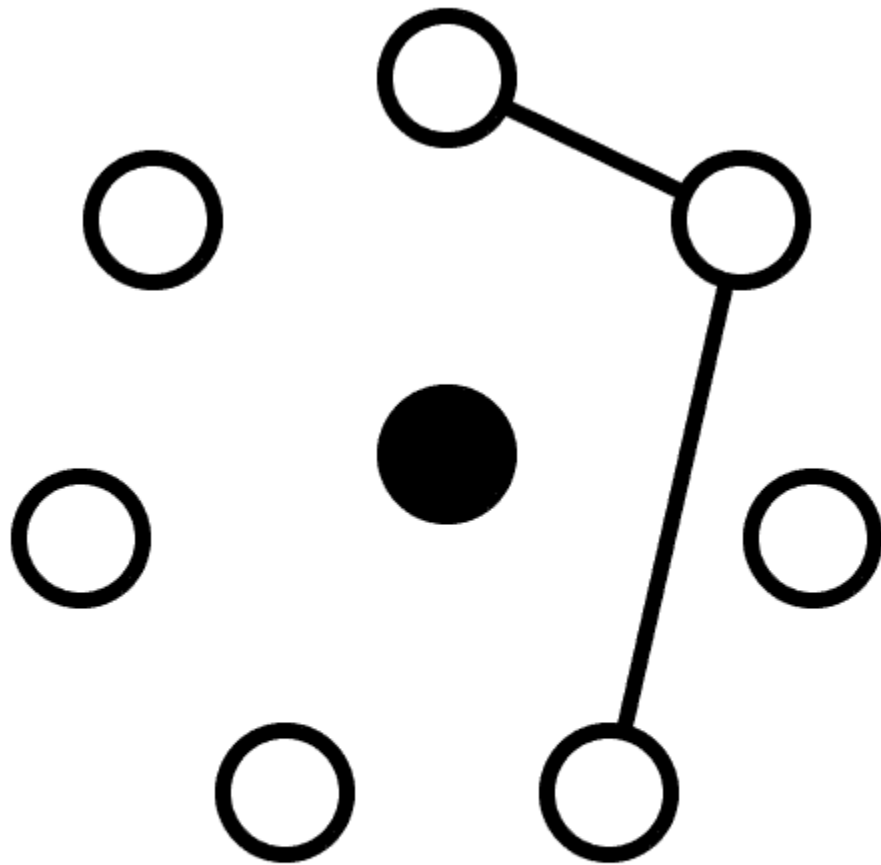
Version 0.3.1

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Clone the source from: <https://github.com/Reification/RePort>

Contact us at: support@reification.io



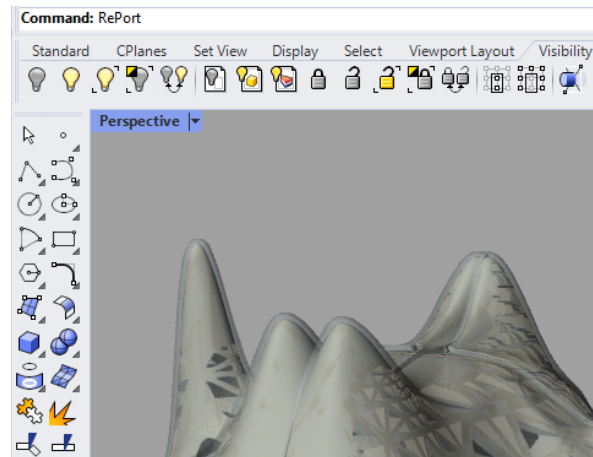
Reification.io

Using RePort

Once you have installed the Reification tools, converting a building design to a playable experience is a 3 step process:

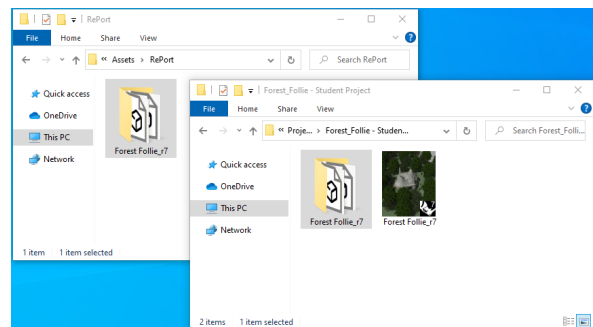
Step 1: Export

Export your building design to an FBX file. In Rhino, use the “-RePort” command to automatically create an optimized export.



