3D Game Design

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Today's Agenda

We're going to be going over Chapter 11: PreFabs, Chapter 9: Collisions, Chapter 4: Terrain and Environments

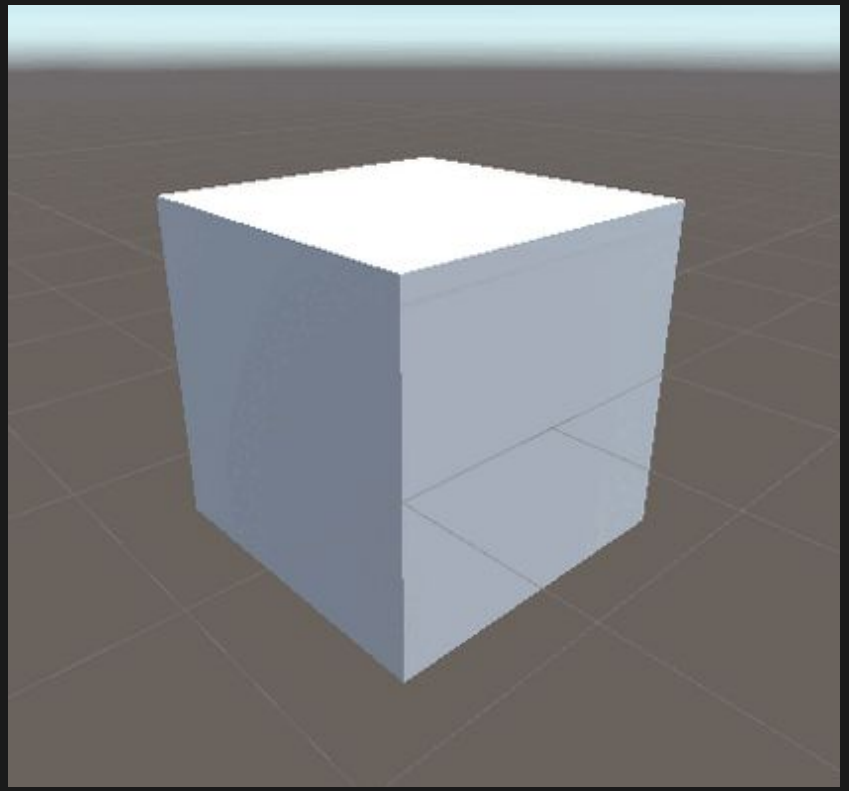
- Learn about PreFabs; what they are and how they are beneficial to us
- Use the Unity Asset Store to get premade assets and how to use them
- Create Game Object with 3D Collision and Physics
- Learn about Terrain and Environment Systems and how we can make game worlds quickly.
- Create and Share Your 3D levels

Built-In Models

We've already encountered models or meshes. In our class, the primary model we looked at was the Cube.

Alongside the Cube, Unity has five other Built in Models: Sphere, Capsule, Cylinder, Quad, and Plane.

The difference between the Quad and Plane is number of Polygons. The Quad model consists of two polygons and is better for UI elements while the Plane model has 200 polygons and is used for walls and floors.



Additional Resources: Pages 41 - 42, **Primitive and Placeholder Objects**

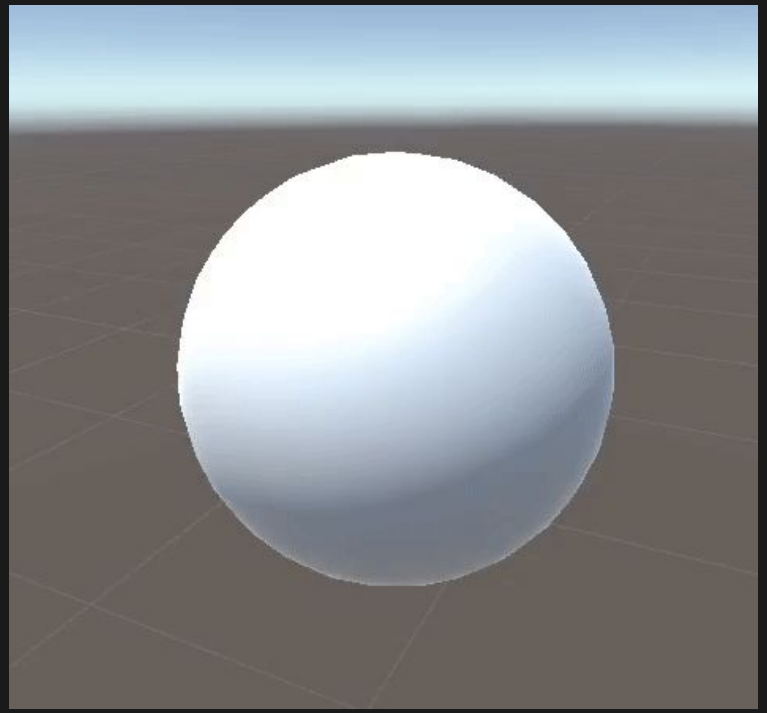
Polygons

Polygons are Triangles that make up 3D Meshes. Every 3D Models is made up of triangles. This is because it is the simplest flat surface you could make.

With a triangle you have three points or vertices and no matter where you put the points in a 3D space they will always make a flat surface.

However, if you were to take four points or more you will have a chance to create a plane or a 3D object such as a pyramid which is much harder to simulate for the computer.

Using polygons allows you to create smoother surfaces that can approximate curves.



Additional Resources: **Why Video Games are Made of Tiny Triangles**,

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Mesh Filter and Mesh Renderer

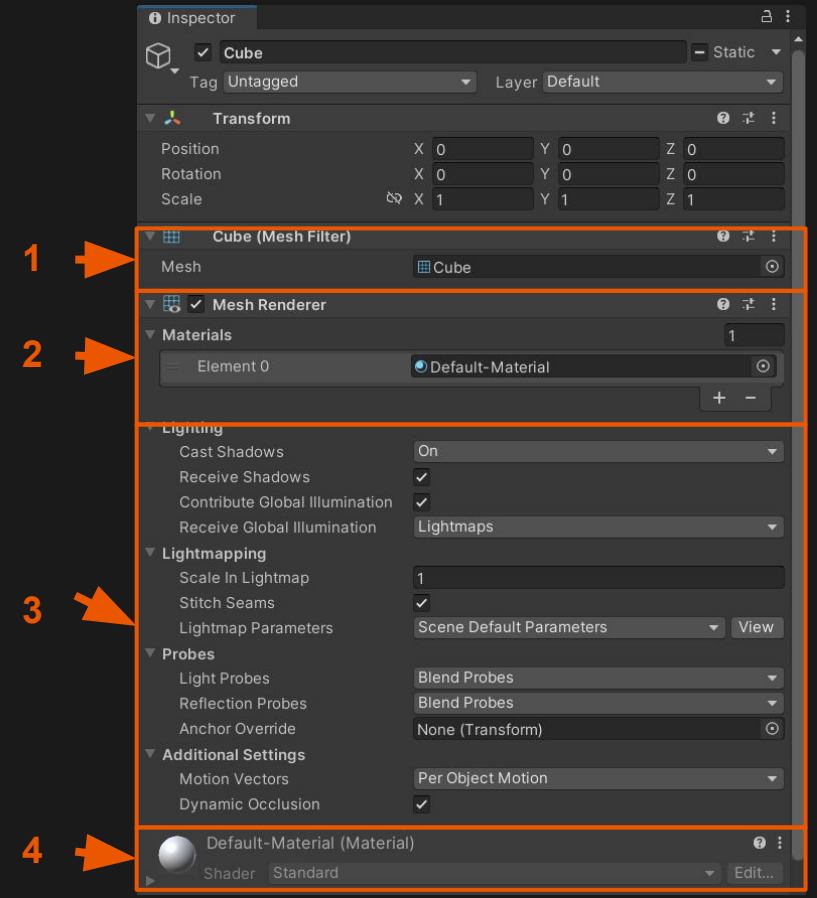
[1] The Mesh Filter Component tells you what Mesh or Model you want to have attached to the game object. Clicking the circle will bring up a PopUp Menu that will show all of the meshes that are in your Project View.

[2] The Mesh Renderer Component draws or renders the mesh with the chosen Material. Material is the way a Mesh is viewed, we will discuss it in the next slide in further detail. You can have multiple Materials connected to a Render but we will not have to worry about that in this class.

[3] The Mesh Render has many lighting setting on how it should interact with lights, we will discuss that in a class focused on lighting.

[4]The Material used in the render will be on the bottom of the inspector in case you want to view it's details.

Additional Resources: Mesh Filter, Mesh Renderer



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Challenge: Create a Character

1. Using the pomade 3D models let's try to put together a very basic humanoid person.
2. Start off by creating a Empty Game Object and calling it a Person
3. Then Proceed to give them a head, body, arms and legs.
4. After that give them a little extra detail, eyes, fingers, nose hair. It's up to you.

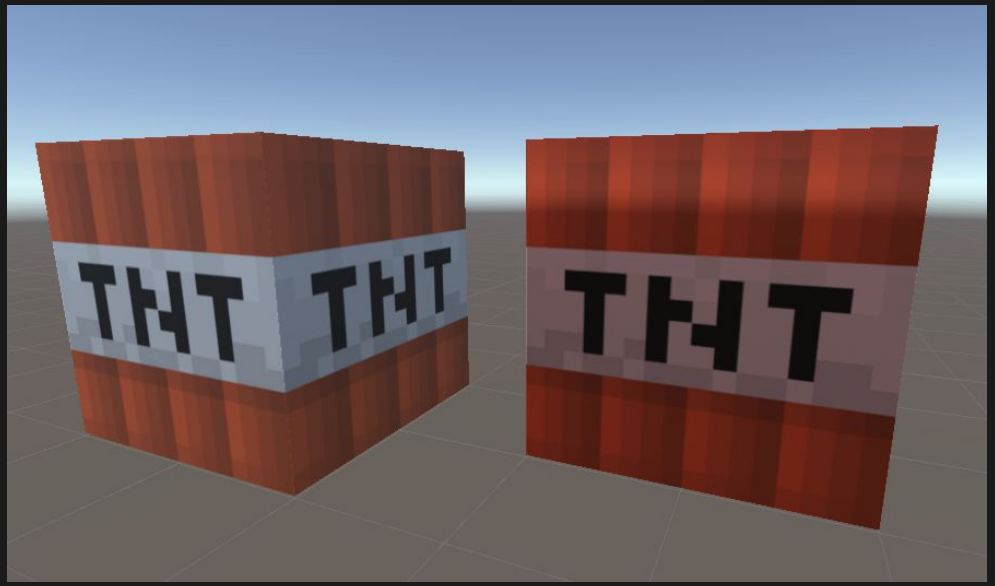
Model Material

To make a 3D asset be viewed it requires something called Model Material, which is made up of two parts

Model Texture - what is drawn on the surface of the 3D Model

Model Shader - how the texture is drawn on the 3D Model

“Imagine you have a piece of wood. The physicality of the wood is its’ mesh, or model; the color, the texture, and visible elements are its textures. Now take that piece of wood and pour water on it. The wood still has the same mesh. It is still made of the same substance (wood). It looks different, thought,. Its slightly darker and shiny. In this example you have two “shaders”: dry wood and wet wood. “ [Page 49]



Additional Resources: Pages 47-50 of the Textbook

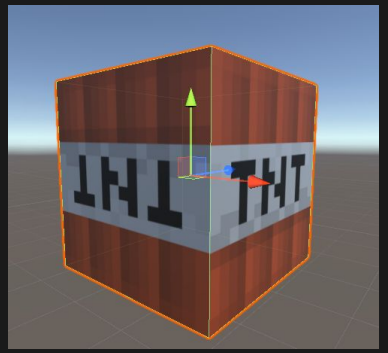
Textures

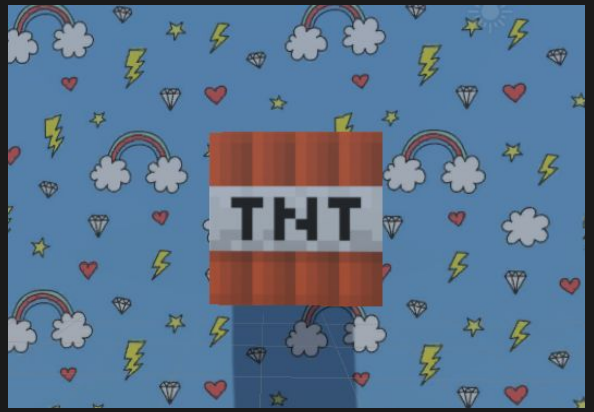
Textures are flat images that get mapped to the 3D Mesh through a process UV Mapping.

In our example we have the Unity standard Cube, it has six faces and just slaps the whole image on its face without much care for orientation.

This may not be best used on a Cube however, given a Tileable Image we could use it to create a convincing floor or wall.

Tileable Image or Seamless Image is an image in which the opposite edges match up allowing you to create a never ending copy of the pattern.



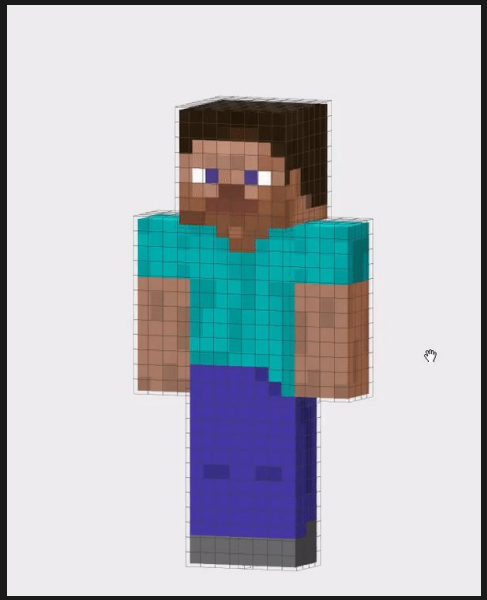


UV Mapping

It's called UV Mapping because the Mesh is in XYZ coordinates the texture is represented in UV coordinates. The mapping comes in play when you divide parts of the texture it can display different parts of an image on different faces of the cube.

Here we can see all the parts of the Steven Texture drawn on a single image, the model has been created to look at those specific parts of the image and map to predefined parts of the mesh.

To do this you'd have to model 3D objects on your own which is beyond the scope of this class, but if you're interested you can download Blendr and try it in your free time.



Additional Resources: Introduction to UV Mapping - Learn the Complete Basics, The Skindex

Image Specifications

When getting the images we want as our textures we want them their dimension to be in power of 2^n as computer chips are programing in binary, so sizes such as 32, 64, 128, 256 and so on.

Best image format for the image being a PNG or TGA, as they aren't compressed and have an alpha channel.

Alpha channel allow image to have transparent parts. Every image will have three other channels red, green, and blue.

File type	Pros and cons
PNG	Commonly used on the web. Lossless compression; has an alpha channel.
JPG	Commonly used on the web. Lossy compression; no alpha channel.
GIF	Commonly used on the web. Lossy compression; no alpha channel. (Technically, the loss isn't from compression; rather, data is lost when the image is converted to 8-bit. Ultimately, it amounts to the same thing.)
BMP	Default image format on Windows. No compression; no alpha channel.
TGA	Commonly used for 3D graphics; obscure everywhere else. No or lossless compression; has an alpha channel.
TIFF	Commonly used for digital photography and publishing. No or lossless compression; no alpha channel.
PICT	Default image format on old Macs. Lossy compression; no alpha channel.
PSD	Native file format for Adobe Photoshop. No compression; has an alpha channel. The main reason to use this file format would be the advantage of using Photoshop files directly.

Additional Resources: Chart from Unity in Action pg 83

Image Import Settings

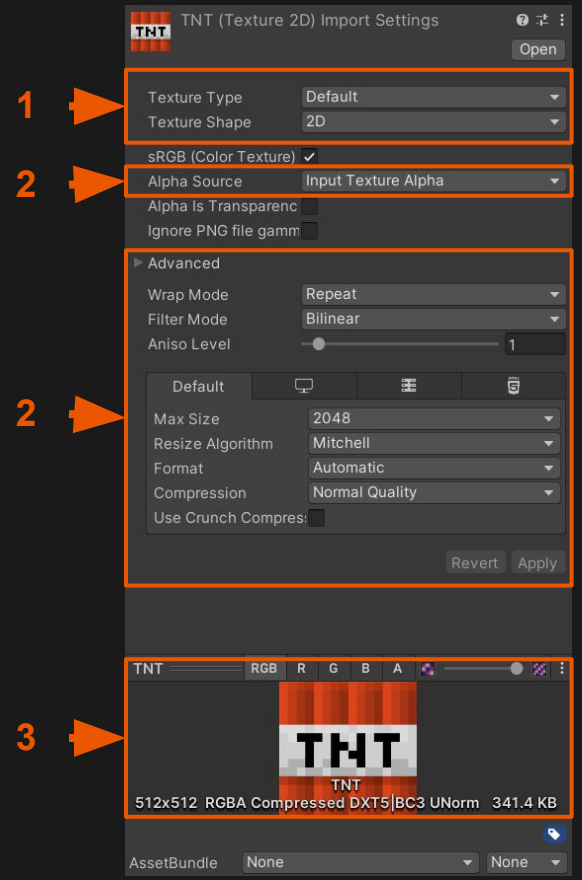
Every image that you bring into Unity will have Image Import settings that tells Unity how the image should behave. You can get to it by selecting the Image in the Project View.

[1] Is telling Unity how it should treat the image, currently it's set to Texture Type is Default, but we'll use Normal Map and Sprite as well. Texture Shape is 2D keeping it an image but can be turned into others which we'll come back to later.

[2] Alpha Source is important for determining what does your image look like if the transparency is lowered. Input Texture Alpha will use the alpha preset with the image while From Gray Scale will gray the image and use that as the alpha channel.

[3] Is how the image should be treated per platform. Some platforms are less powerful and texture need to be compressed for them to operator optimized.

[4] Is the preview of how your choices affect the image.



Additional Resources: Texture Import Settings, Textures - Unity Official Tutorials

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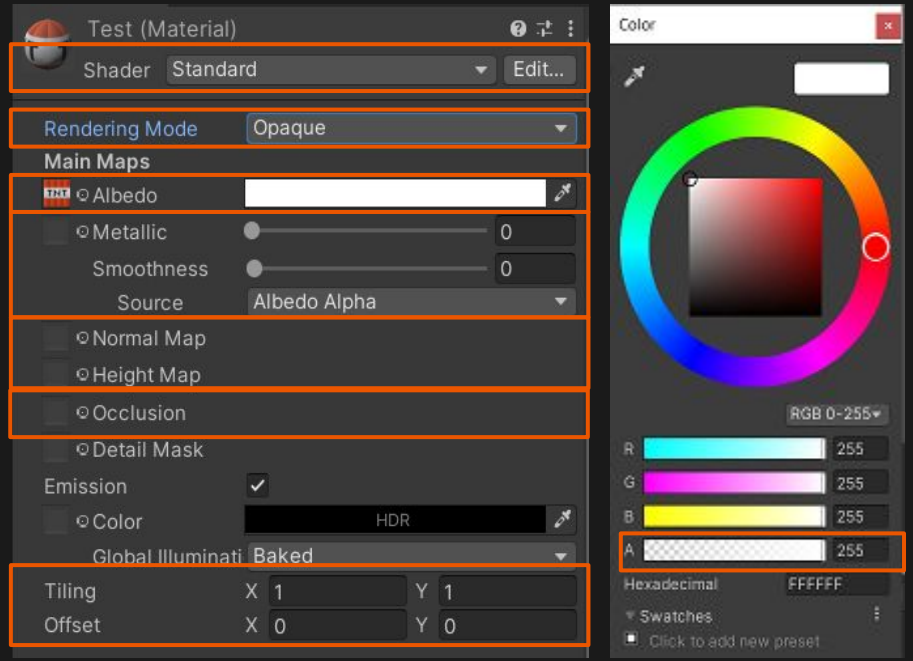
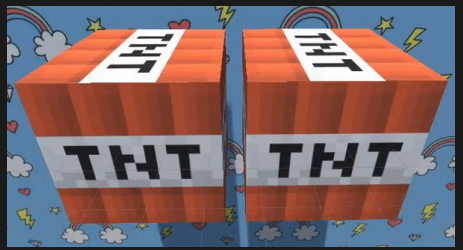
Material

Here we are at the Material Inspection, in the [1] Header you are allowed your Shader type. We only will use Standard and Standard (Specular). The difference between them is that Standard will make the material look metallic while Specular will make it more reflective to light sources. It direct effect what's displayed in [4]

[2] Rendering Mode, there are four modes, Opaque which will show the image as solid, Transparent, Fade and Cutout. Difference between Transparent and Fade is that Transparent even with 0 on the alpha channel will leave behind a reflection of the mesh while Fade will fully disappear. To edit the transparency you will edit it from the color select in Albedo Map [3].

Additional Resources: Standard Shader, Rendering Mode





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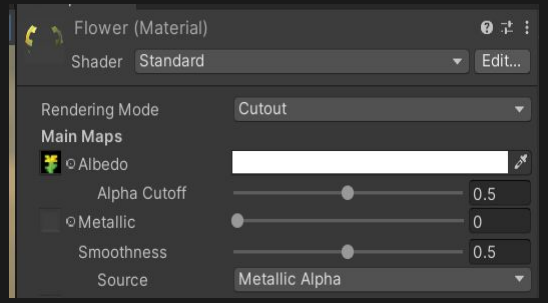
Material

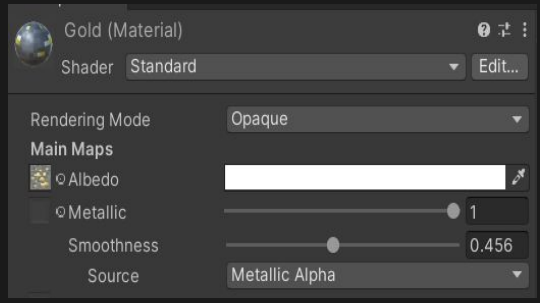
The Flowers are are an example of a Cut Out Material, being two cubes with the Texture drawn over them.

