TERRAIN GUIDE FOR UNITY 5

Jason Rising (@Sketch343)

About the booklet:

Hey everyone! My name is Jason however, I also go by the name *Sketch* online. I'm a game designer and artist.
I have had tons of experience using the Unity engine and would like to spread my knowledge on the subject.
I noticed that there is little information out there on how to create magnificent terrains. So to fill this gap on the terrain topic I have created this manual. I also have a YouTube channel (linked below) which contains a digital version of this booklet.

This booklet is designed for complete beginners and slowly works up to more advanced topics. I explain unity components and terminology in detail with the inclusion of images to make the learning process as easy as it can be.

Apart from providing information to create terrains I also included various assets and settings which I personally use for my own scenes. I included these to help in finding high quality products for your own work (trust me it takes a long time to find descent assets). All the assets listed in this booklet are also free!

Alright, enough talking let's get started!

SOCIAL MEDIA LINKS:
- YouTube
- Instagram
- Online Portfolio
- Twitter

WORK SHOWCASE:

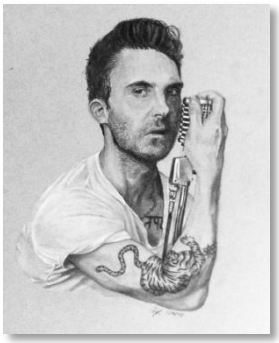


Table of Contents:

Creating a terrain (For complete beginners): 4

How to realistically sculpt terrain: 10

Painting terrain: 12

Realistic grass: 14

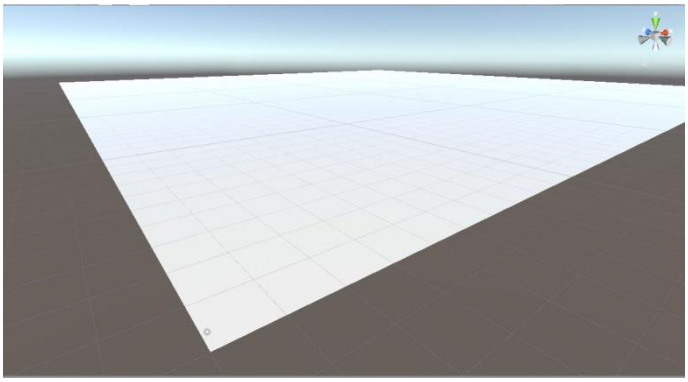
Post Processing Stack: 16

Useful free assets: 19

Creating a terrain (For complete beginners):

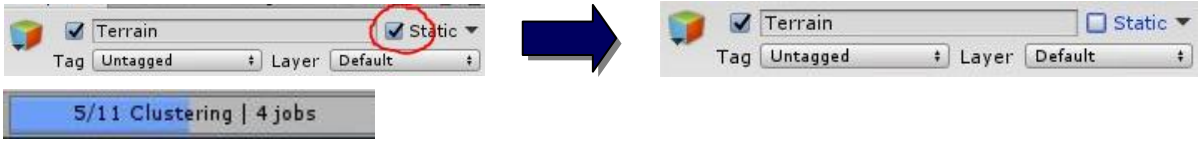
To create a new terrain in unity navigate to:

GameObject > 3D Object > Terrain



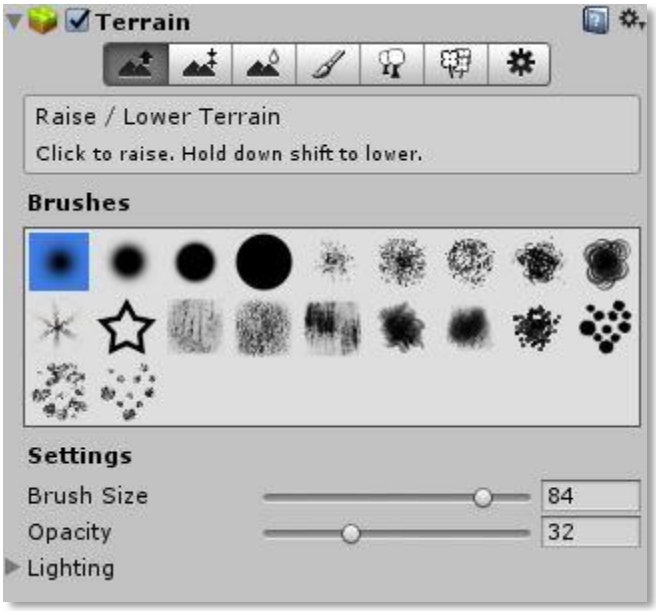
Awesome! We have just created a new terrain however, there are some values we should change before we get level designing!