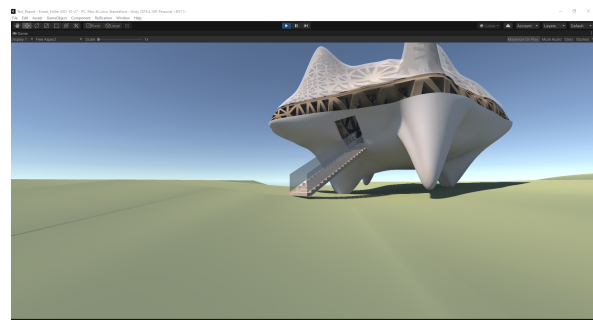
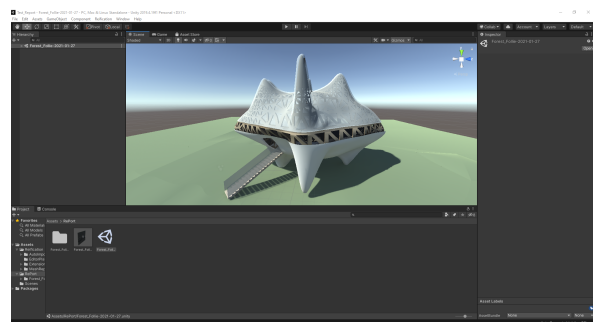
Step 2: Import

Copy the exported file or folder into the “Assets/RePort” directory of your Unity project to begin the automatic importing of the model.



Step 3: Play

When the import is complete Unity will open a created scene. Click the “Play” button in the editor to begin exploring your model in the “Game” panel.



Installing

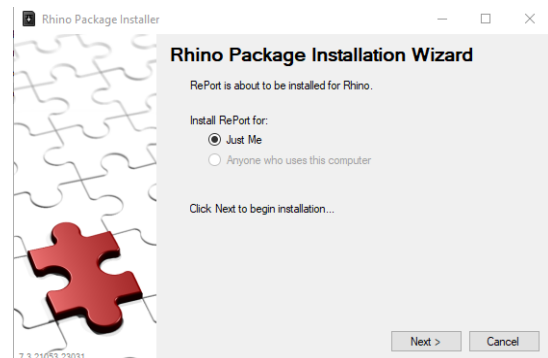
The latest version of RePort can be [downloaded here](#).

The RePort.zip folder will contain the latest version of 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.)

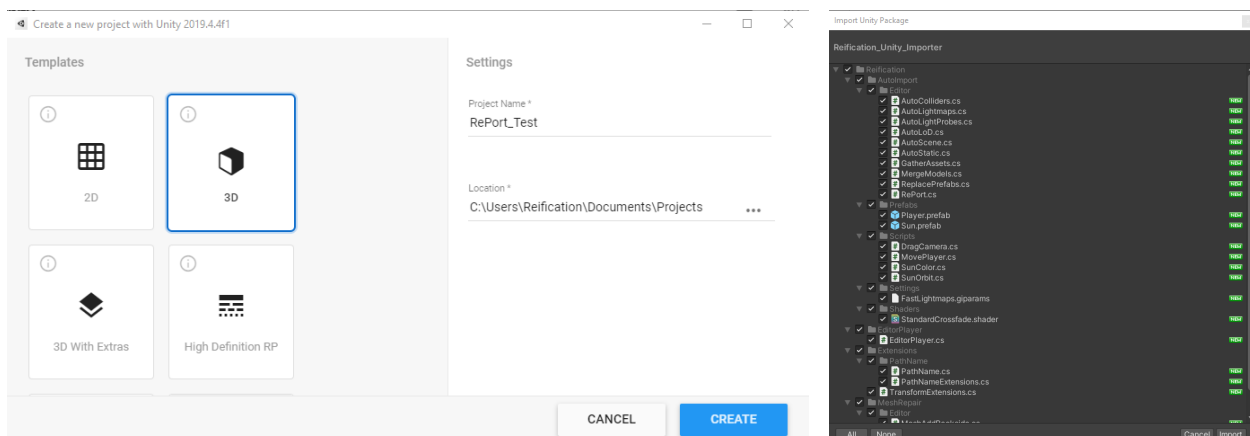
After installing Rhino, the RePort_for_Rhino.rhi tool can be added by opening Rhino & dropping the file into the application window. This will open the Rhino plugin wizard which will add the RePort exporter. Select “Just Me,” then click Next to install.



Unity

Unity 2019.4 LTS can be [downloaded here](#). (Only version 2019.4 has been tested.)