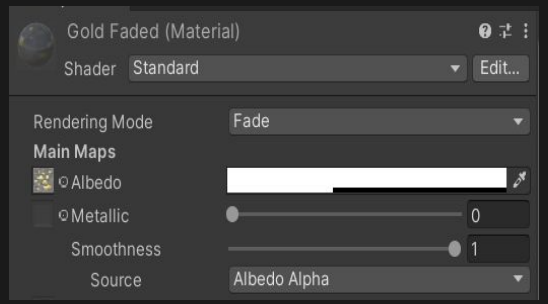
The Gold Brick is a example of Opaque Material. A solid texture influenced by the color.

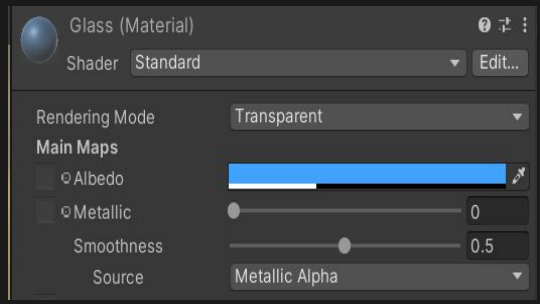
Gold Fade shows what happens when you have a fades object.

Glass is a good example of a Transparent Material.









Challenge: Create Material

1. Go into the Materials Asset Folder and create a brand new Material
2. Using the Lock on the Inspector keep the Material Information available as you go to the Texture Folder and assign the Albedo using one of the provided textures or one you download from the internet.
3. Edit the textures to fit how you'd like them to interact with the world.
4. Then drag that material Asset from the Project View onto your character

Material

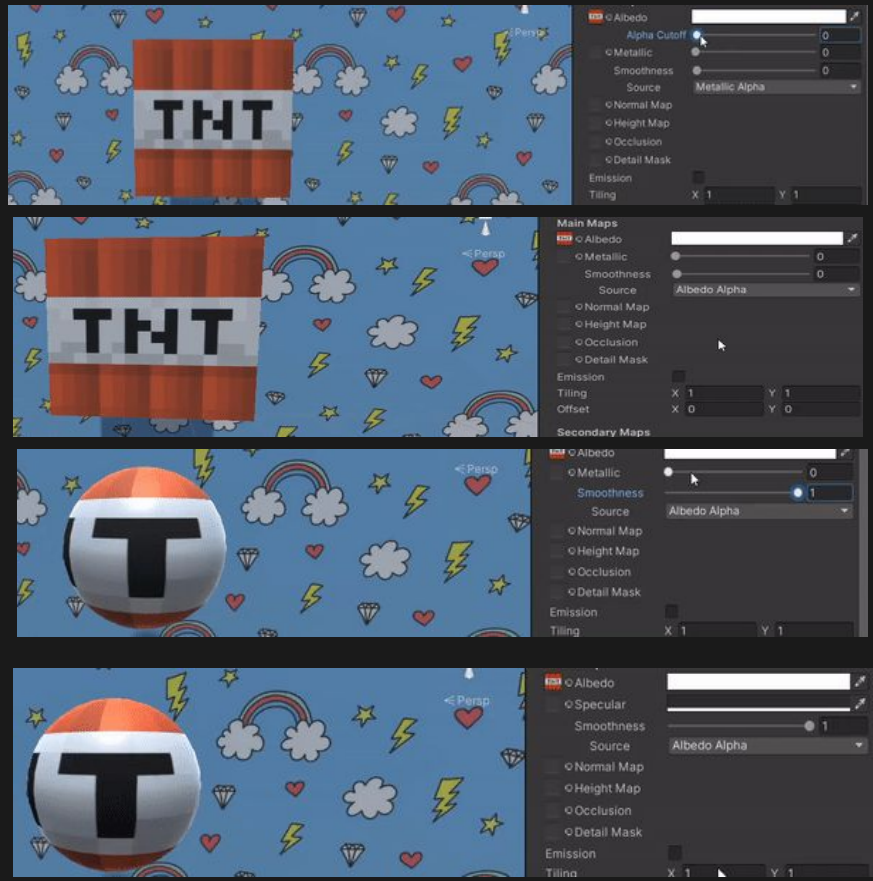
[1] Rendering Cutout - Allows us to show portions of the texture by cutting out the darker parts of the alpha channel. It's a great way for creating grass and bushes.

[3] Albedo Map - Determines the color of the material in light, that's where you connect your texture. You can edit the tint and transparency of the original texture here.

[4] Metallic - Controls how metcalic the object looks like.

[4] Shader Specular - How much does it reflect light sources in the scene.

For both metallic and specular you could include an image map of which areas you'd want to be more metallic/specular but that's beyond our scope.



Additional Resources: Albedo Map, Metallic, Specular

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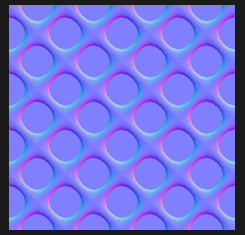
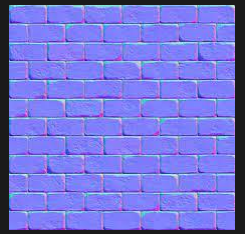
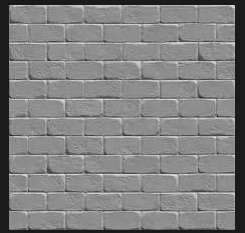
Material

[5] Normal Maps - Also known as a bump map. Allows us to give the illusion of extra geometry by having bumps catching the lighting. This is done with the bluey-purple image where the blue, red and green bits represent which way the light should bounce off in.

[5] Height Maps - Work in conjunction with Normal Maps they can provide the extra detail by creating depth on the flat surface. They use black and white to high each pixel is from the other, the darker it is the lower it is and the brighter it is the higher it is.







Additional Resources: Normal Map, Height Map

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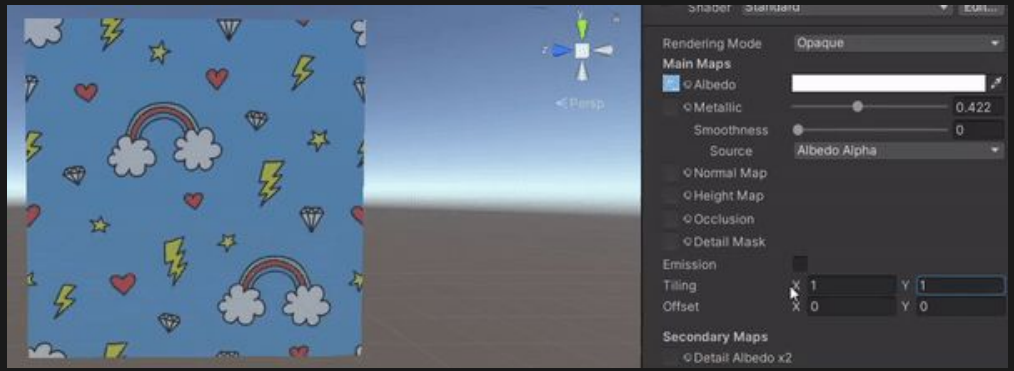
Challenge

[6] Occlusion Map is used to provide information about which areas of the model should receive high or low indirect lighting. Indirect lighting comes from ambient lighting and reflections, so steep concave parts of your model like a crack or a fold would not realistically receive much indirect light." This is beyond our scope but it's good to know.

[7] Titling - Allows the texture to be repeated across the X and Y axis and be offset. For best results you want to have Seamless or Tiled Textures that will repeat the pattern when replicated.

Additional Resources: Occlusion Map



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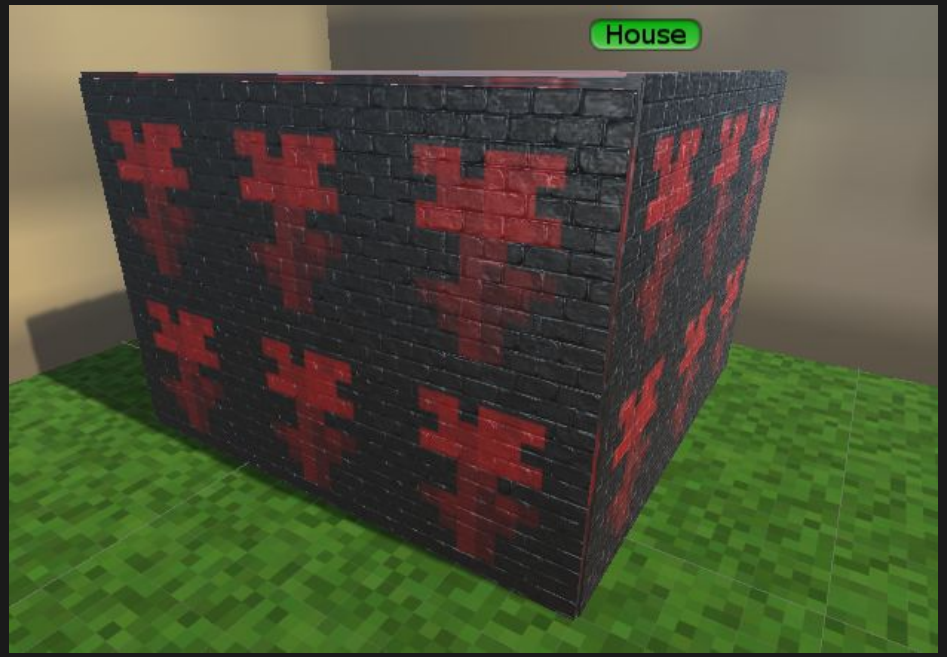
Challenge: Build a House

Your person need a place to live

Using the Normal Maps, Height Maps and Tiling create them a home.



What is a Prefabs

A Prefab is a complex asset that has been bundled and can be reacted with little extra work. It also gives us the power of Inheritance.

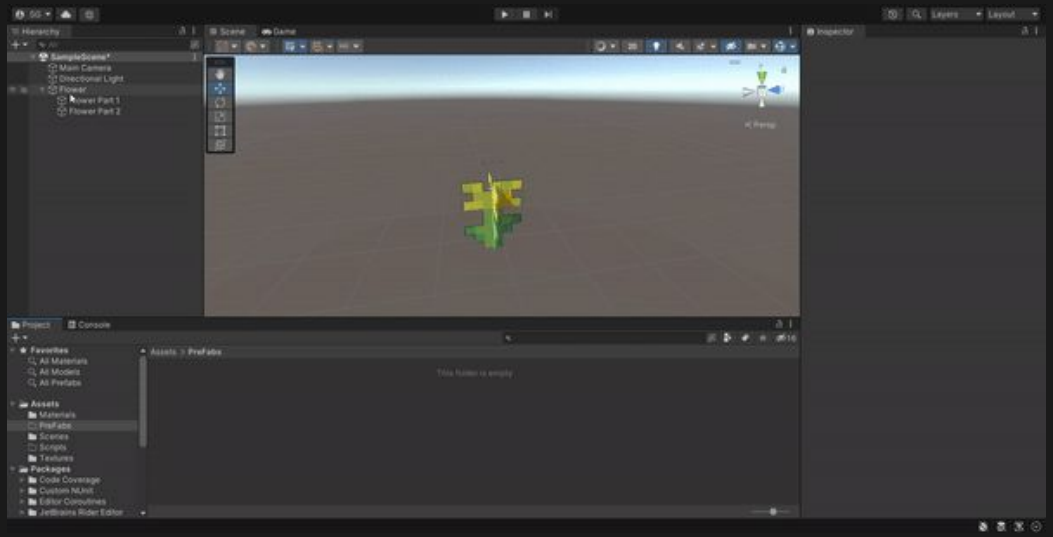
Inheritance is when all of the Game Object are linked to the Prefab, giving us the power to edit the PreFab and passing on those changes to all of its children Game Objects.

For example, let's take the Flower we had in previous Lesson. Let’s say we wanted to make a lot of them and after we made all of them we wanted to change their size, without a Prefab you’d have to go to individual game object and edit those characteristics.

Additional Resources: Pages 191-192 of Textbook

Creating A Prefab

Creating is as simple as dragging a Game Object from the Hierarchy View into the Project View.



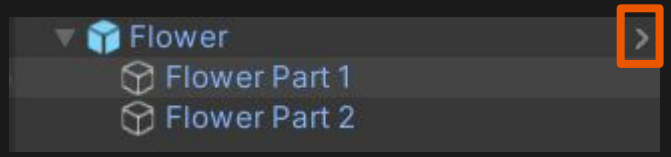
Visual Difference of PreFabs in Views

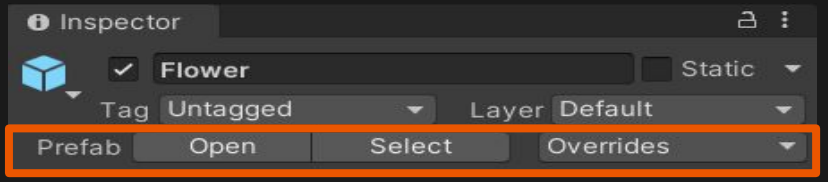
Once you've turned a Game Object into a Prefab few things will change/became available to you.

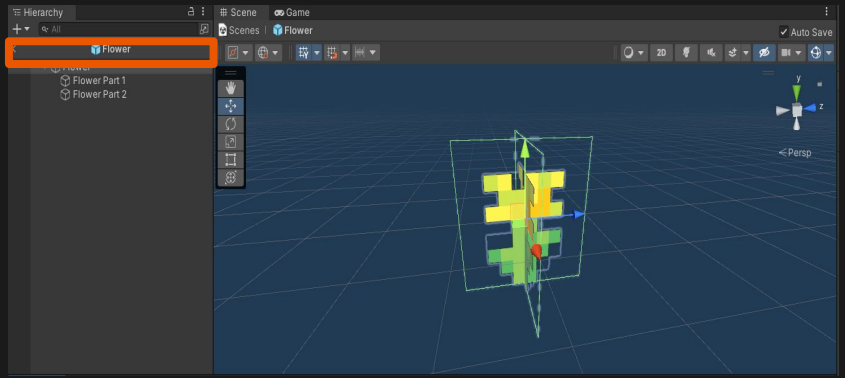
First, the Game Object and all it's copies will appear with Blue Text in the Hierarchy view to indicate that it is an Instance of a Prefab.

Along side of that the Inspector View Header will gain another row giving you [2] Prefab options, [1] The Arrow in Hierarchy View and the Open Button will send you to the Prefab Mode where only the Prefab and all of its children will be for you to edit directly.

You can exit the Prefab mode by clicking the back [3] Tab in the Hierarchy View.







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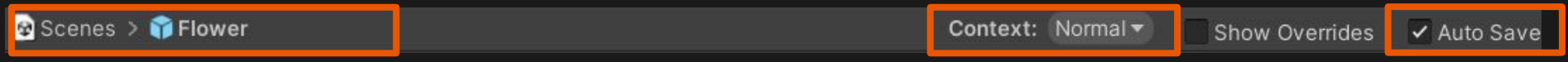
Prefab Mode



1

2

3

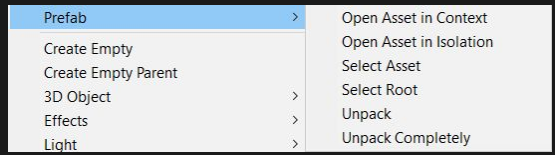
Scene View will receive a new row of options as well. [1] Showing you the Breadcrumb Trail of how you entered the Prefab Mode. [You can nest Prefabs in prefabs]

Next you can change the way the background of the Scene View looks with [2] Context DropDown

And lastly you can [3] Auto Save, if you check it, it will save and copy all of your edits on the Prefab asset. You can also uncheck it and a manual Save button will appear next to it but I recommend keeping the Auto Save on.

Additional Resources: Prefab Mode

You can get into PreFab mode in two ways, Context which is still in the Scene or Isolated where it's just the Prefab. . Just right click on the Game Object in the Hierarchy View and select Prefab for more options.



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Challenge: Create a Prefab

Create a Cube or any other 3D game object.

Create Material and give it a Color that's not White.

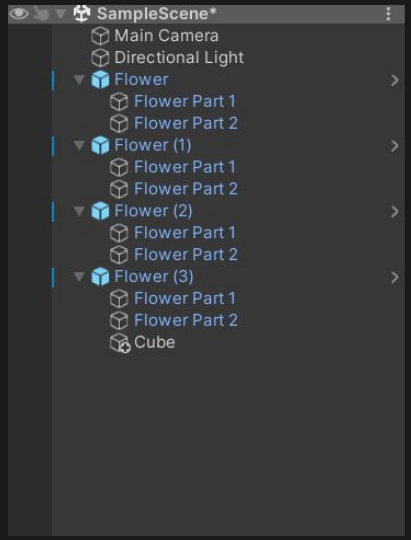
Connect the Material to the Game Object you made.

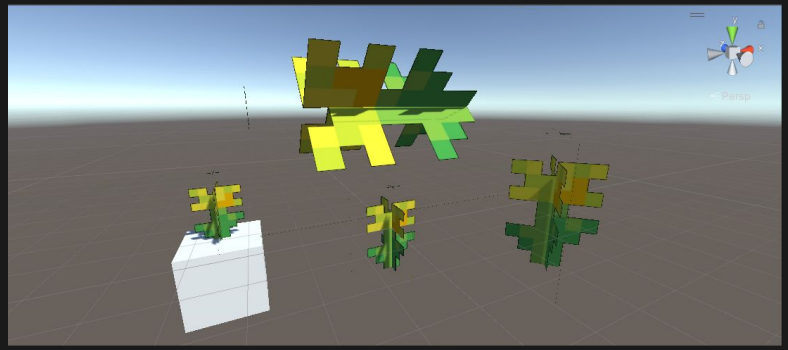
Drag the Game Object from Hierarchy View to Project View.

Modifying Prefabs in Scene

While in the regular Scene View you can modify the Prefabs and all of its components as long as it does not affect the structure of the Prefab. Meaning you can change the Components settings like Position, Rotation, Scale, if the Collision is on or off, you can even add additional components or meshes to the Game Object.

The only thing you can't do is Remove the Game Objects or Components that are already attached to the Prefab.

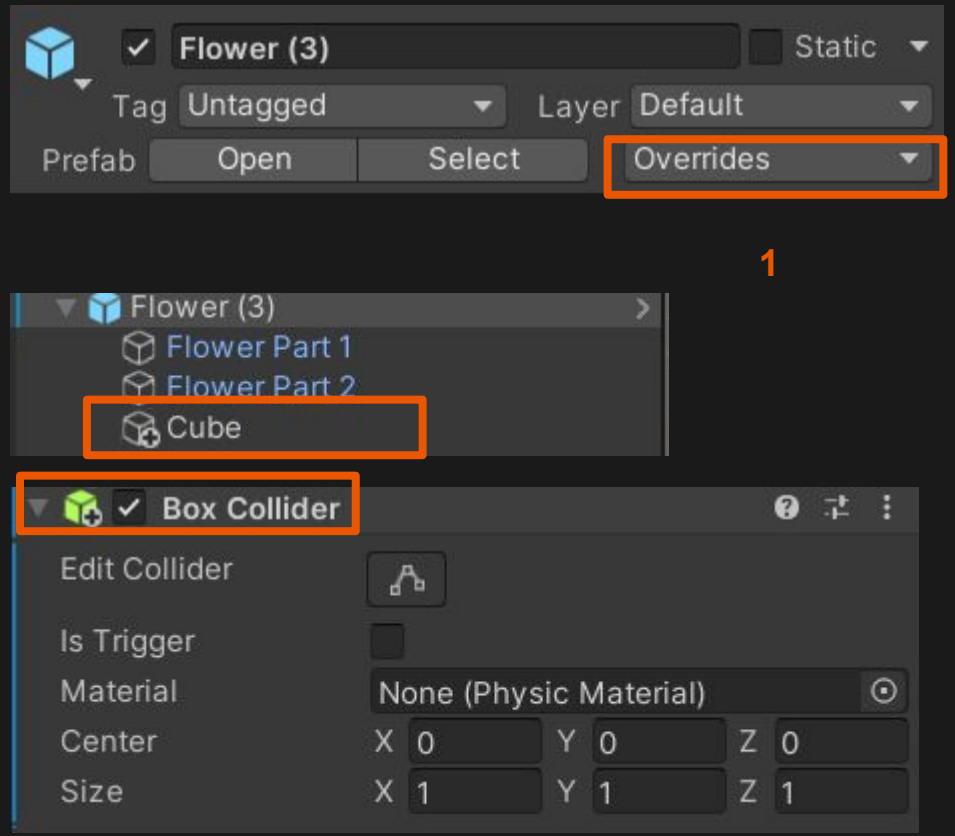




Modifying Prefabs in Scene

While Modifying Prefabs by adding Game Objects or Components to the Instance of a Prefab you will notice the newly added. This is because you can actually apply those changes to the Prefab and pass them onto all the other instance.

By going to the Inspector View Header and cling the Overwrite DropDown you can see all of the changes you've made to the Instance in reference to

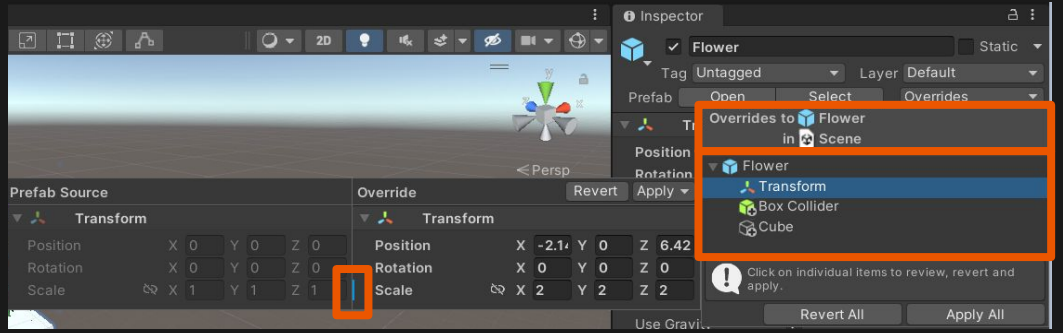


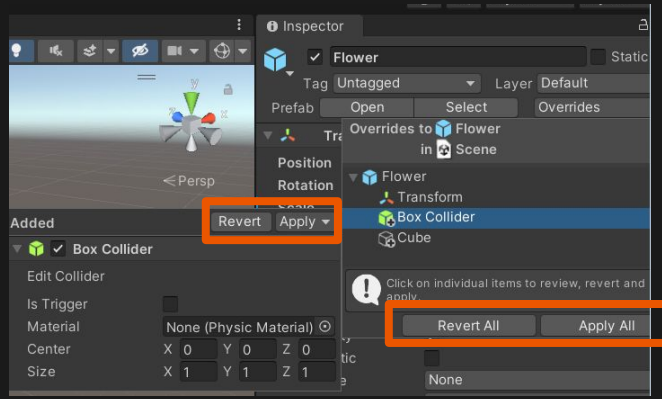
Inspecting Overwrite Changes

When going through the overwrite you will have the Header that shows you where the changes occurred. Then you will have a break down of all of the Game Objects or Components that were affected.