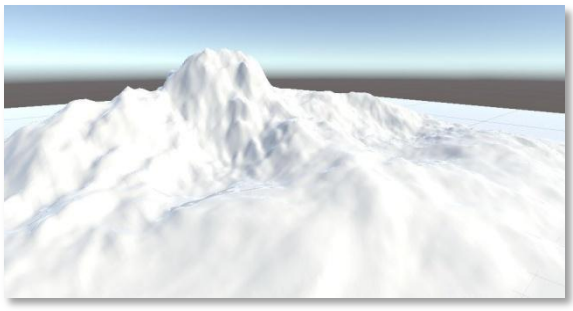
Now, in the terrain inspector we should see a button with the text *static*. When an object is regarded as **static** it infers that the object will <u>not be moving</u> during run time therefore, unity can pre-calculate light maps etc, to help with performance. This is a very useful thing however, since we are going to be editing our terrain we do not want unity to be processing constantly in the background. So for now disable the button.



Alright, before we start designing let's have a quick overview of all the tools. Click the terrain and find the *terrain* component in the inspector. You will see an array of tabs representing different features.

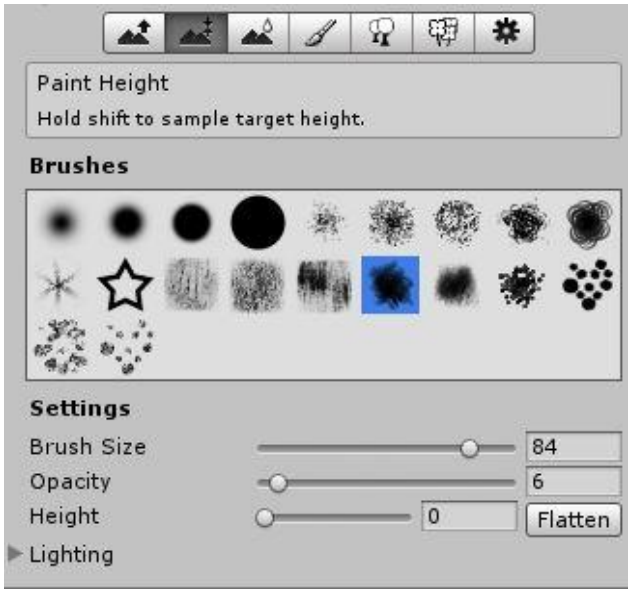
The first tool allows you to **raise and lower the terrain**. Select a brush from the *brushes* section. If you hover over your terrain you should now see a blue symbol mirroring that of the selected brush. If you hold the **left-click and drag** you can **raise** the terrain. If you **hold shift and left-click** you can **lower** the terrain.