After installing Unity, open Unity Hub and create a new “3D” project. 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.



Reviewing Your Building

When the model import is complete, the “RePort” folder will contain 3 items with the same name as your original model: a folder, a prefab, and a playable scene. If a single model was imported, the scene will already be open. If multiple models were imported you can open a 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.

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 (or holding Alt/Opt and moving the cursor), and can be reset by pressing the scroll wheel (or holding Alt/Opt and clicking).

NOTE: When playing, the Game panel can be made to fill the Unity editor window by right-clicking on the “Game” panel tab, then selecting “Maximize”.

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.

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 panel 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.

You can also reposition the player by pausing, moving the player object, and then un-pausing. Using this trick you can explore inaccessible parts of your model, or save yourself from falling.

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 permission from an admin account.

Reification can provide signed builds with multi-user support via dedicated servers. If you choose to use this service you will have access to 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

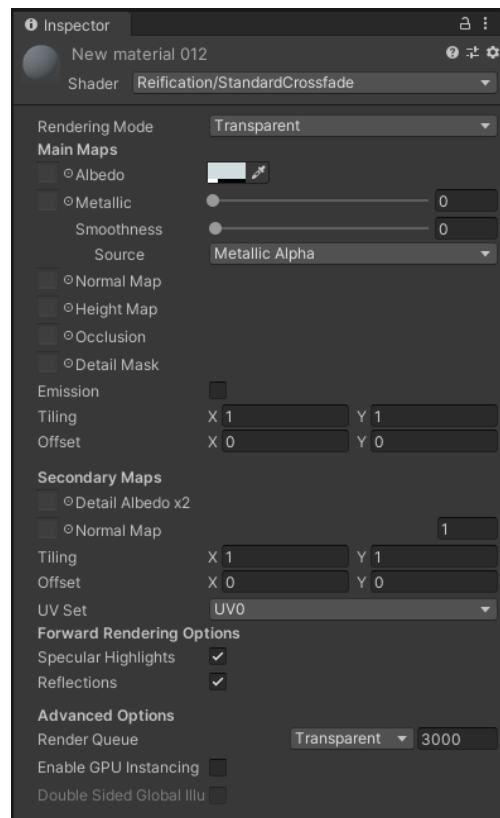
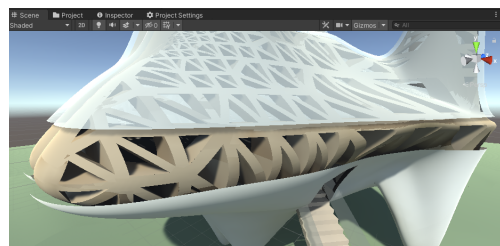
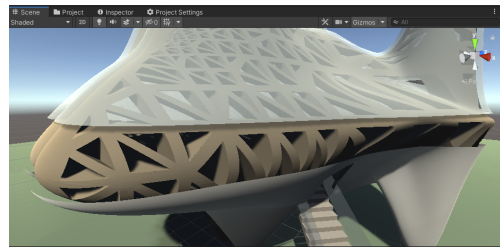
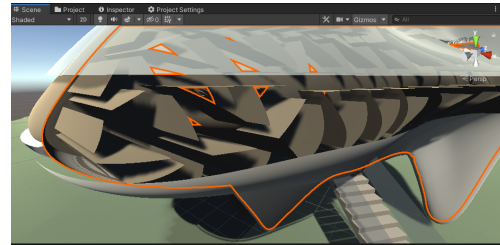
An inverted surface can be recognized as an unexpectedly concave part of an object. It may also appear incorrectly illuminated due to the inward facing surfaces. To fix this, in the Scene panel, select the surface, then from the Reification menu choose “Invert.”

Materials

To modify the material used by an object, 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. Changes to the material will be applied to all objects.

Reflective material properties will not be imported. Adjust the [metallic](#) and [smoothness](#) properties of the material to create the correct appearance.

If a material is opaque when it should be transparent, check that the rendering mode is set to Transparent. Then click on the Albedo color swatch and adjust the alpha channel to change the transparency.



In most cases, rendering mode, textures and normal maps will be imported and correctly associated with materials. If this appears to have failed, view the material in the Inspector panel, then find the missing textures in the Project panel and drag them onto their associated parameter boxes.