In case of Components that pre existed in the Prefab and were changed you'll get to see what the values are in the reference to original. In this case the Scale was changed indicated by the Blue tab.

On Game Objects or Components that were Added you'll just have them pop up. You can Revert/Apply the changes individually or Revert/Apply All at once.





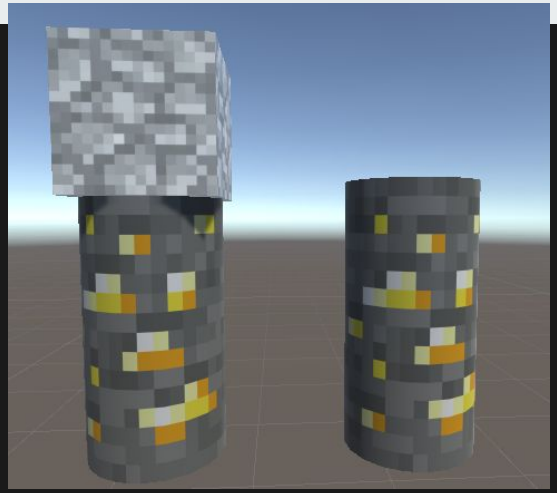
Challenge: Overwrite

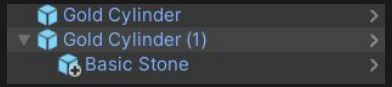
Create a Second Object and attach it to the first one you've made.

Now create copy of the Prefab by dragging it out of Project View, see how it does not have the new object yet attached to it.

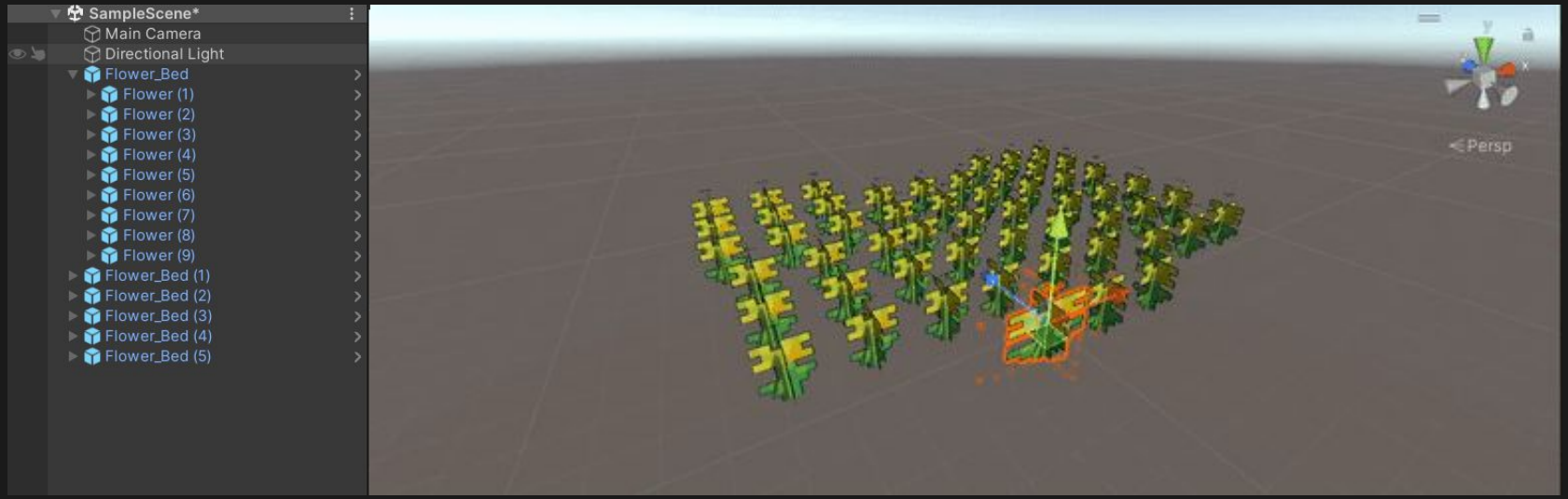
Now go to the Prefab with an addition to it and in the inspector click the drop down menu and apply.

Now both object should be changed.





Nesting PreFabs



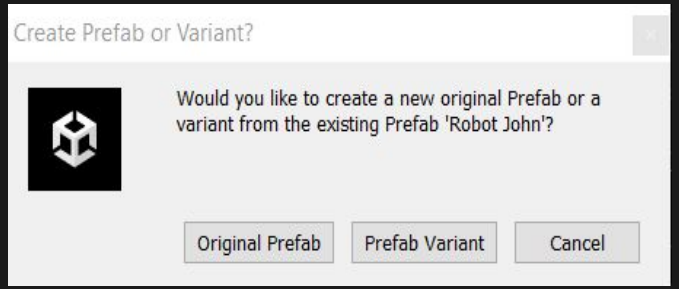
Say you want to make a field of flower out of the one we made, it would be much easier to fill the Scene with flower is you made a Flower_Bed Prefab that contained ten or more of our Flower Prefabs and then used the Flower_Bed to decorate the level.

And now if you think that the flower is too small or the wrong color you can change the original Flower Prefab and all of the Flower_Beds will be updated with the new flower as well.

Making a Variant or Original

You may have done enough changes to a Prefab in Scene that you may want to make it an entirely new prefab.

If you drag and drop the changed Prefab into the Project View you will get this PopUp, allow you to create and Original or a Variant.



Original will create a fully separate Prefab with no connection to the one used to make it.

Variant will create a new Prefab that is connected to the one used to make it, this is great for creating enemies with small variants. Any changes to the original used to make the varraint will also be added to the Variants.

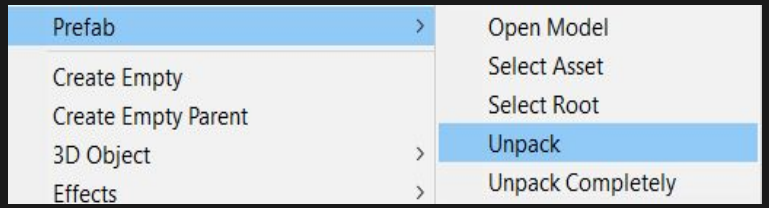
Additional Resources: Prefab Variant

Disconnecting Prefabs

Last thing to mention is sometime you may need to change a core component of the Prefab in the scene but you don't want to make the Game Object from start.

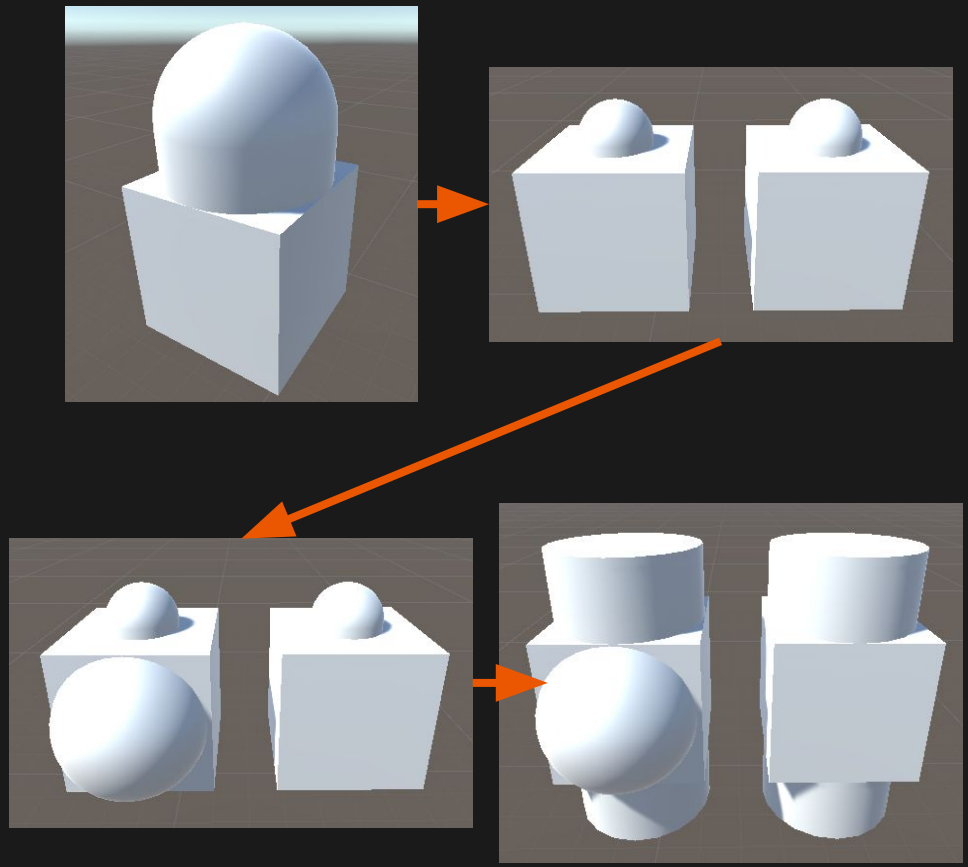
To do this you can right click on the Prefab Object and choose to Unpack it. This disconnects it from the Prefab and allows you to modify or delete any Game Object or Component that was part of it.

Unpack Completely will break down any Nested Prefabs inside the game object too.



Challenge

1. Create a Cube Game Object and nest a Capsule Game Object in it.
2. Make it into a Prefab
3. Instance a copy of it from Project View
4. Go into the Prefab Context Mode and half the scale of the Capsule.
5. Add a Sphere to the Instance Copy and make that Copy into a Variant.
6. Go back to the Prefab Mode of the Original Cube and add a Cylinder Game Object to it.

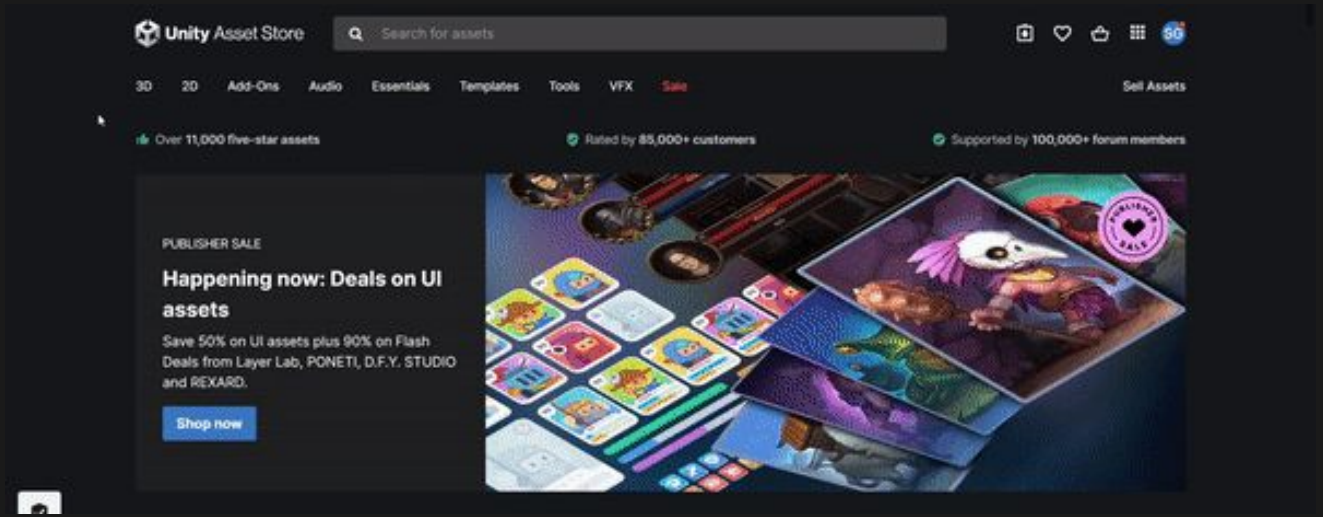


Unity Asset Store

It’s time to utilize the Unity Asset Store.

Make sure you’re logged in. Then go to 3D Character and then scroll on the right to select Free.

Now you have an overabundance of character models at your disposal.

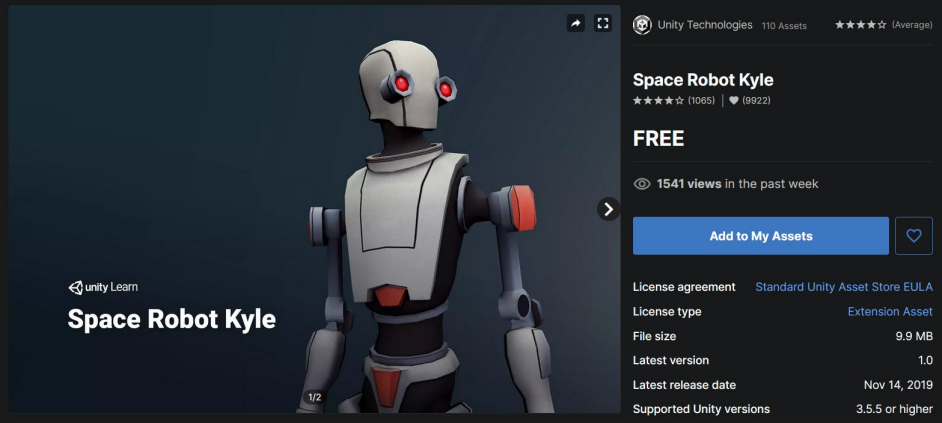


Space Robot Kyle

There is a very specific one we're going to use at the moment called "Space Robot Kyle". This model is provided to us by Unity itself.

To be able to use Kyle you will have to select add to my Assets and accept the pop up.

Additional Resources: Space Robot Kyle

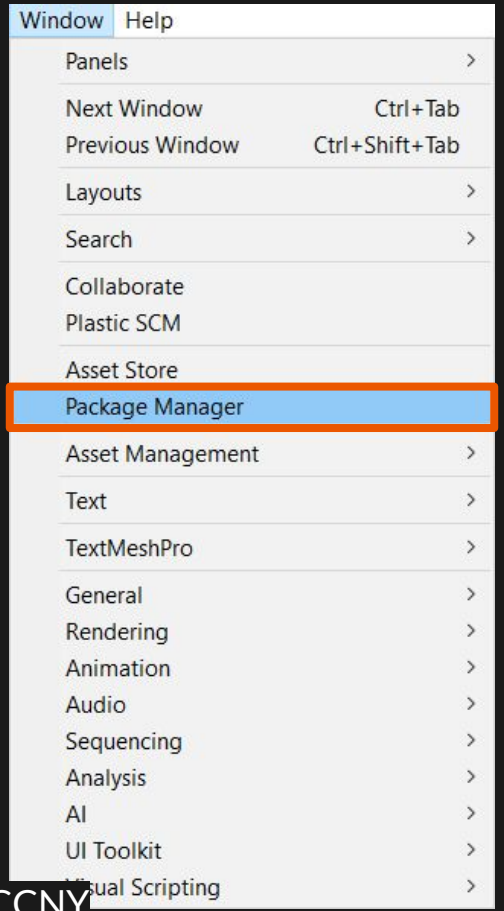


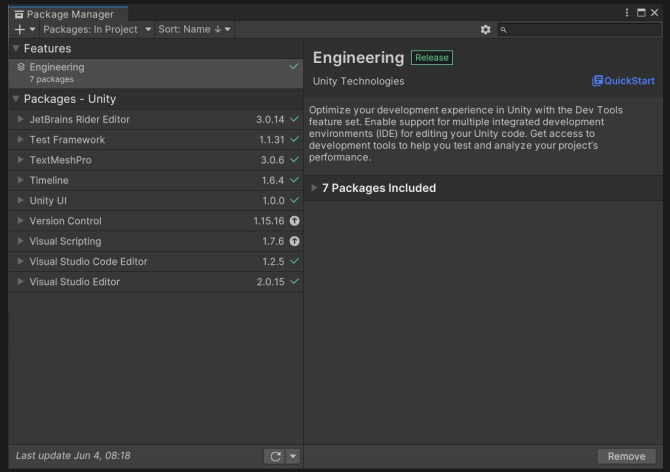
Package Manager

To be able to get Kyle into our Project you will have to go to Window Tab and select Package Manager.

This will bring a new Package Manager View that allows us to see all of the all of the packages currently installed into our project.

Additional Resources: Package Manager



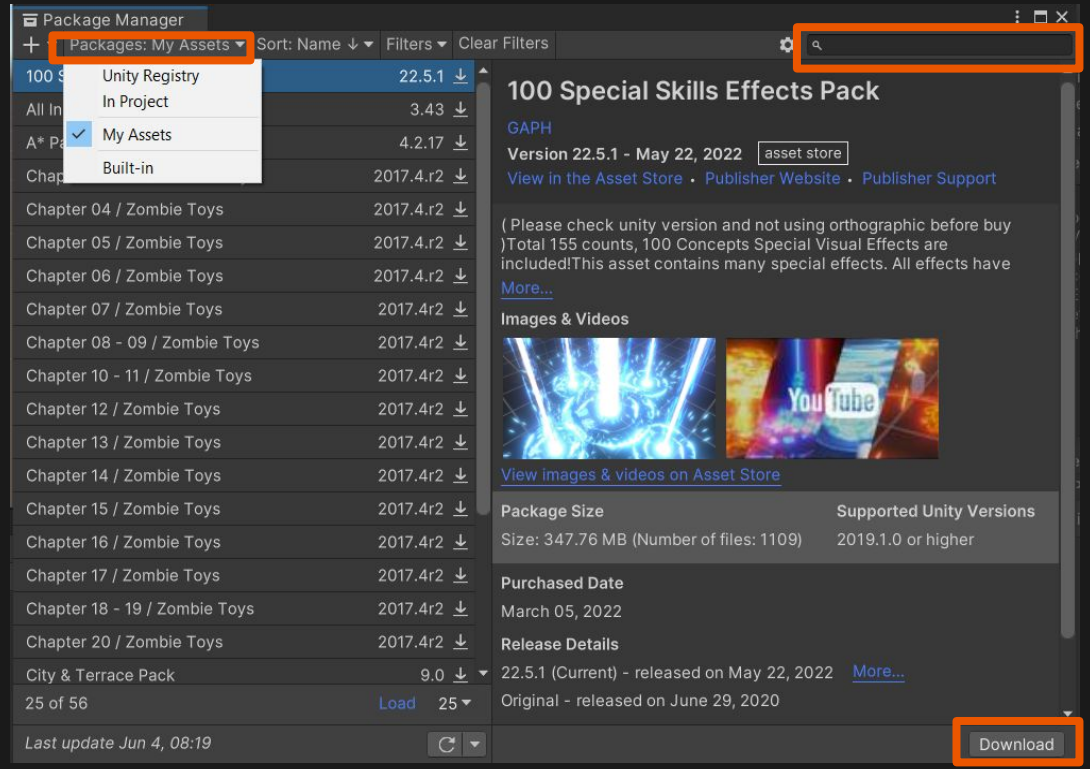


Package Manager Importing

To get Kyle you will go to the Package Choices, and move from In Project to My Assets.

Space Robot Kyle should show up and you will be able to Download him.

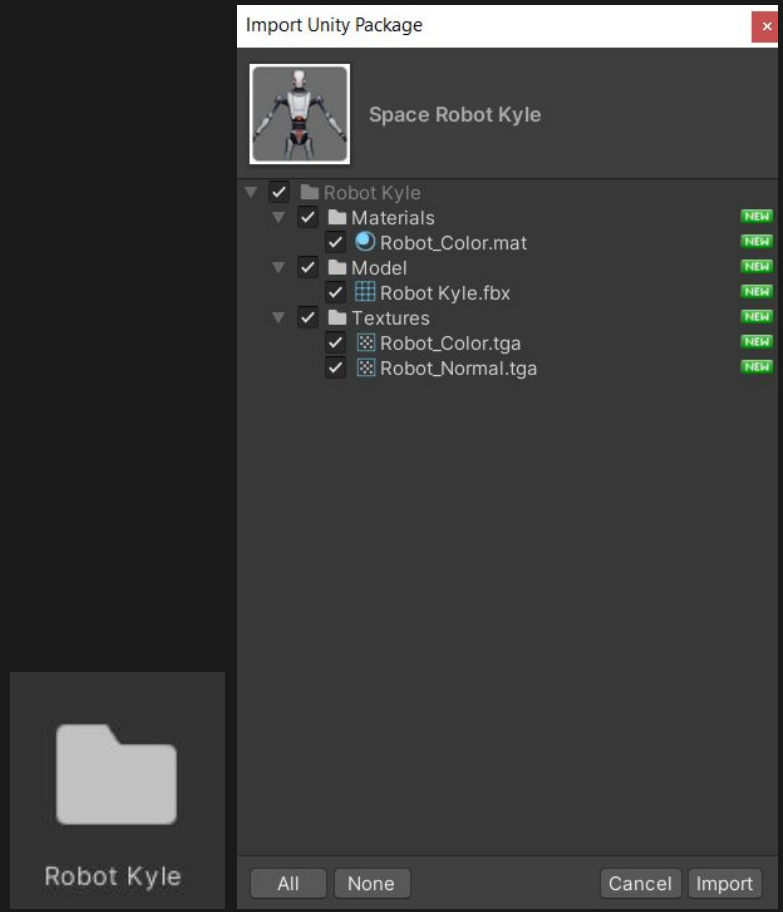
Once the Download is complete you'll be able to Import him into your Project View.



FBX Models

Importing a Asset Package will provide you with a PopUp window of everything that the Package has to offer. You don't have to download all of it but in this case we will.

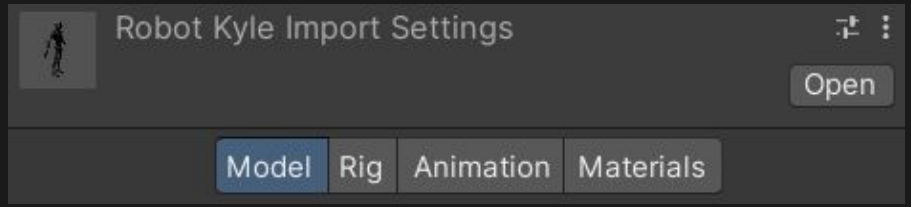
Once the import is complete you will have a new Folder with the Package name in your Project View.



Importing Model Setttings

Importing a Model is similar to importing an Image for a texture but with a more complicated object. Model can have four Model, Rig, Animation and Material. We will talk about Model and Material and come back to Rig and Animation in Week 3.

Unity supports many model data but the most common one used will be FBX as it store the Mesh as well as the Animation of the Mesh.



File type	Pros and cons
FBX	Mesh and animation; recommended option when available.
COLLADA (DAE)	Mesh and animation; another good option when FBX isn't available.
OBJ	Mesh only; this is a text format, so sometimes useful for streaming over the internet.
3DS	Mesh only; a pretty old and primitive model format.
DXF	Mesh only; a pretty old and primitive model format.
Maya	Works via FBX; requires this application to be installed.
3ds Max	Works via FBX; requires this application to be installed.
Blender	Works via FBX; requires this application to be installed.

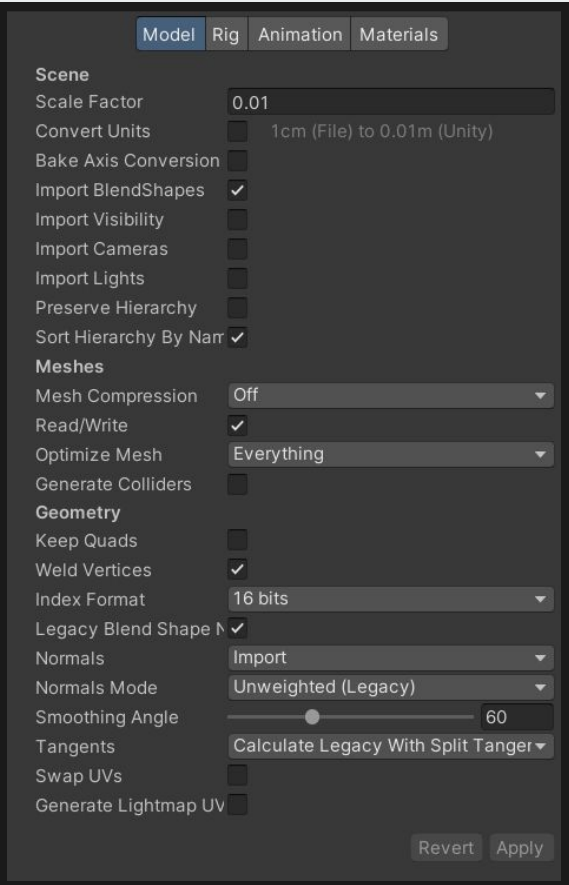
Additional Resources: Model Import Settings, Chart from Unity in Action pg 83

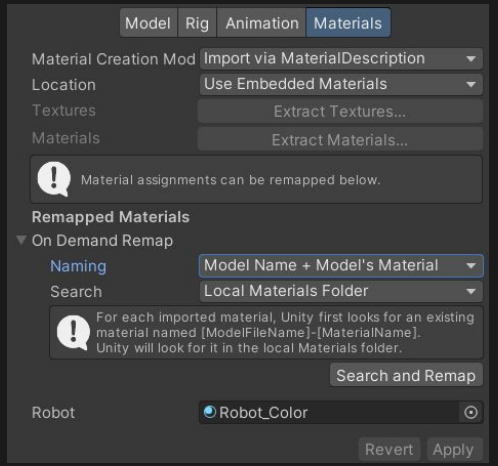
Model Import Settings

Import Settings for model allow you to change how it's brought in from whatever software created it. Currently we can look at the Model and Materials Tabs as Kyle has yet to have any Rigging or Animation done to him.

Its best to leave it alone as the artist most likely left the mesh on the settings they thought were best.

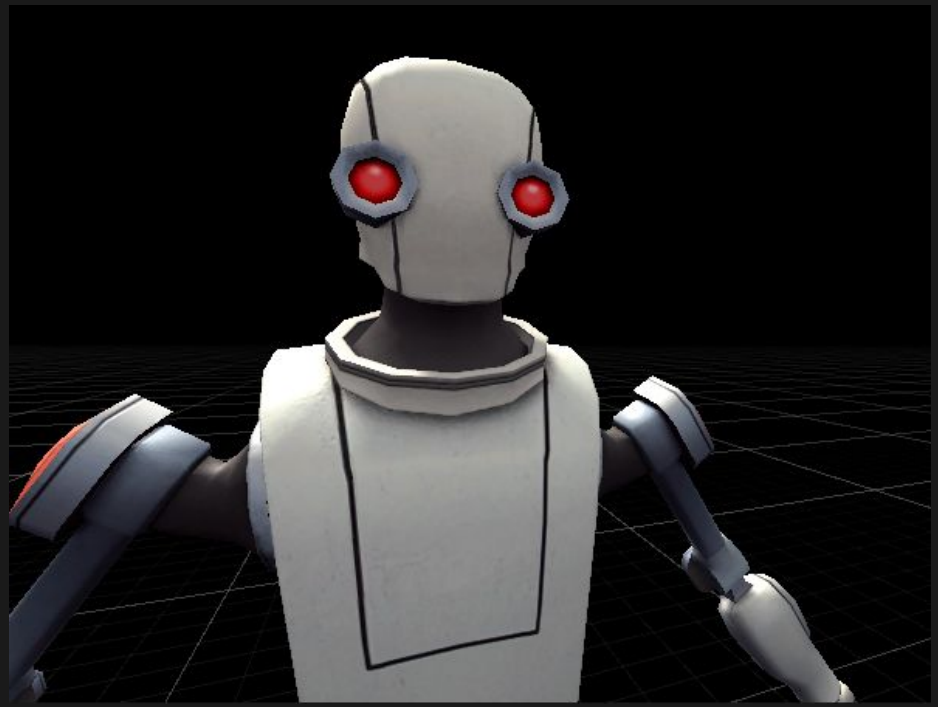
Additional Resources: Model Tab Material Tab





Challenge - Get Kyle

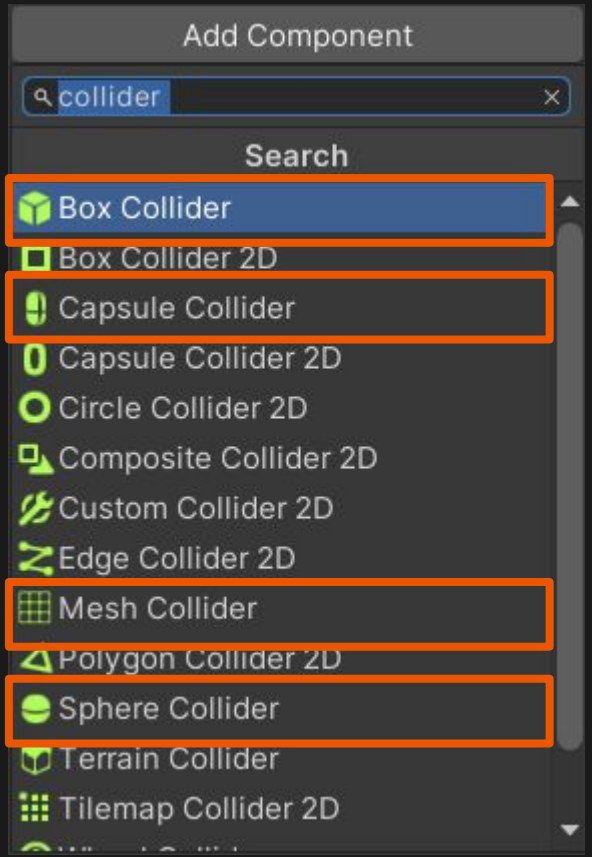
1. Go to Unity Asset Store Page
2. Find Space Robot Kyle Page
3. Add Kyle to your Asset
4. Go to Package Manager and download the Space Robot Kyle asset into your project
5. Bring Kyle into your Scene.



3D Colliders

Go to Add Component and you type in Collider, you will be met with a long list. We are only concerned about four at the moment. Box Collider, Capsule Collider, Sphere Collider and Mesh Collider.

You will notice that there are many 2D Colliders, due to how the objects interact a Game Object cannot have 3D and 2D Components at the same time.

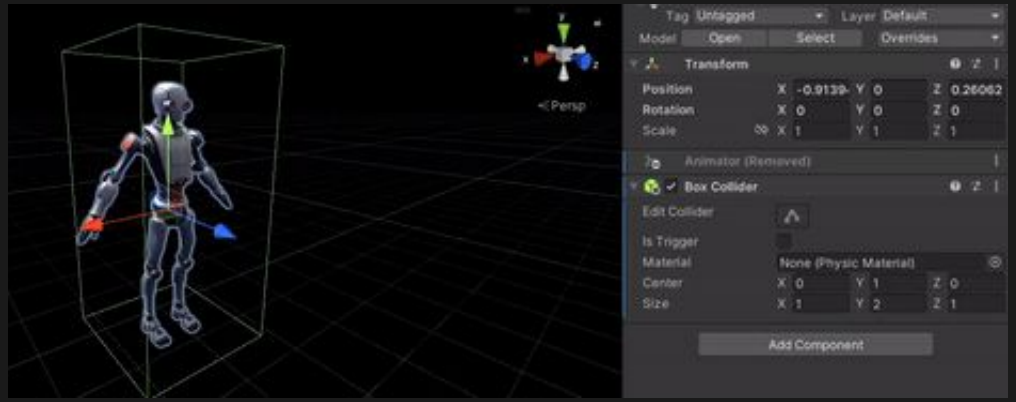


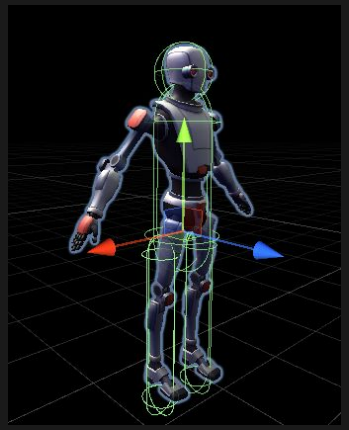
Additional Resources: Introduction to Colliders

3D Colliders

The first three called Primitive Colliders as they make up simple shapes. Unlike the Primitive Colliders Mesh Collider takes the shape of the Mesh given to it making the collision exact, however this is a very costly process as you have to simulate any interaction on the mesh's surface.

To alleviate the high calculations it's better to create a Compound Collider which means you're put several Primitive Colliders to approximate the shape of the Mesh.

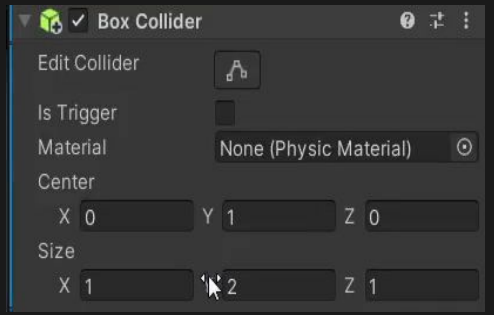


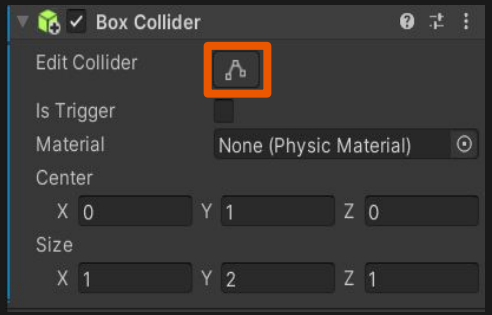


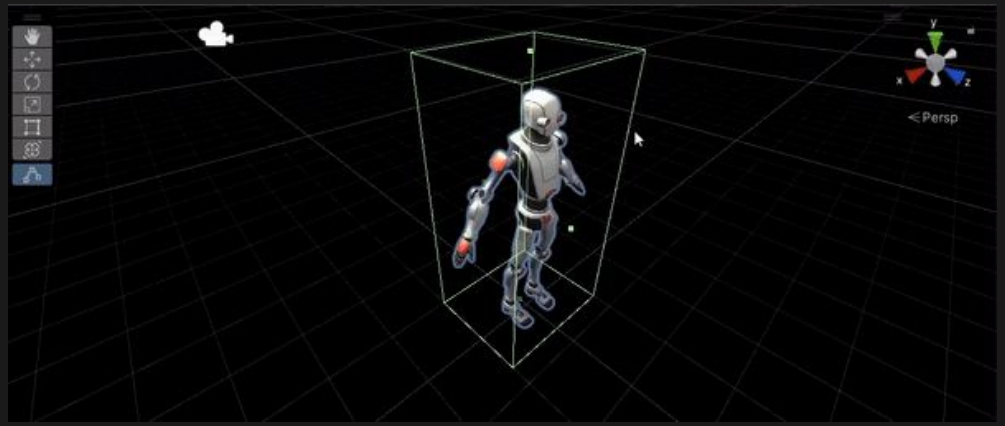
Editing Box Collider

To Edit the box collider you can do it from the inspector, a good way to do that is hold over the direction and drag your mouse.

Alternatively you can click the edit Toggle which will allow you to manually move the collider parts in the Scene View.





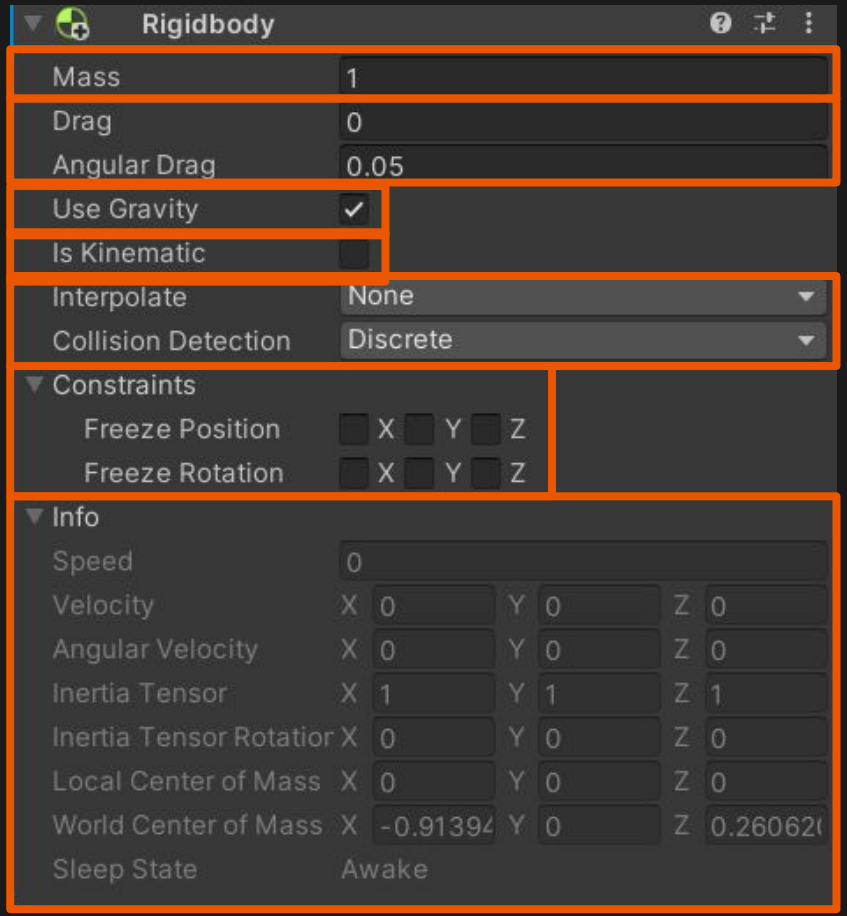


3D Rigidbodies

Up to this point all of the Colliders can be called Static Colliders since even if something collides with them they won't react or move.

Introduction of the Rigidbody will change them into Dynamic Colliders or Kinematic Collider if you select [4]. Doing so will enable the ability to react to Collisions and move with the use of the Physics Engine.

Dynamic Colliders will react to any Physical interaction with it while Kinematic Colliders are there to allow movement but won't be affected by external colliders. Think of it as Player vs a moving platform.



Additional Resources: Rigidbody, Understanding Physics: Static, Kinematic, Dynamic, Unity Official Tutorials

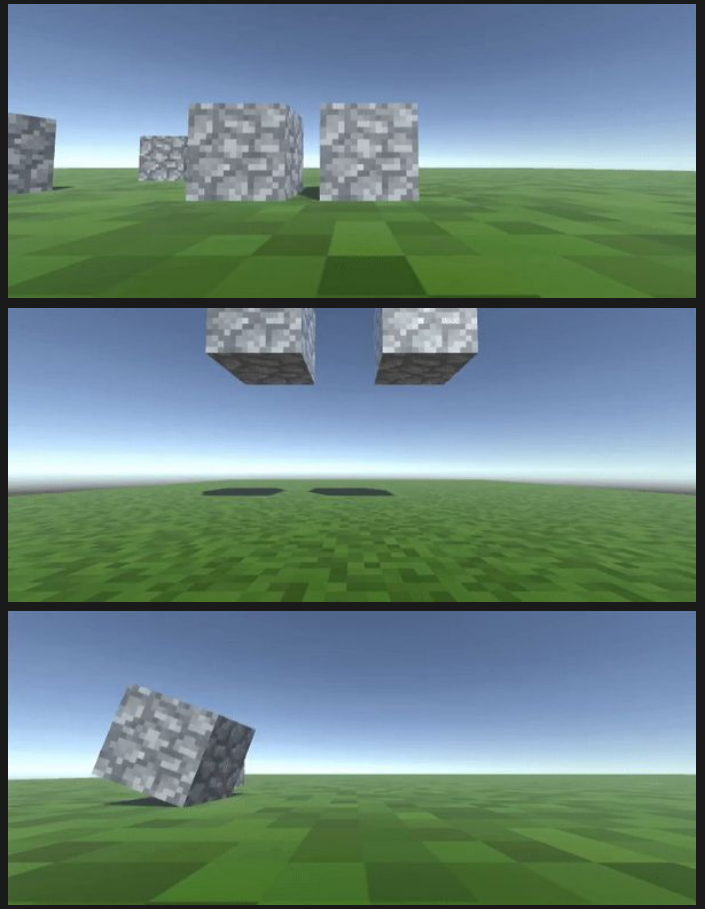
3D Ridgebodies

[1] Mass determine how colliders react with each other, nothing to do with weight or fall of the Game Object.

[2] Drag and Angular Drag determines how much air resistance the object will encounter when it falls. The higher the number the slower the object falls.

[3] Toggles if the object has Gravity force on it. By default it's -1 in Y direction.

[6] Constraints, stop the object from moving or rotating in a particular direction.

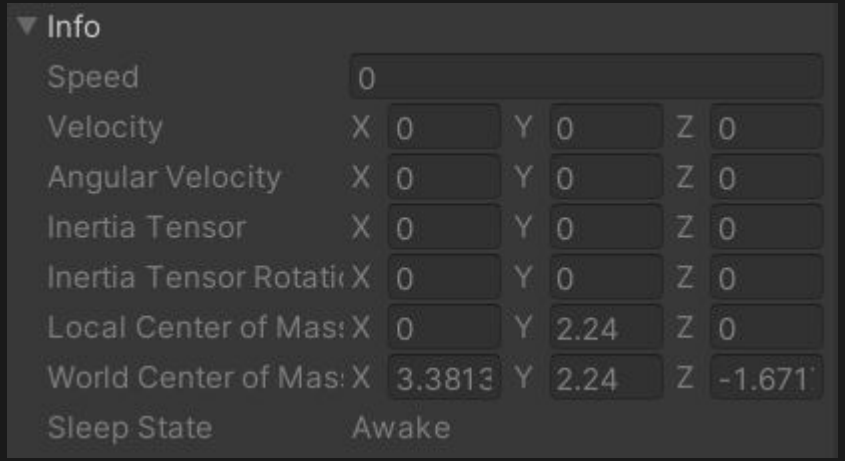


3D Ridgebodies

[5] Interpolation - Is used to transition the Game Object between different states of transform.

[5] Collision Detection - Is used to detect fast moving object and making sure they actually hit and not pass through.

[7] Info - Shows you all of the forces playing on the rigidbody, really useful to testing if something goes wrong.

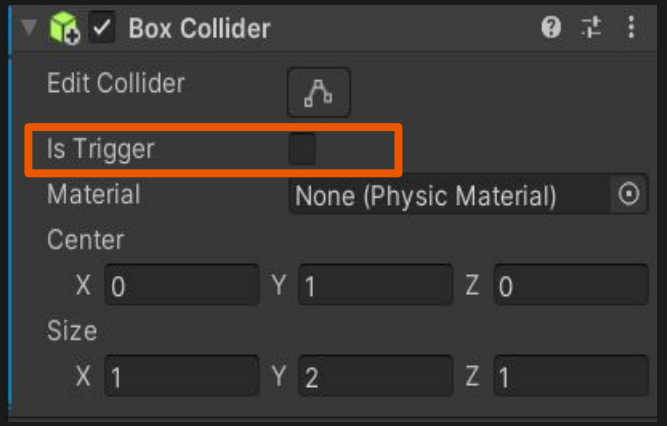


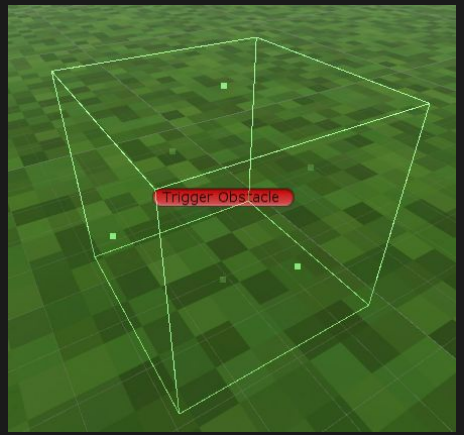
Triggers

Triggers change the Collision areas into Trigger area meaning that if an different Collision Object enters the zone they won't be pushed back but will be able to walk through it and Trigger and event.