Doors

Doors are not (yet) automatically identified when imported. The simplest way to enable passing through a door is to disable its collider. To disable an object in the Scene panel select the object, then in the Hierarchy panel find the parent object, which will be seen in the Inspector panel to have both LODGroup and a MeshCollider components. Disable the object by unchecking the top left box in the inspector. This will gray-out the object in the Hierarchy, and will hide the object in the Scene.



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 be imported but will be disabled.

To review and enable lights, from the Window menu choose "Rendering" > "Light Explorer" to open the Light Explorer panel. The enabled status and intensity of each light in the scene will be listed.

After lights have been enabled, visible light sources will be need to be created. From the Reification menu choose "Auto Light Sources" to recreate visible sources for every light, including intensity adjustments.

Re-Generating Lighting

The default lighting configuration for RePort scenes uses [Enlighten](#) to enable dynamic bounced lighting. This requires precomputing the lighting dynamics, so any modifications to the scene objects, including albedo changes, requires that the lighting is regenerated.

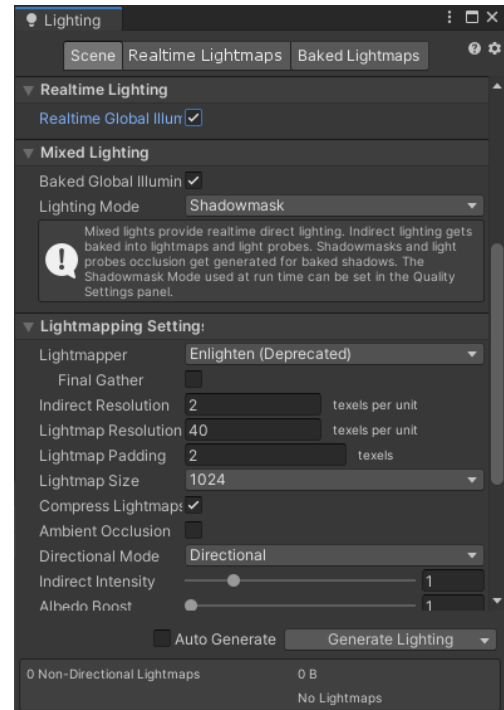
[Light probes](#) are placed adjacent to surfaces. If meshes were modified, or objects were repositioned, the probes should be regenerated. From the Reification menu choose “Auto Light Probes”.

If light sources were enabled, disabled, or had their intensity modified, the visible light sources should be regenerated. From the Reification menu choose “Auto Light Sources”.

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 the 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.



Advanced Importing

The default importing process provided by RePort is intended for buildings. However, the process can be adapted to other use cases, such as landscapes. And, if needed, the import stages can even be applied manually or invoked from custom scripts.

Rhino Blocks = Unity Prefabs

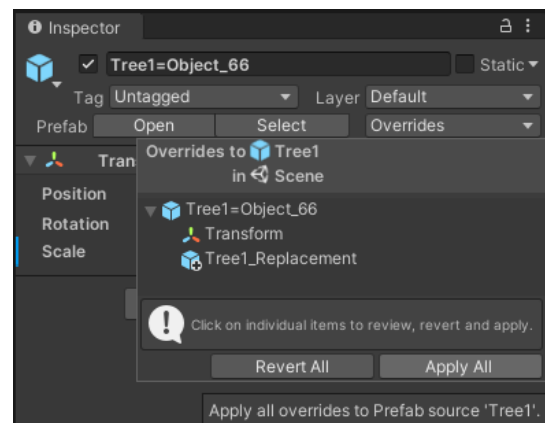
Every [Rhino block](#) used in your model will be converted into a [Unity prefab](#). These prefabs will appear in the imported model subdirectory. Each will have associated subdirectories for textures, materials, and meshes.

If a block's subdirectory is deleted before importing an empty prefab will be created and included in the scene where the block was located. This makes it possible to skip the import process for blocks (e.g. trees) that will be replaced with other assets in Unity.

WARNING: Presently, the RePort system supports only position, rotation, and uniform positive rescaling. If general shear or inversion transformations are applied to blocks, the imported model will not be correct.

Prefab Replacement

In some cases it may be easier to configure a replacement asset in situ. With the scene open and landscape added, copy a prefab instance and paste it into the root of the scene. (There will now be two instances - the original inside the landscape prefab, and the independent copy) Next, add the replacement asset to the scene and configure it as the copied prefab instance. Then, make the configured asset a child of the prefab by dragging it onto the prefab. Finally select the prefab, in the Inspector panel expand the Overrides menu and select "Apply All" to add the asset to the prefab, and thereby to every instance in the scene. The prefab copy can now be deleted.