Many applications for this. It can be a way to move between levels, turn on a Spawn point for enemies, count if the player went through a hoop or a bounce pad.

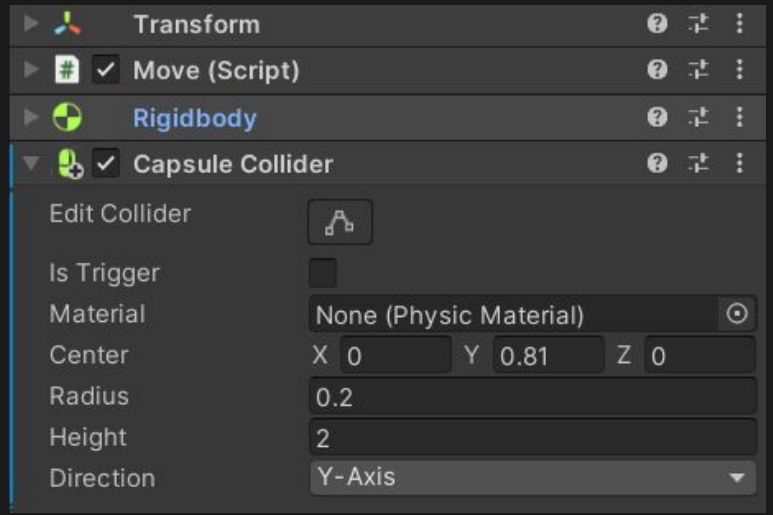
This also shows that you don't need a mesh to have a collider, colliders can be connected to any Game Object.





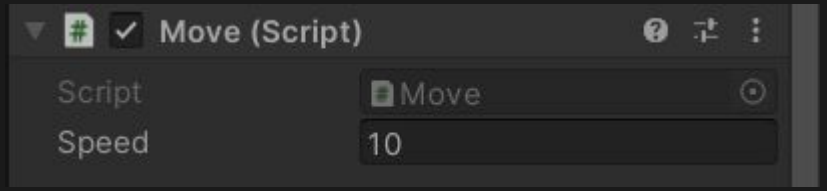
Challenge

1. Bring in Kyle into the Scene
2. Attach the Camera to Kyle in the Hierarchy View
3. Adjust the Camera so it at Kyle's eye level
4. Attach a Rigidbody, Capsule Collider and a Script called Move.

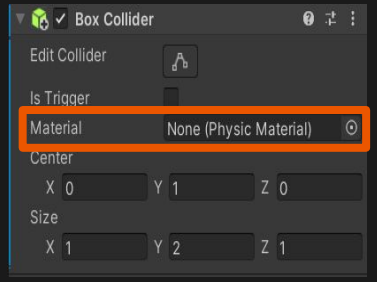


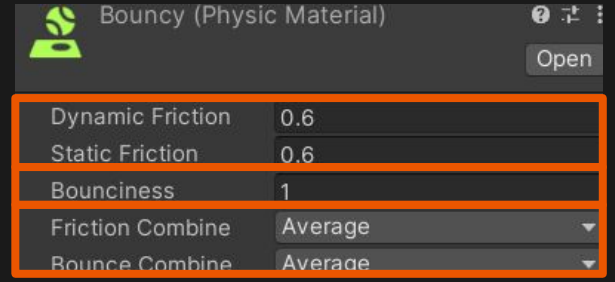
Challenge

1. Robot Kyle has a Script Component called Move attached to him with a variable you can edit called speed. Feel free to adjust it.
2. Once everything is ready click Play and see how he interact with Game Objects in the Scene.



Physics Materials



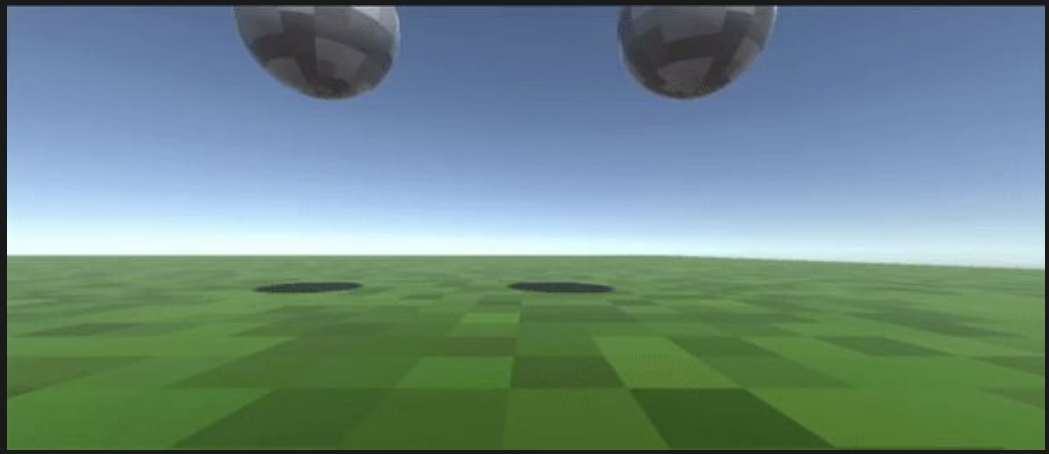


Colliders can have Physics Materials connected to them, a Physics Material allows you to modify the

[1] Dynamic and Static Frictions, dynamic controls the friction while moving and Static controlling how hard it's to get a static object moving.

[2] Bounciness which is how much object will bounce when colliding with a surface

[3] How the combination between the two Game Object Colliding should make the math work.



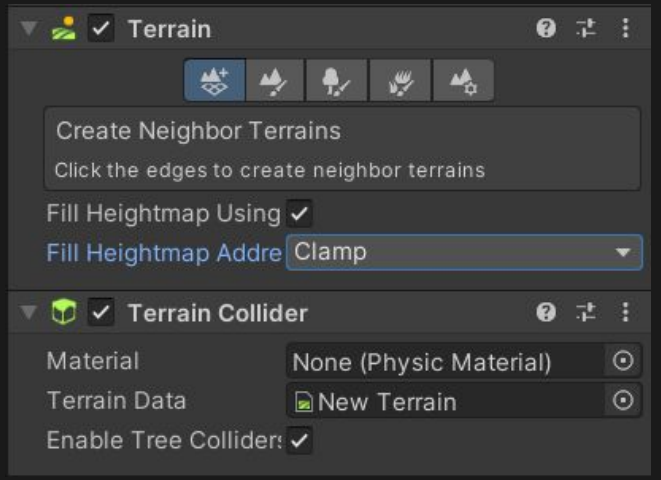
Additional Resources: Physics Material, Unity Official Tutorials

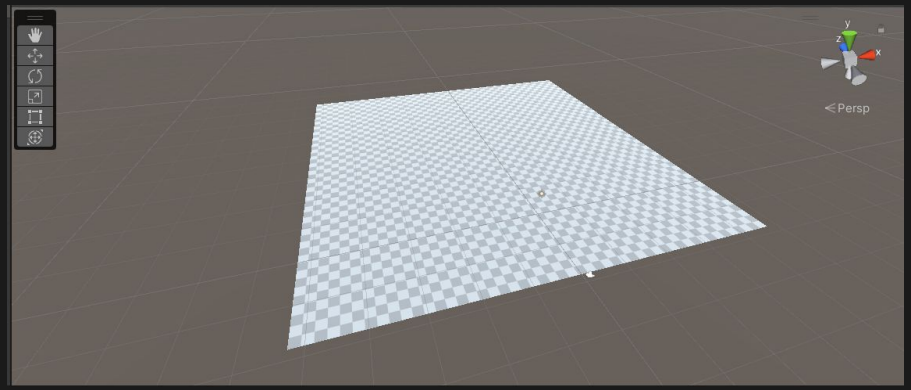
Sebastian Grygorczuk - STEM Institute at CCNY

Terrain

Terrain Game Object allows us to

create realistic 3D worlds.





Additional Resources: Unity using Terrain Tools

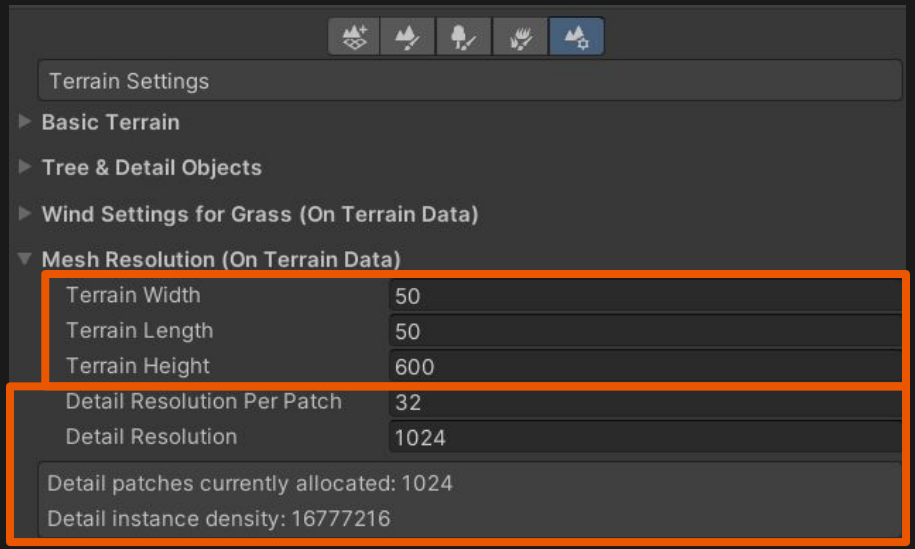
Sebastian Grygorczuk - STEM Institute at CCNY

Mesh Resolution Settings

We'll quickly jump to the fifth Tab that holds the settings and talk about the Mesh Resolution.

[1] The dimension settings set the size of the terrain is using Width, Length and Height to define. For this example we'll be using 50 x 50 x 600

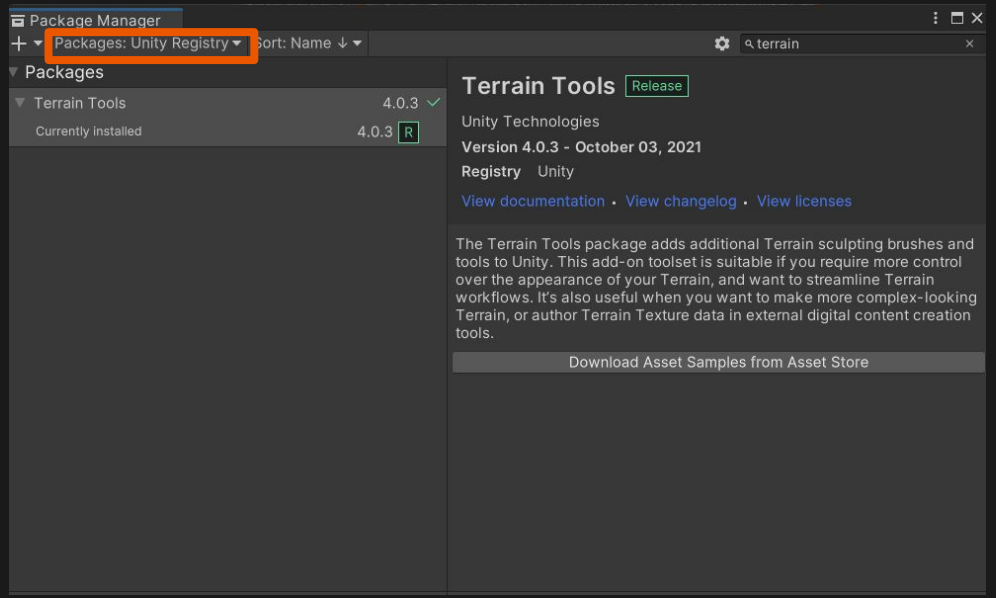
[2] The resolution settings set how much detail can each tile store. We'll come back to this.



Terrain Tools Package

The terrain tools that come preinstalled with Unity are a great resource, however there is a package called Terrain Tools that will make our jobs even better when design terrain.

1. Go to Package Manager from the Window Tab.
2. Set your Packages to Unity Registry and search for Terrain
3. Download Terrain Tools

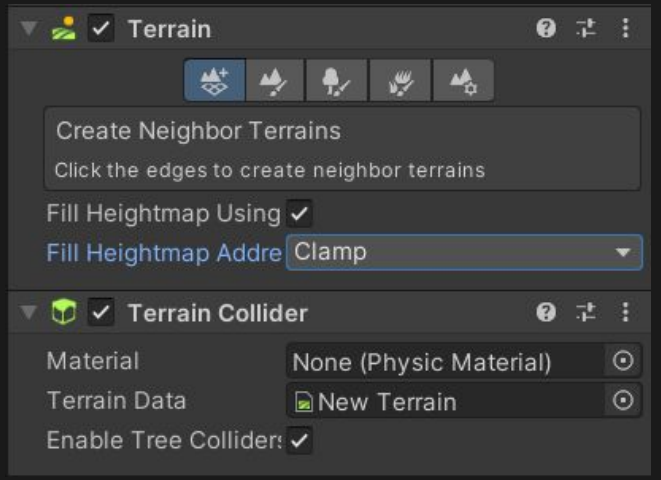


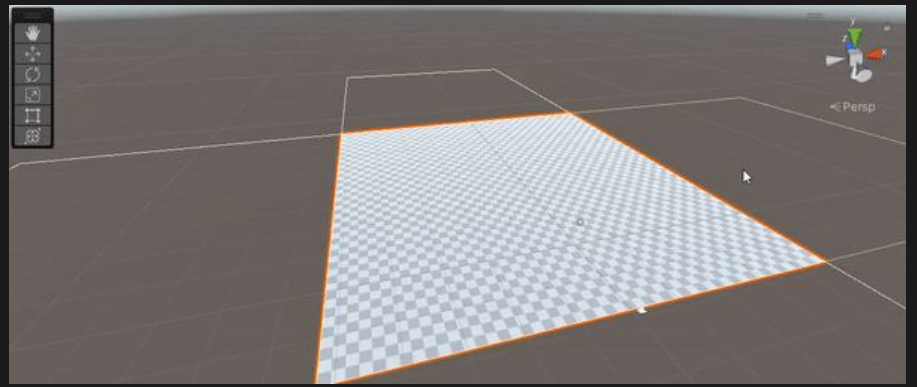
Terrain Neighbor

The first tab allows you to create neighbors for the terrain you are currently working on.

Keep in mind that every new terrain counts as a separate game object and it will create its own Terrain Data in Project View upon creation.

This is one way you can develop a level. If it's too complicated, take a portion and load it into a new scene.





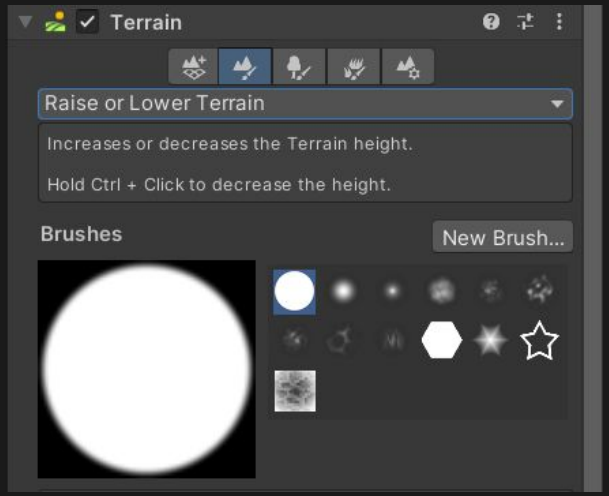
Sebastian Grygorczuk - STEM Institute at CCNY

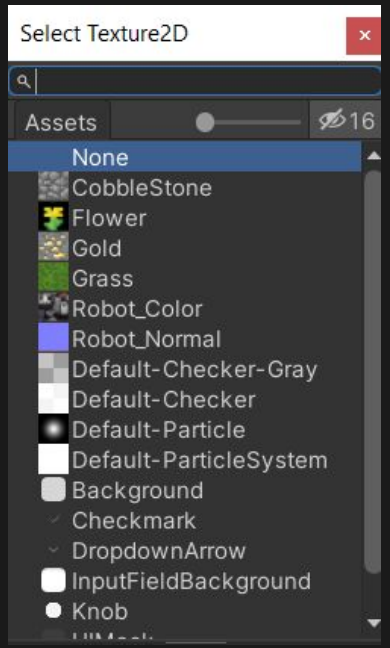
Brushes

Brushes are the way we can manually change the terrain you're working on.

The shape of the brush will be how you change the terrain. If the brush is a circle you'll make circles while if you have a star you will make stars.

You can create your own Brush by clicking New Brush… and selecting a texture you have in your project.



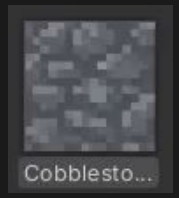


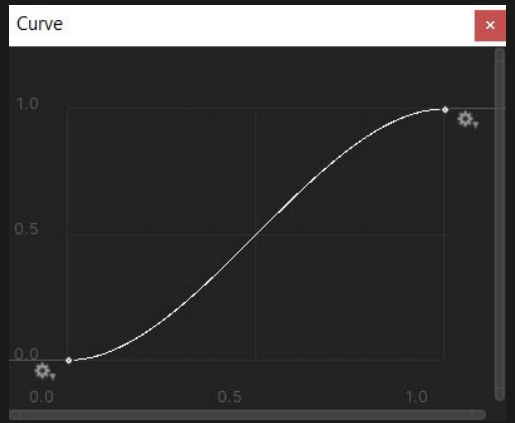
Brush Asset

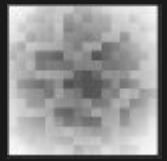
The Brush Asset is created when creating a new brush, it can allow you to further manulute the brush so you get what you want from the image.

The Fall Off Curve and Radius allow you to control how much of the image is used, creating circle cut out as everything else fades off.

Brushes work like heightmaps so the darker the are the lower the point and the brighter the higher so if you want to create something that will pop out of the terrain you can invert the brush.







Brushes Controls

Controls Brush Strength and how tall the rise or lowering will be. This is adjustable.

Brush size controls how much of an area the brush will be used over.

Brush Rotation will control the rotation of the brush.

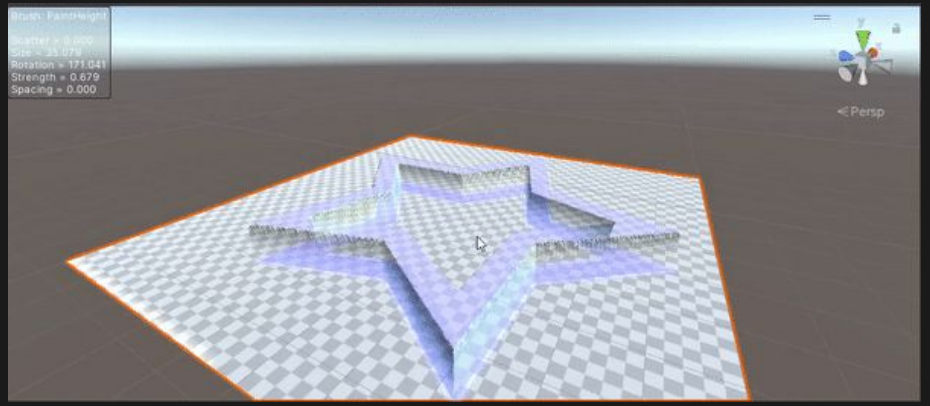
The first two allows you to set the Min and Max for the slider, each actions will have their own settings.

All of these also have Jitter, which is the randomization that will alter the strength, size, or rotation as you are brushing. This allows the brush to feel a bit more natural as real worlds aren't perfect like our tools allow for.

Brushes Controls and Shortcuts

Left Click of the Mouse button will perform the action you are trying to do, raise the terrain or paint texture or hole.

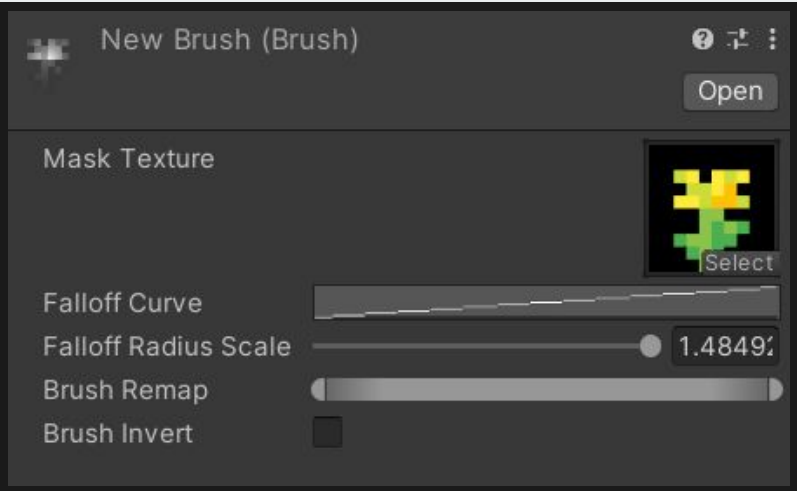
Holding Ctrl while doing that will do the inverse if there is such an options, such as lowering or bring back the texture from hole.

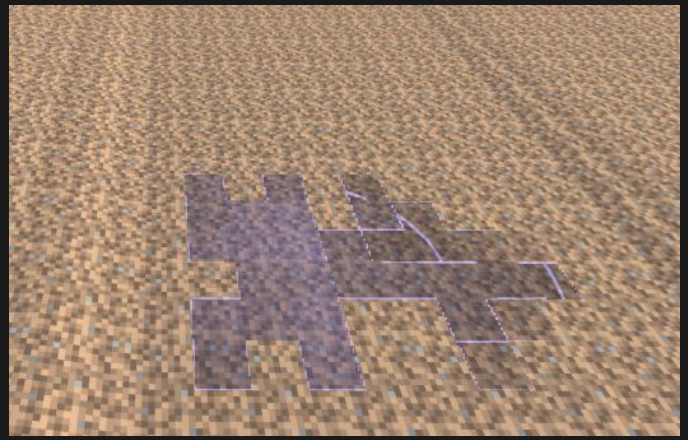


Brush Strength Adjustment	A + Mouse Movement
Brush Size Adjustment	S + Mouse Movement
Brush Rotation Adjustment	D + Mouse Movement

Challenge - Make Brush

1. Click the new Brush Button
2. Select a desired Texture
3. Use the Brush to paint on the Terrain
4. Go to the Brush Asset and modify the values as you fit
5. Use the Modified Brush on Terrain and see the difference

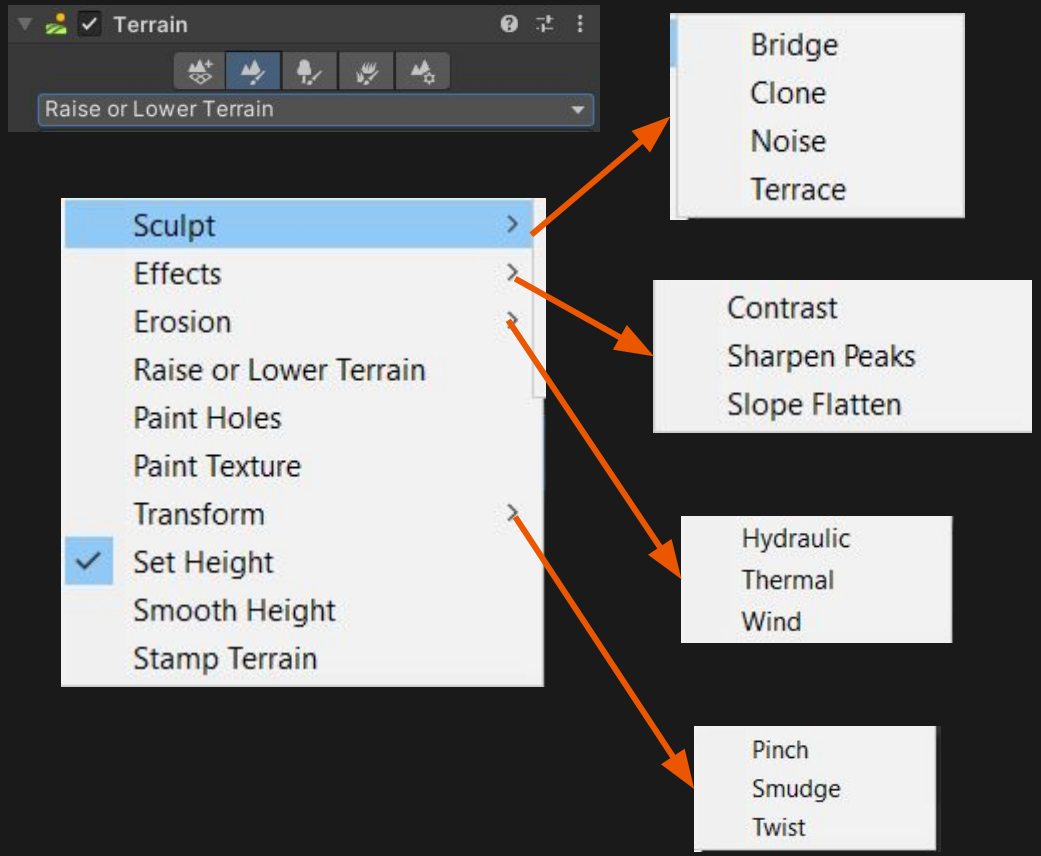




Terrain Editing Tools

The second tab on the Terrain Component allows you to manually edit the Terrain. There are six different ways to edit the terrain without the Terrain Tools Package, those are Raise/Lower, Paint Holes, Smooth Height, Set Height, Stamp and Paint Texture.

The Tool Package adds Sculpt, Effects, Erosion and Transform all of which come with sub tools.

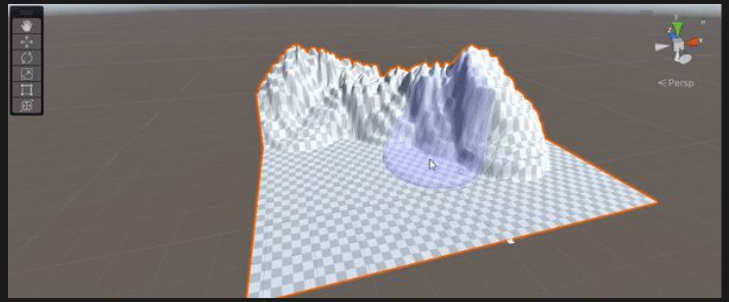


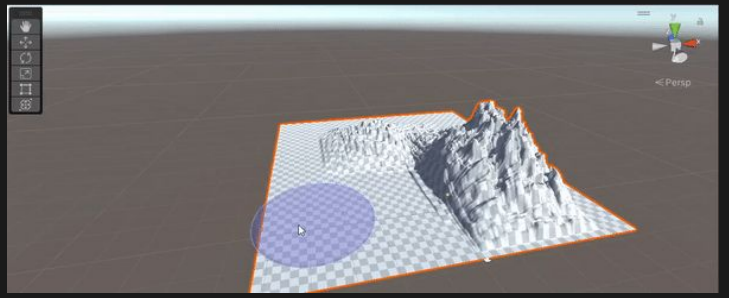
Sculpting Tools

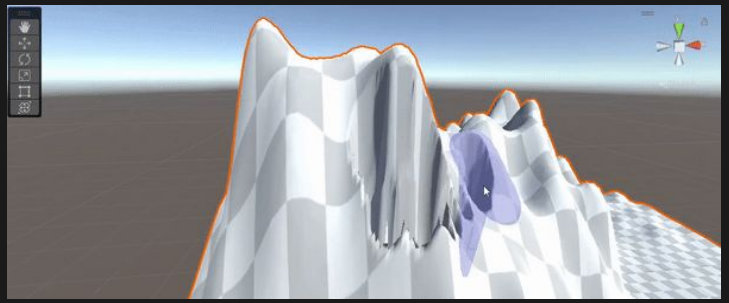
Raise or Lower, allows you to raise and lower the.

Paint Holes, allows you to create missing areas in the terrain, this can be used for creating caves or just hiding away unnecessary detail.

Smooth Height, will smoothing out the nearby terrain to be roughly the same height.







Additional Resources: Digging into Terrain Paint Holes

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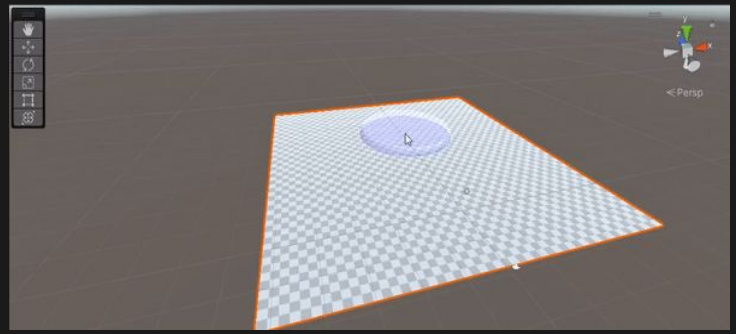
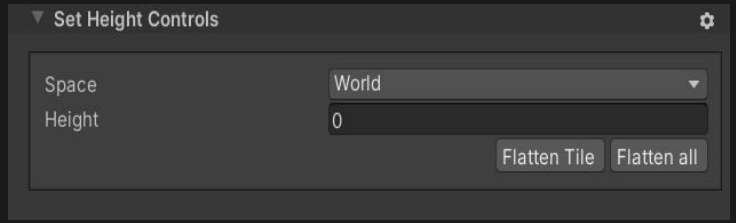
Set Height

Set Height, will rise the height of the terrain to the selected Height and no higher, also allows you to flatten the terrain in respect to Space. World referring to scene, so if terrain is at Y of 3 and the height is set to 10, it will make all of the terrain height of 7. While Local would make the height of the terrain 10 no matter the position of the terrain.

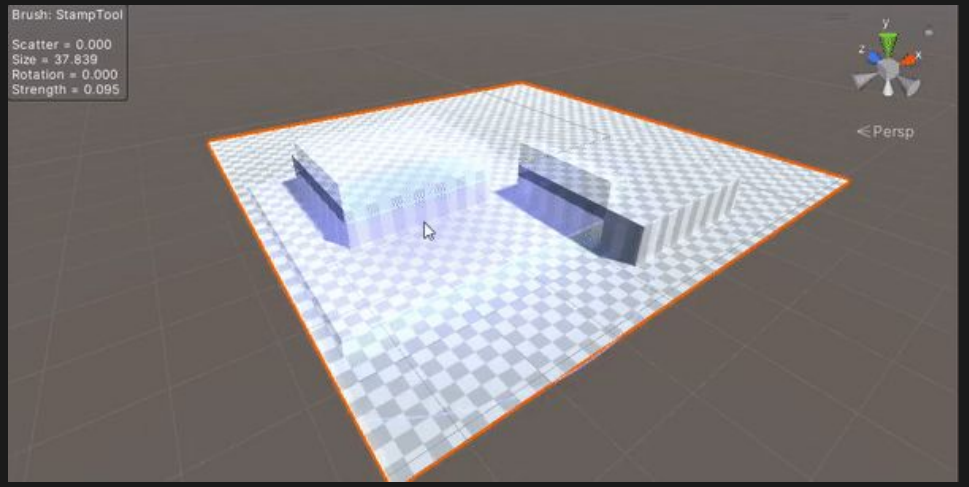
There's no change to this tool.

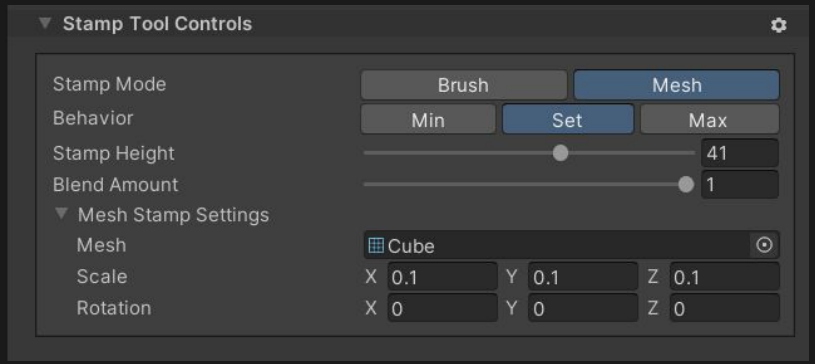




Stamp Tool

The Terrain Tool Stamp allow you to use either a Brush or a Mesh to stamp your terrain. The scale work in conjunction to the brush controls.





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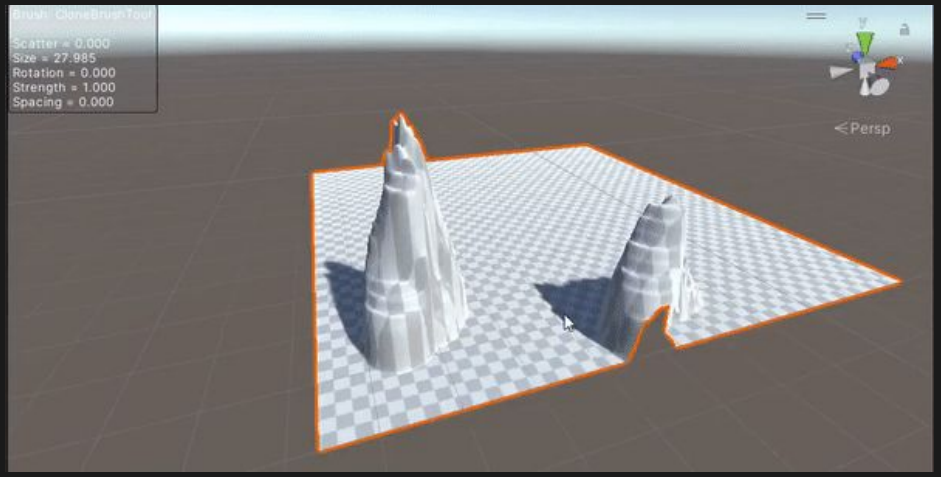
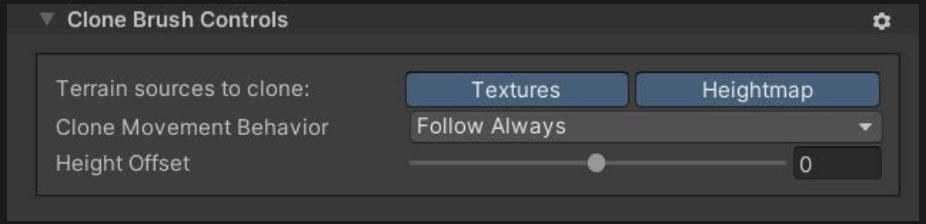
Sculpt Tool - Clone

Clone Tool allows you to select area of terrain copy it creating a marker of which area you are copying and paste it somewhere else.

You have the options of copying the texture, heightmap or both.



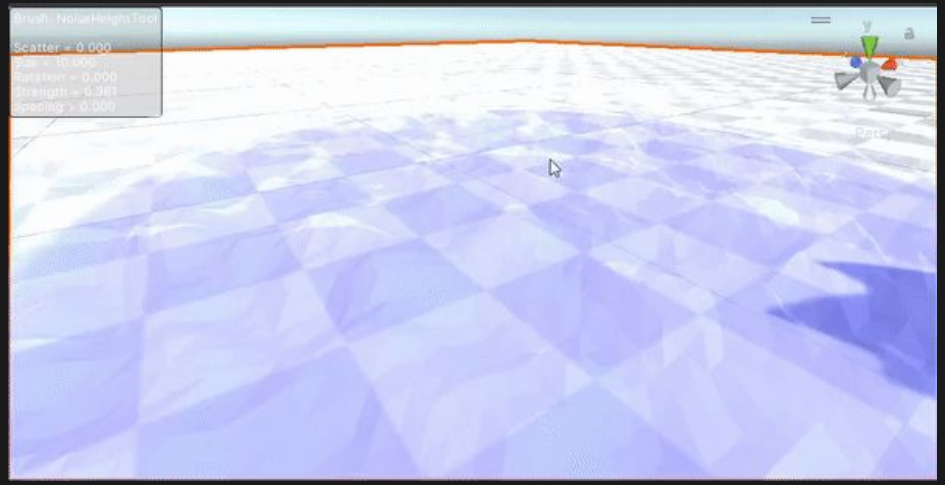


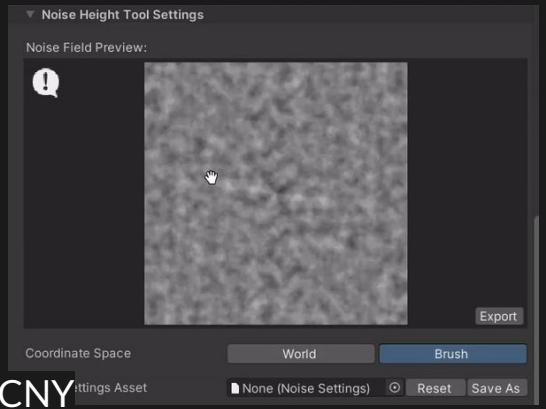
Sculpt Tool - Noise

Noise allows us to make the environment a bit more realistic, things don't look perfectly flat and noise allows us to randomly disturb that.

We do this using the Noise Height Tool, which is created using the Domain Settings, we won't go into them but play around and see how they generate different maps.

You can also change the way we are looking at the map using the Transform Settings.

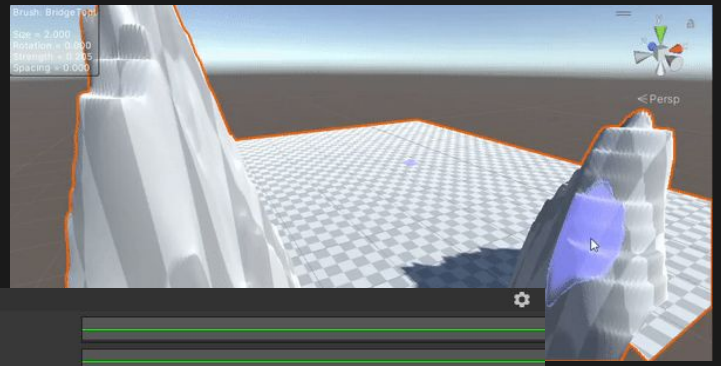


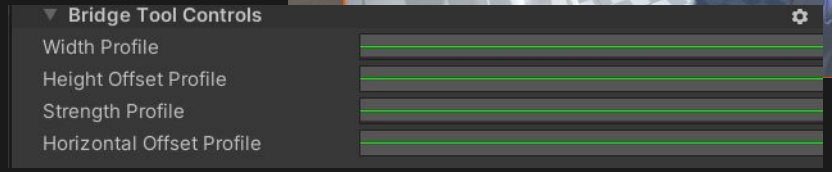


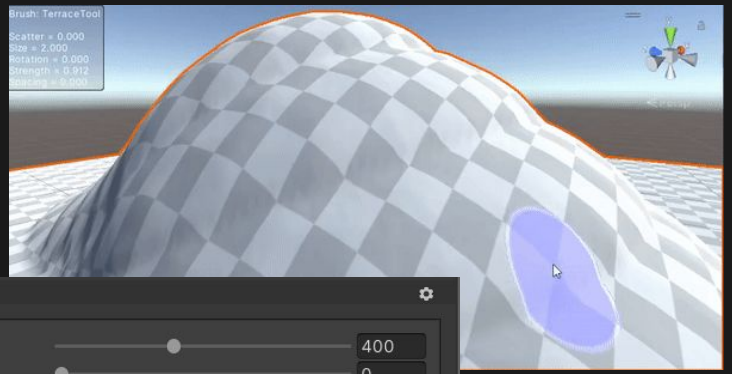
Sculpt Tool - Bridge & Terrace

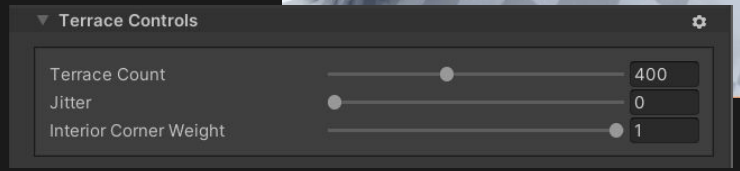
The Bridge Tool allows you to create bridges, you first have to select a start point by clicking Ctrl + Left Mouse Button this will leave a mark from your start point, then click on another point you'd like to set the bridge to end. Now you have a bridge.

The Terrace Tool allows you to create terraces, cliff edges with a flat surface on top.









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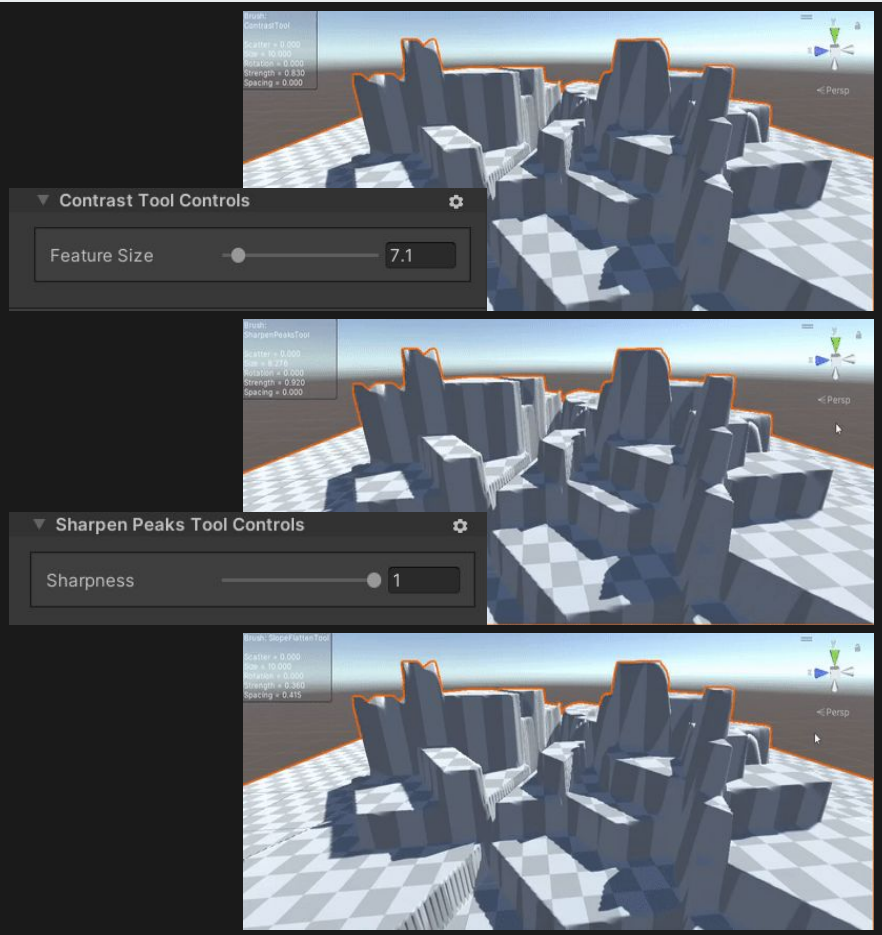
Effect Tool

The Effect Tools allow you to put in more detail on the edges of the terrain.