Landscape Exporting

While a building and the surrounding terrain can be imported as a single model, it is recommended to export and import these separately. The default RePort importing process is suitable for buildings, but not for large objects (such as terrain) or organic objects (such as vegetation). This is addressed by exporting landscape separately from buildings, and reassembling after import.

The RePort plugin for Rhino exports only the objects that are visible when it is run. Preparing an export with a landscape requires 3 steps:

1. Make sure that only the buildings are visible, then execute the “RePort” command to export the building in the specified root export directory.
2. Make sure that only the landscape is visible and execute the “RePort” command again, but export to a new subdirectory within the root export directory.
3. If vegetation objects are block instances, each block will have been exported to a subdirectory of the landscape directory. If you are planning to replace these with other assets, delete the block’s subdirectory to skip the import process.

Landscape Importing

After following the landscape exporting steps, the root export directory will contain files for both the building and the landscape. Copying the root export directory into the RePort directory of the Unity project will initiate importing both the building and landscape import. However, the resulting scene will contain only the building. The landscape will have been imported as a prefab in the model directory, and which will also contain prefabs for the vegetation blocks. The import process requires 3 steps:

1. Open each of the empty vegetation prefabs and add the replacement asset by dragging it into the Hierarchy panel.
2. With the model scene open, add the landscape to the model scene by dragging the landscape prefab into the Hierarchy panel. (The replaced vegetation objects will be included.)
3. In order to include lighting bounces from landscape to buildings regenerate the lighting.

Multiple Imports

Importing begins automatically only when the Unity application has focus. To enqueue multiple model 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.

Discarded Models

After importing, the original model files (e.g. files with a .fbx extension) will have been moved to the OS trash. If these files were retained, then if the Library folder were regenerated (which can occur when cloning a collaborative project) the entire importing process would be re-run.

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.

Manual Importing

In Unity, dropping a model or folder into any location other than the RePort folder will use a default import process. In particular, for models exported from Rhino using the “RePort” command, the default import process will not reassemble the constituent prefabs and levels of detail.

Models or folders that are copied into the RePort folder directly will be used to create a scene. The scene generation process includes generating lightmap UVs for the LOD0 meshes, and generating scene lighting. However, if there is an intermediary folder then no scene generation will occur. In particular, this behavior is relied on for the landscape import process described above. This is done because the lightmap UV generation for trees, and lighting generation for terrain are both extremely slow.

A significant limitation of standard imported models is that they are not mutable. This can be addressed by selecting the model in the Project panel, and then applying “Gather Assets” from the Reification menu. This will extract the textures, materials, and meshes, and will create a regular prefab that uses them.

Each step of the import process is listed, in order of execution, in the Reification menu. Using these actions, every step of the import process could be manually executed. Furthermore, each import step is implemented in its own script, which can be invoked using an Apply(...) method, so a custom import script could be created using these building blocks. Finally, if any part of the initial model import process needs to be modified a custom importer can be created, following the model of the RhinoImporters.cs script.

Resources

The [Unity Asset Store](#) provides a searchable selection of assets that can be purchased and customized.

If you are planning to use Reification's services to share your model there is one strong limit to keep in mind: [no code can be added](#). Nevertheless, any model comprised of geometry, materials and textures can be added.

Staging

Many staging assets are described by dense meshes that will be very slow to render. However, the RePort exporter can only reduce detail levels on parametric models.

In the case that a model asset supplied multiple levels of detail, the original asset can be imported using the RePort system, and used to replace the block for the unoptimized asset.

Alternatively, staging can be performed in Unity. The publisher page of [ArchVizPro](#) offers both highly optimized 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](#).

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 directories (“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>

Enlighten middleware site:

<https://www.siliconstudio.co.jp/middleware/enlighten/en/>

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 XR support?

Unity's XR Plugin Management system does not support SteamVR. Because of this RePort will continue to use the legacy Virtual Reality SDKs. We will be assessing [new solutions](#) as they become available.

Why does RePort use deprecated lighting?

Unity's Progressive lightmapper will not update bounced lighting as the sun moves. Because of this RePort will continue to use the Enlighten lightmapper. Furthermore, Unity has recently changed Enlighten's status from [deprecated](#) to [de-deprecated](#). We are presently working to update RePort to take advantage of both ray-traced reflections and bounced diffuse lighting.

Acknowledgements

Example Model: Forrest Follie by Carlos Esquivel

Unity Networking: [Mirror](#)

Unity Networked Audio: [Dissonance](#)