Contrast - makes the contrast between the top and bottom more exact updated

Sharpen Peaks - sharpens the tips of the terrain into points

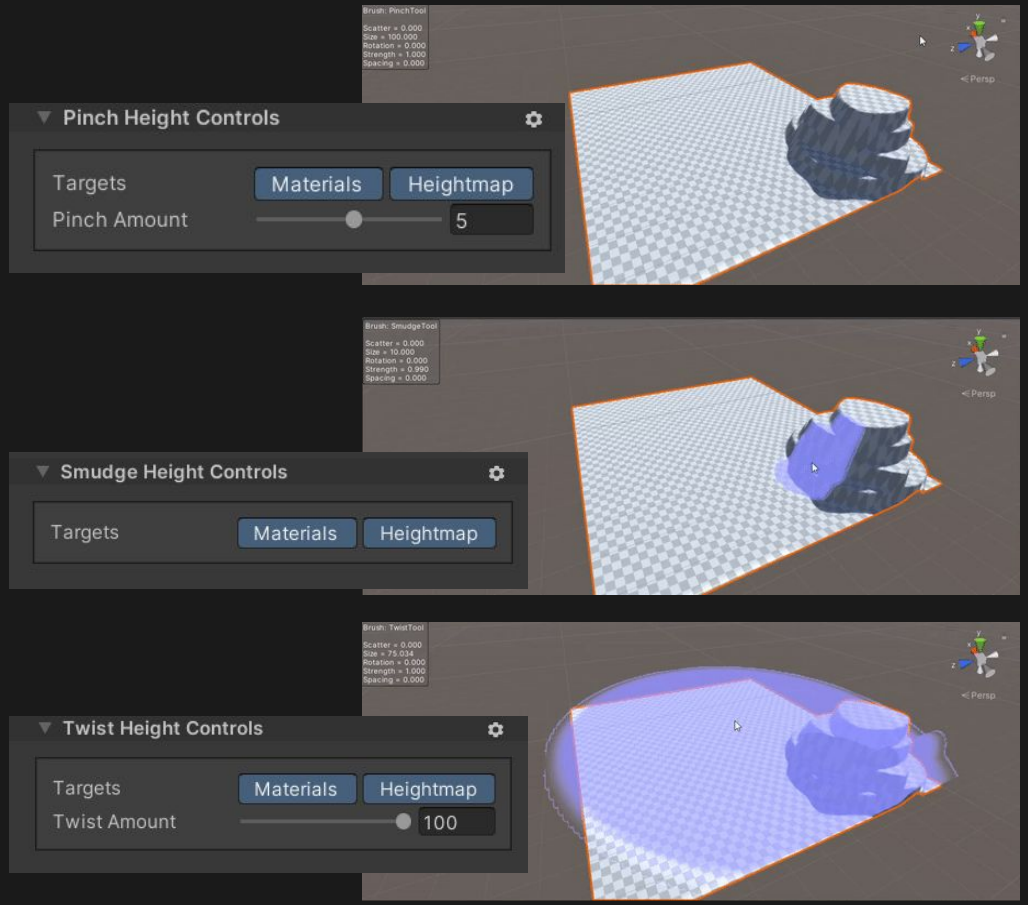
Slope Flatten - smooths out the slope between the bottom and top for a more natural slope.



Transform Tool

The transform tools can be useful from moving certain terrain but are really a great way to edit textures on the terrain.

- Pinch brings everything closer to the center of the terrain.
- Smudge, smears textures and heights to creates a good blend.
- Twist lets you rotates and squeeze the terrain.

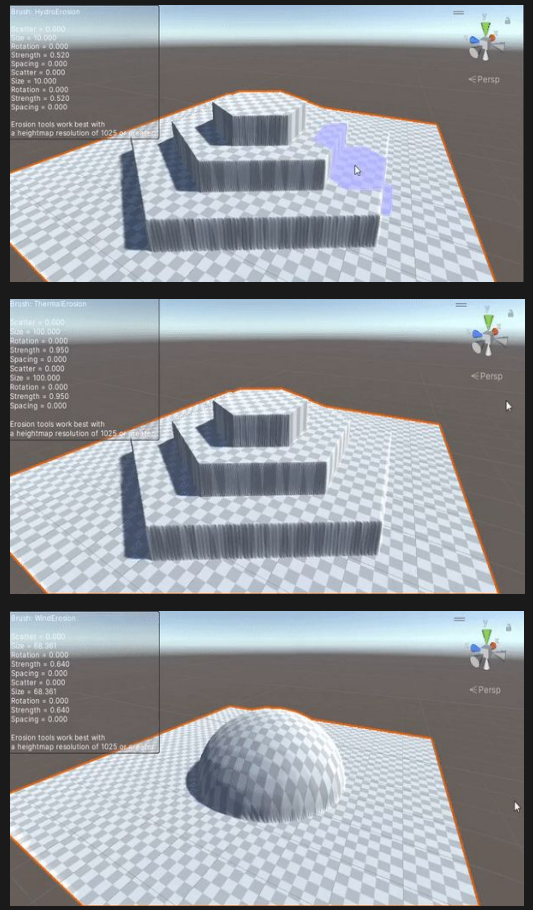


Erosion Tool

We won't get too deep into these tools as they are way to advanced simulating the change in terrain by

- Hydraulic , how water displaces the land
- Thermal in which heat distorts the land
- Wind how it moves the land

All of these are amazing simualtion and do play around with them if you are interested in terrain creation.



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Challenge - Make Terrain

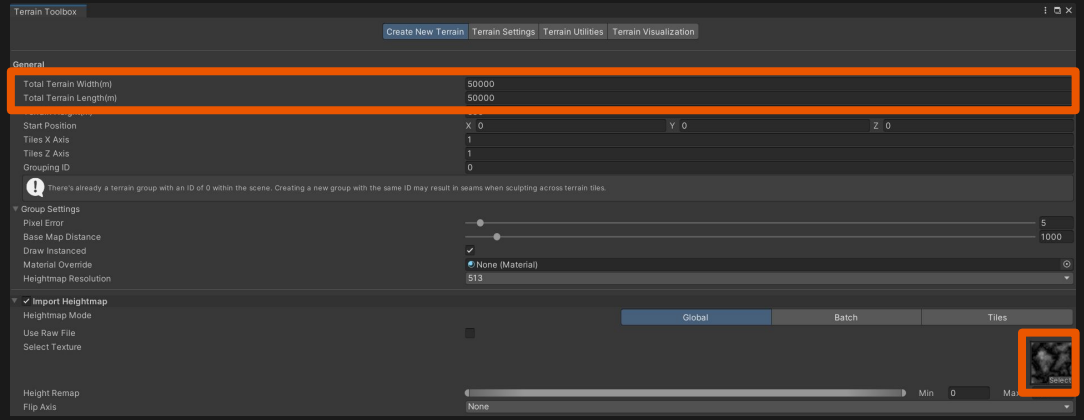
1. Try out the different terrain tools and create a world. Build a
2. Once you're done take a screenshot and post it on Padlet.

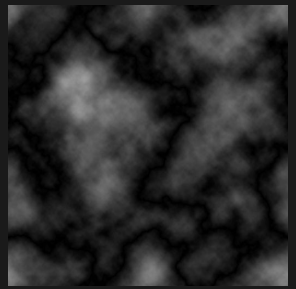
Heightmap Image Import

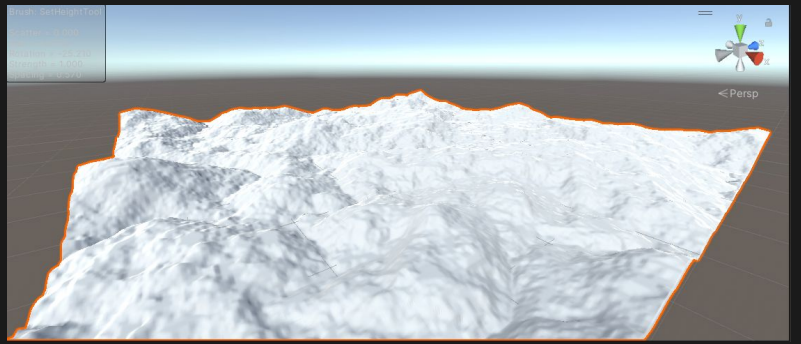
Since the terrain is based on a heightmap we can import one to create a terrain.

By going to Windows -> Terrain -> Terrain Tool Box we will be able to plug in a heightmap image.

Make sure the Dimensions are very large otherwise the terrain won't look like anything.







Additional Resources: [Create Terrain from a Heightmap]

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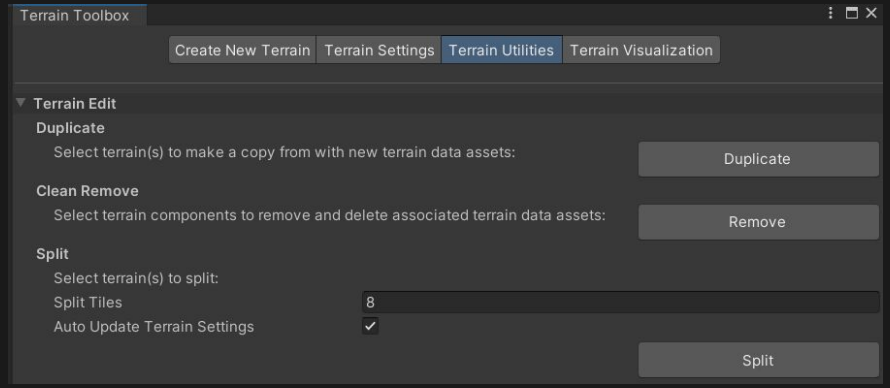
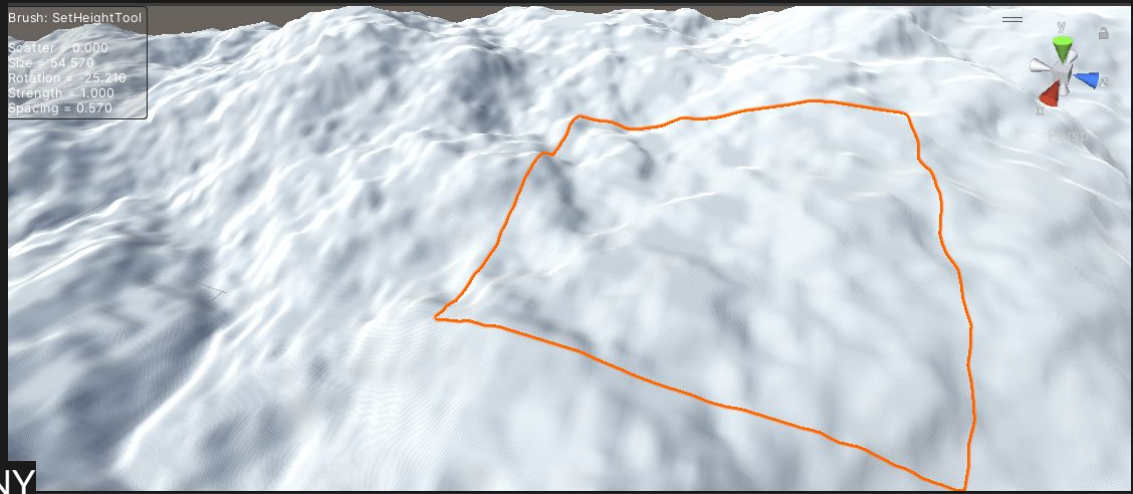
Heightmap Image Import

The large amount may not be possible to work on and may be too much to handle for the game so you can go in the Terrain Utilities, go to Terrain Edit and split it into tiles.





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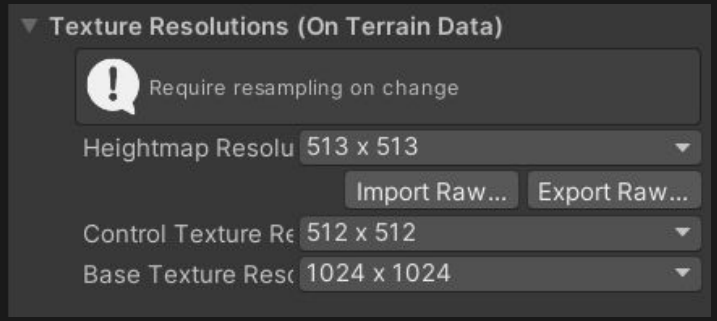
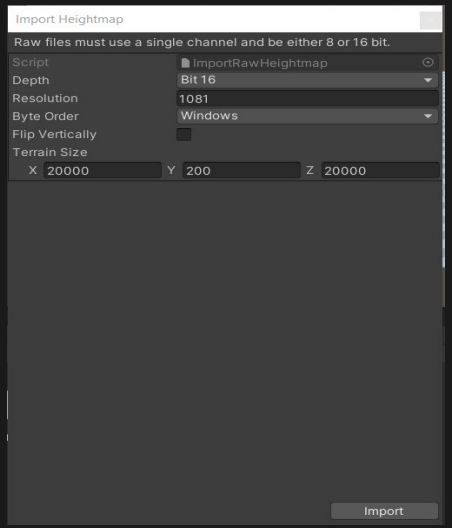
Heightmap Raw Import Export

Additionally by going to the Settings tab and looking at the Texture Resolutions section you can Import and Export the heightmaps as .raw file. These files are a bit harder to come by but can contain great amounts of data for a terrain.

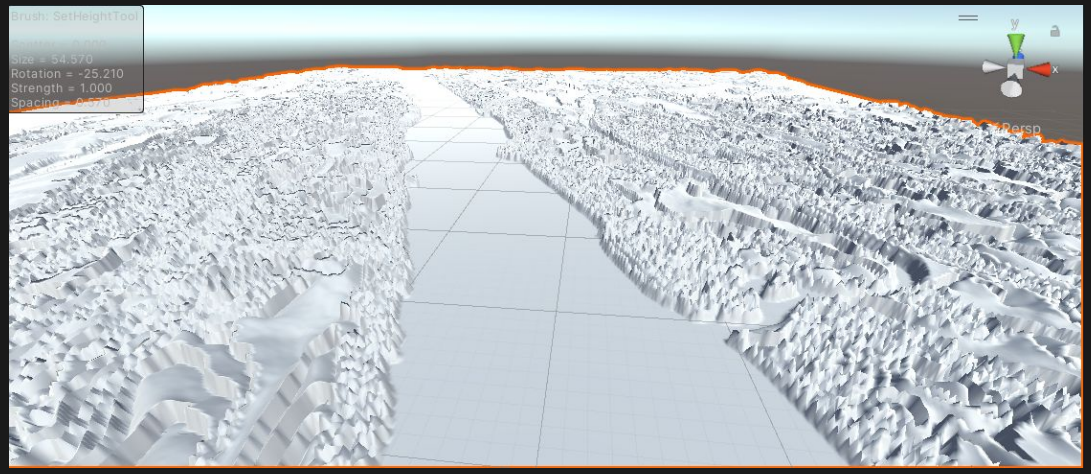


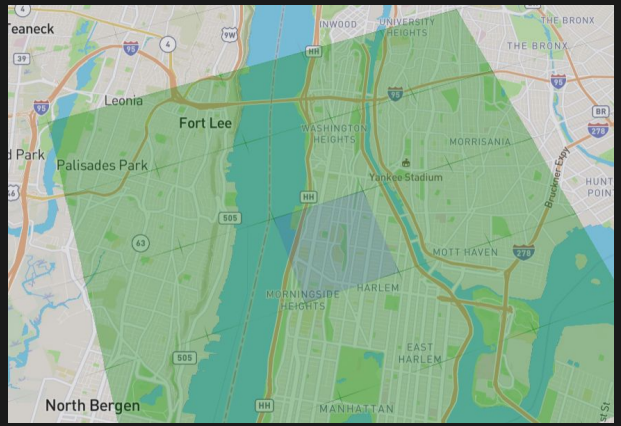


Heightmap Import Export

City Skylines has a height map generator based on world maps.

Here is an example of a Raw File of the New York Area.





Additional Resources: **City Skylines Heightmap Generator**

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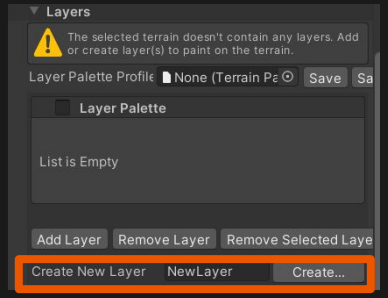
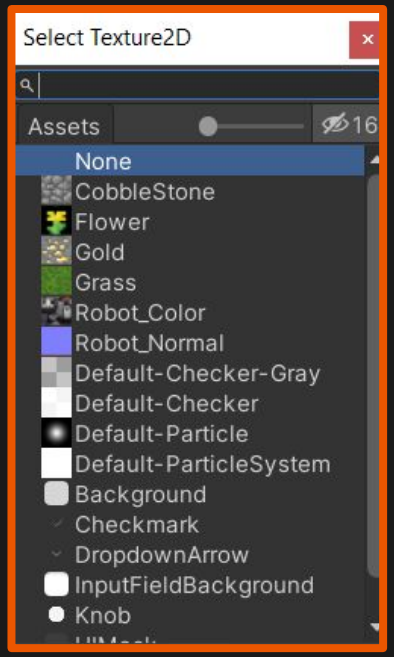
Texture Layer

Last Sculpting Tool will allow us to Paint texture onto the terrain.

You will start with an empty Layer Pallet. Set the name of the Layer and click Create similar to Brush you will get the Texture PopUp and this will be added to the Layer Pallet.

Whenever you create a Layer it creates a Layer Asset in the Project View folder you are currently in

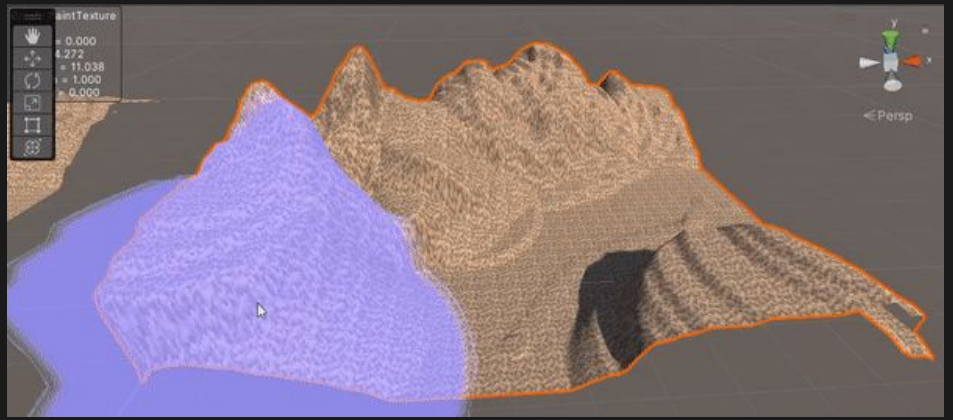




Painting

When you create the first Layer you create will become the base of the Terrain.

Then using the different Layers and brushes you can paint the terrain.



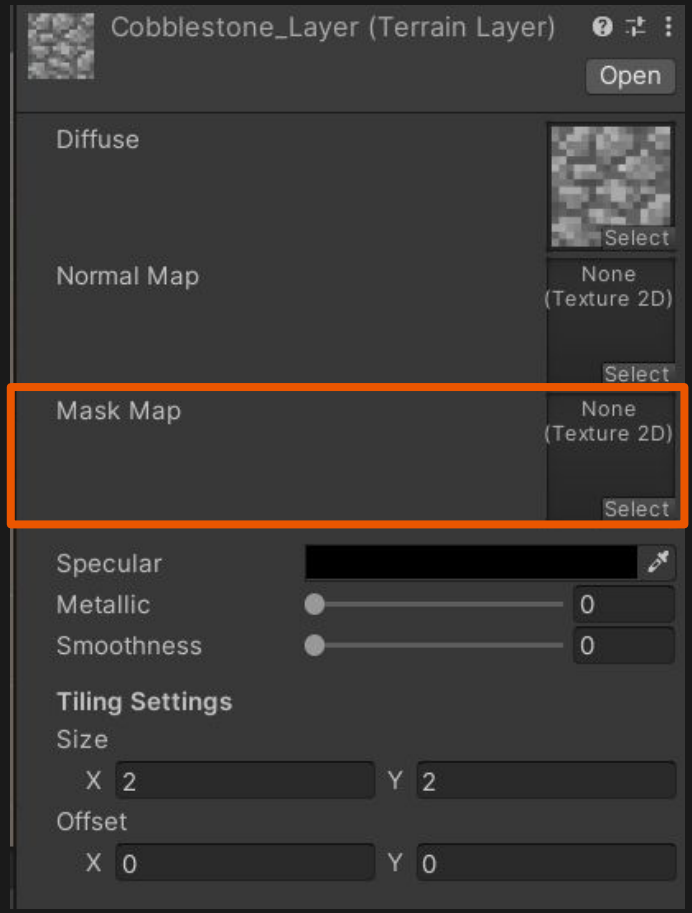
Terrain Layer

All of the Terrain Textures have their own asset that can be further tweaked so that you get the best result you want.

It should look very familiar to the Material Inspector View with Diffuse taking palace of Albedo, Normal Map acting the same as it did there but having the Mask Map which acts as controls Metallic, Occlusion, Height Map and Smoothness.

If you don't use a Mask Map you can tweak those setting with given sliders.

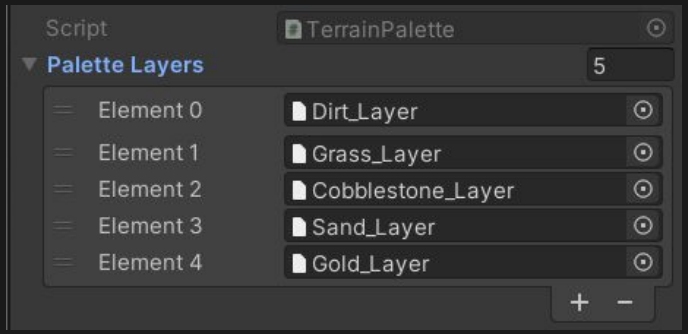
Lastly a similar section is the Tiling, saying how many times you'd like to repeat the texture.



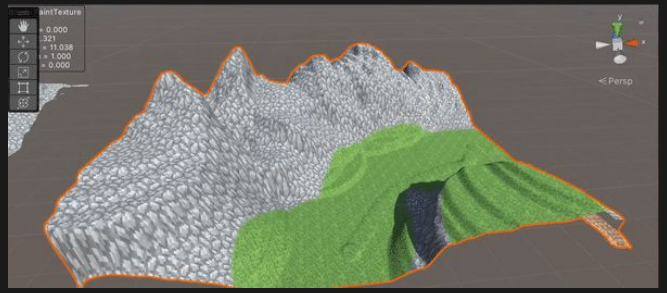
Palette

Once you got all of your layers set you can now Save the palette and create a palette asset.

Now you can move the Palette between Terrain which isn't possible without this package.

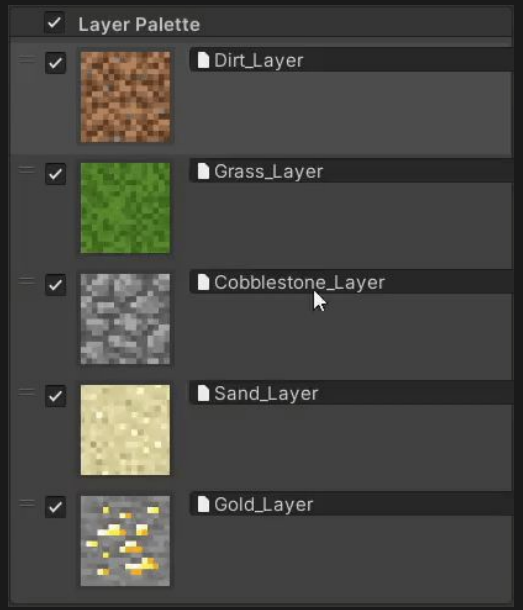


Splat Map and Pallet Order



Once you start using Layers to paint the terrain the Terrain Data Asset will create a Splat Map, which tells the terrain which layer is drawn where on it.

It directly connect to the order of the Layers in the palette, so if you already started painting rearrange the pallet will change the way your terrain loosk.



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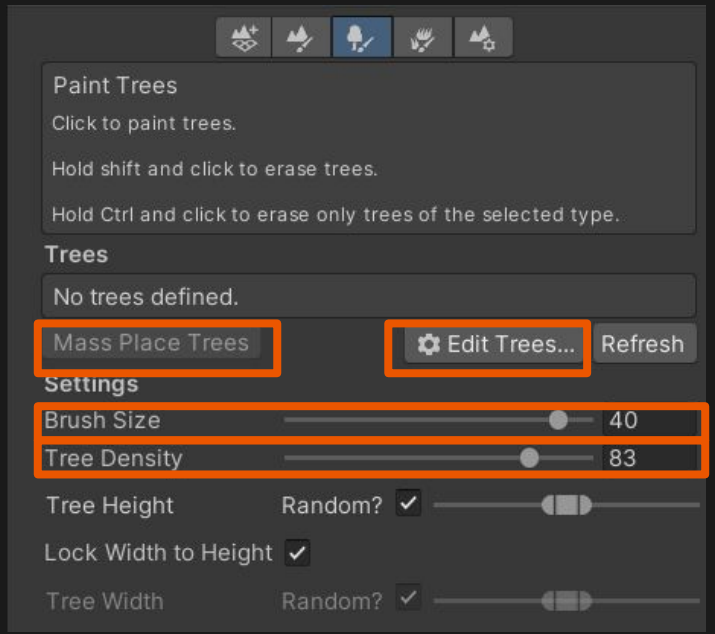
Challenge - Paint

1. Put together your own palette using the provided textures or download your own from the web.
2. Using the Palette paint the Terrain you previously created and once you're done post the new screenshot on Padlet.

Trees

Trees tab allows you to paint on trees which are any Prefabs with models attached to them.

It works very similar to the texture paint tool with the size of brush and strength behind the Tree Density with how many trees per in that area you'd want to fit.



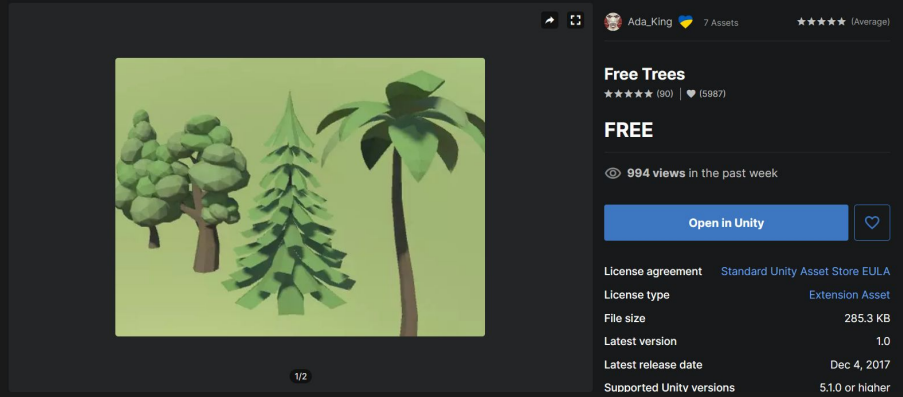
Tree Asset

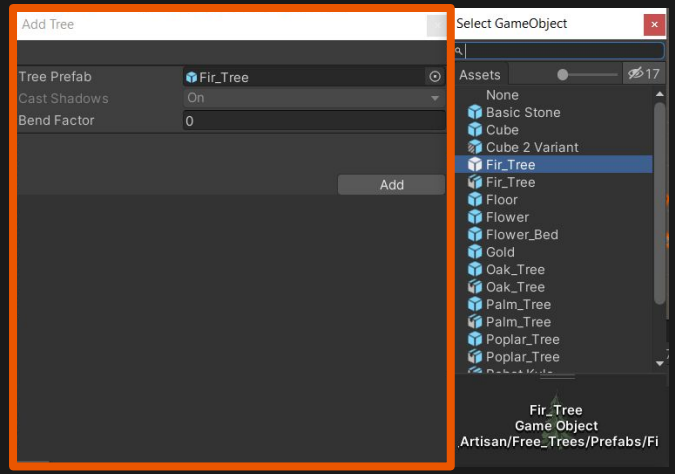
For this example we will use the Free Trees by Ada_King.

Import the Trees just like we did with Kyle.

Once you the trees imported you can click on the [1] Edit Trees... button which will bring up the Add Tree Menu from which you'll add all of the new trees.

You are adding PreFabs, whatever attributes the prefabs holds will be relayed to the tree spawned on the terrain.





Additional Resources: **Free Trees**

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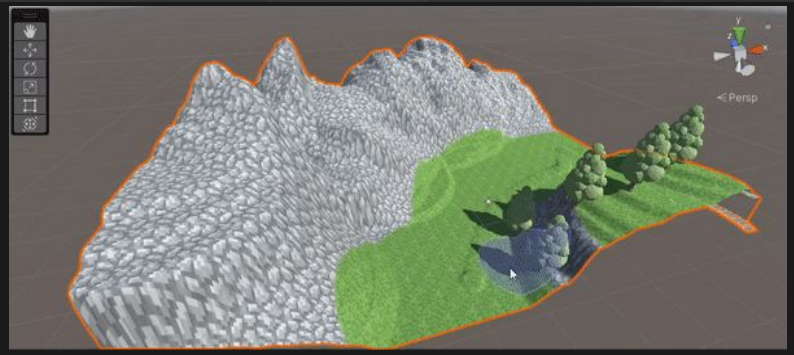
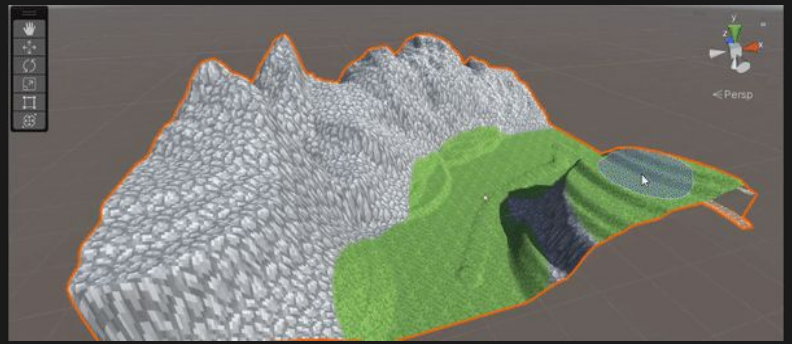
Paint Tree

Once you have your trees picked out grab one and begin to paint like you would the texture.

This isn't necessarily tied to only trees as you can attach any 3D Model and start using it with the Tree Paint Tool.





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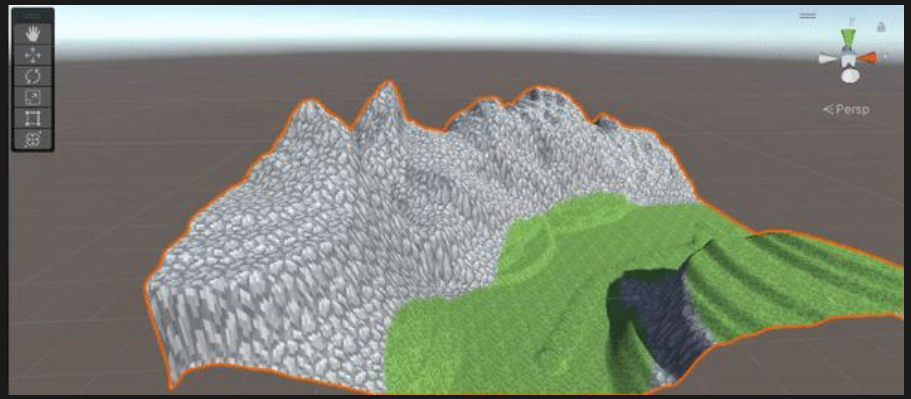
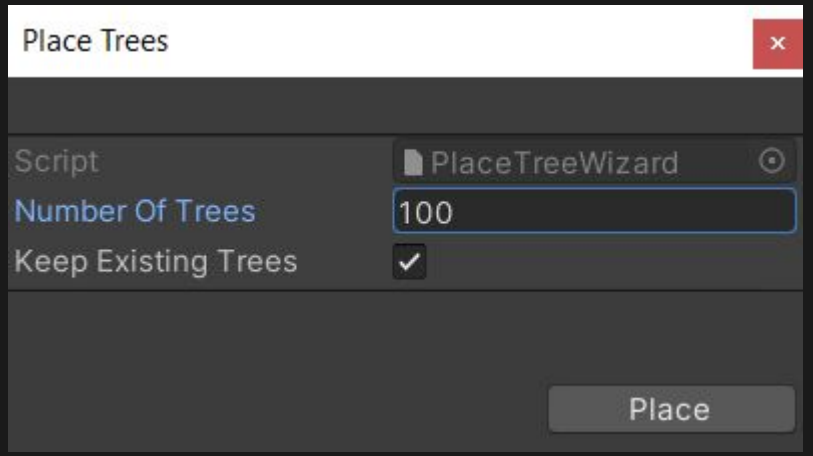
Tree Auto Generate

One way to create nice looking environment is by using auto generation. By clicking [2] Mass Place Trees you will get a pop up of how many trees you want to use.

The Script in place is PlaceTreeWizard and it looks for the flattest terrains and uses all of the trees you've imported.

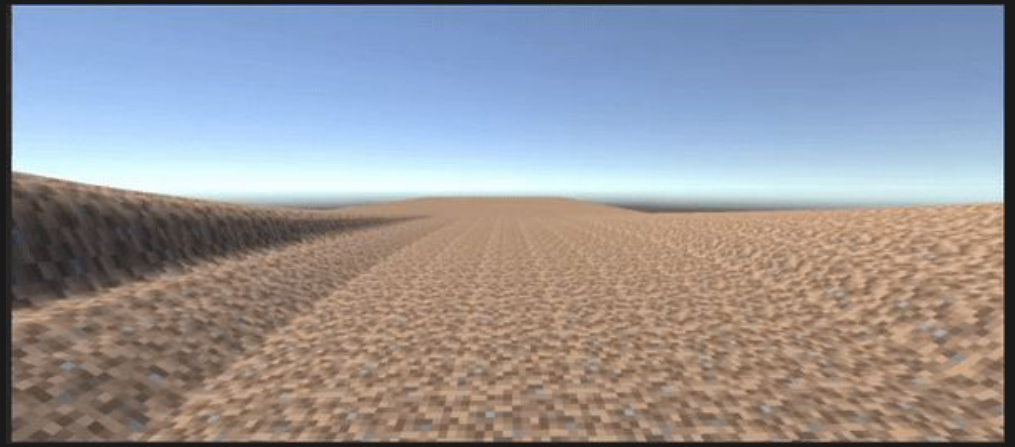


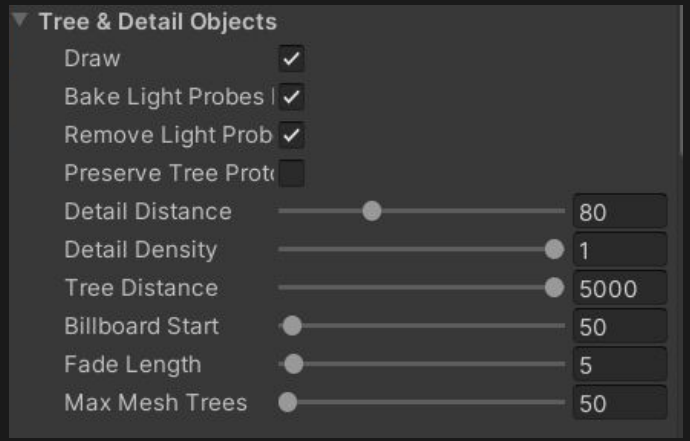


Draw Distance & Billboarding

Drawing all of the trees always would be very energy intensive, that's why Terrain have a built in draw distance meaning if you're far enough it won't be drawn and if you're the just far enough it will draw the 3D Model as a 2D Image.

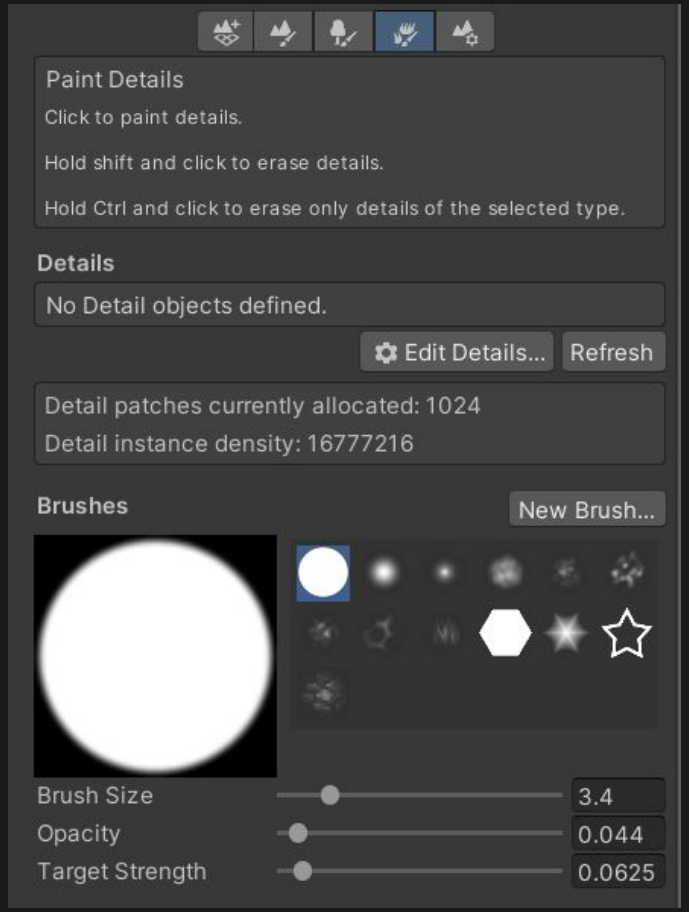
2D Images are less computationally consuming on the computer, to keep that 3D effect something called Billboarding is introduced where the 2D Image always faces you no matter which direction you are looking at it from.





Grass

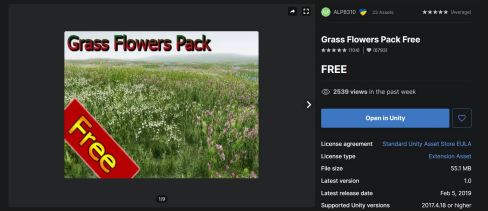
Grass tool uses the same options as the texture for paint on grass. With the only difference being that rather than textures we're painting on 2D sprites or 3D Meshes.

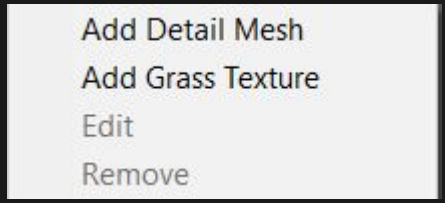


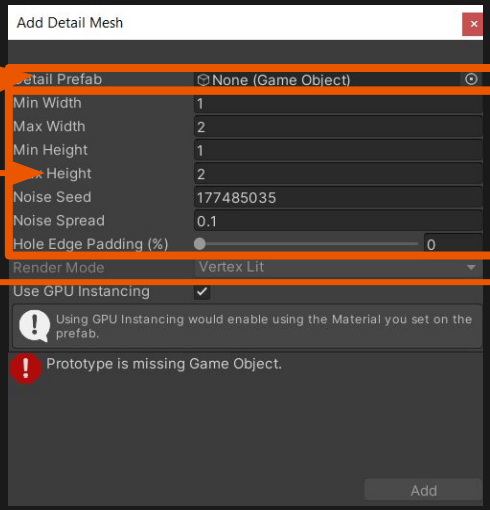
Add Details

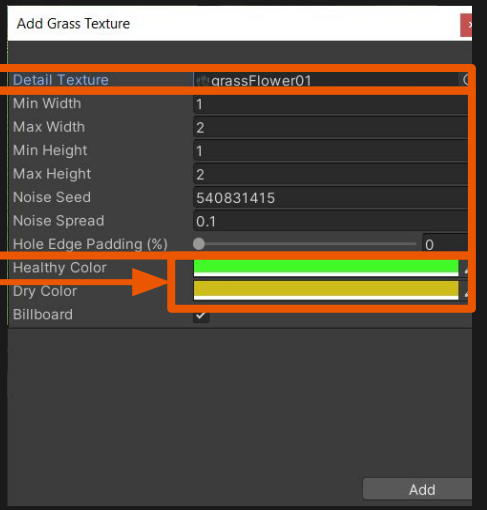
When adding detail we have choice of adding a Mesh or Texture.

Once you choose weather you want to add a Mesh or a Texture you'll be met with similar screens. [1] will ask you to choose the Prefab you want to use. [2] will provide you with extra control over how the object is painted on the terrain and [3] is only for textures allowing them to change the hue of the image to add additional visual variety.







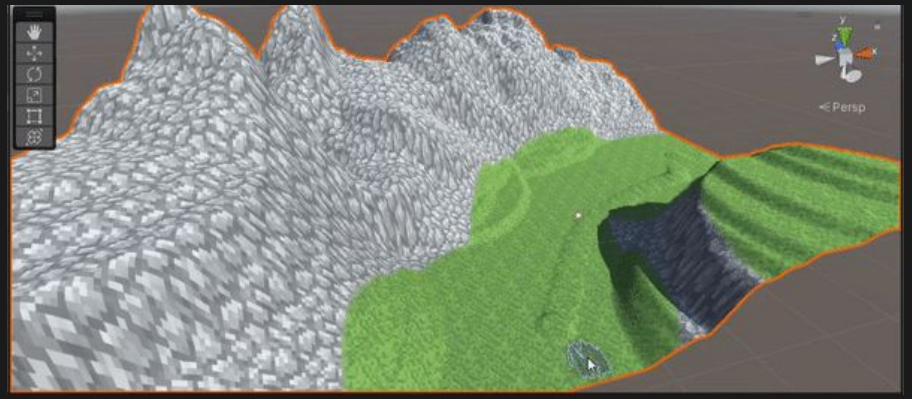


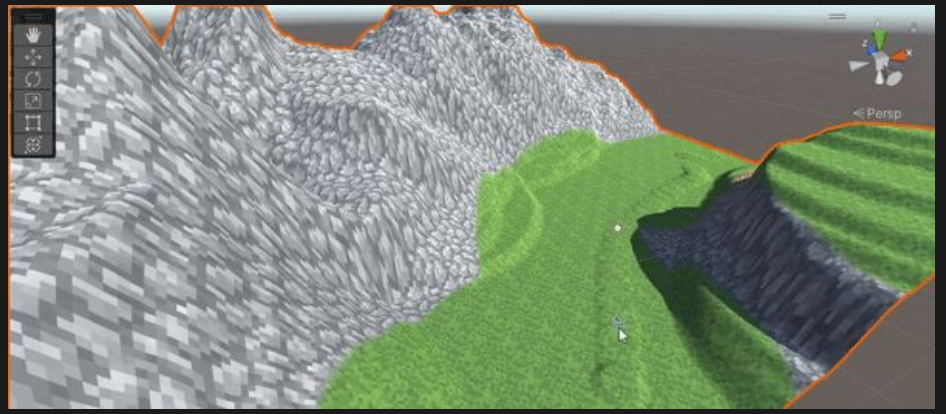
Sebastian Grygorczuk - STEM Institute at CCNY

Painting Grass

Painting grass or models is just as easy as painting on texture, choose the area and plop down you details.

Be warned the more grass, detail mehes and trees you add the more work it is for the computer to render and process all of them.

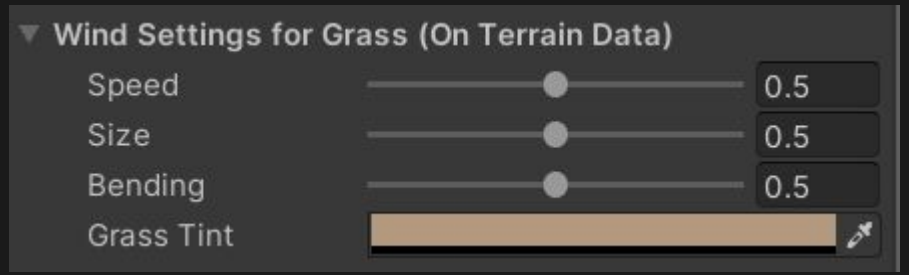




Wind

When working with Texture Grass they will be stimulated to sway in the wind.

Going to the Setting tab and looking at Wind Settings will allow you to control the wind actions.



Challenge Tree + Grass

1. Finish off your environment using trees and grass.
2. Once you're done upload you finished setting onto Padlet.