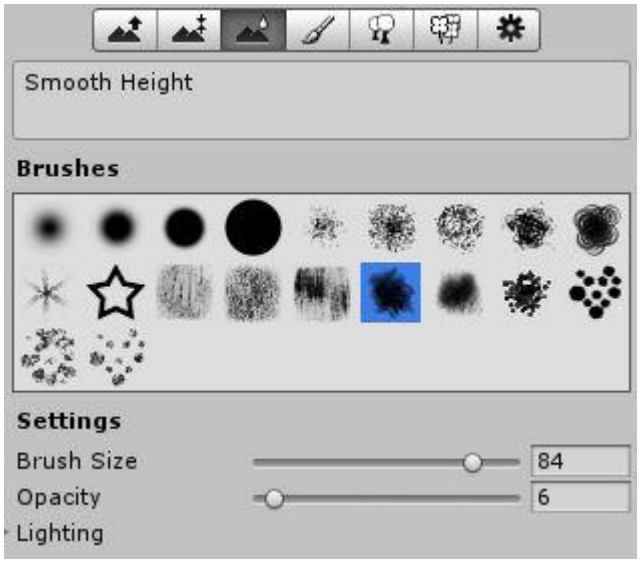


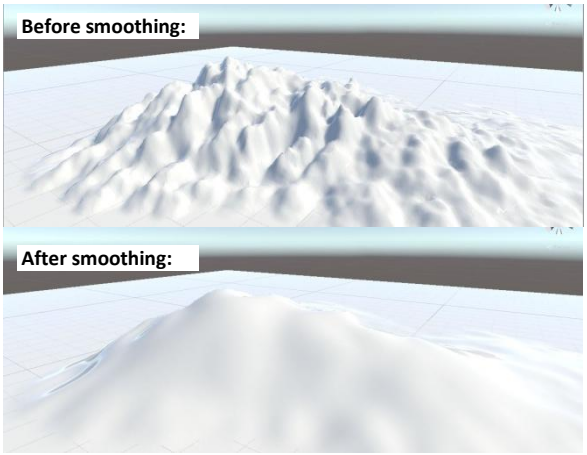
In the settings component we can see *brush size* and opacity *sliders*. Brush size changes the size of the raise/lower area while opacity changes the strength of the raise and lower effect. For detailed work and precision a low opacity is best. I usually work with **opacities < 10**.
My favourite brushes for creating amazing landscapes features (mountains etc) are the 15th and 16th brushes.
We don't need to worry about the *lighting* component at this stage.

The next tool is similar to the previous however, this time we can **limit the height in which the terrain can reach**. This is useful for creating flat areas and smooth hills.
To set a max height alter the height slider.
Clicking the flatten button will update the entire terrain to be a certain height. It is useful to do this at the start before sculpting to allow for crevices to be created later on, these can turn into rivers, lakes etc. Holding shift and left-click while on the terrain will **update the height value to the mouse position of the terrain**.
Bruch size and opacity are the same as the previous tool.



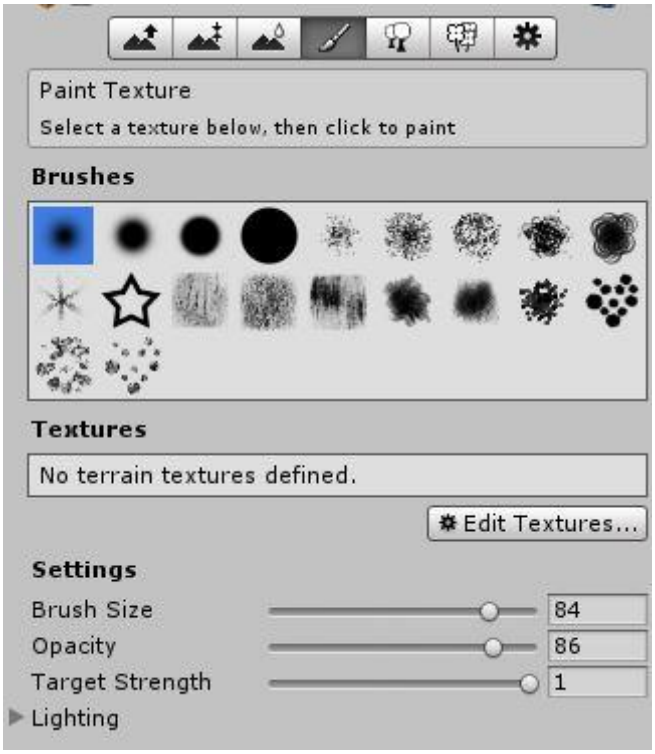
The third tool is used to **smooth your terrain**. Depending on the opacity the strength of the smoothing will change. When using this tool I generally have the opacity high.





This tool is used to **paint textures over our terrain**.

To add a new texture click **edit textures... > Add texture**, this will activate a new panel with two options: the albedo texture and a normal map. Click the select button or drag your texture into the slots and then click add to create a new texture.

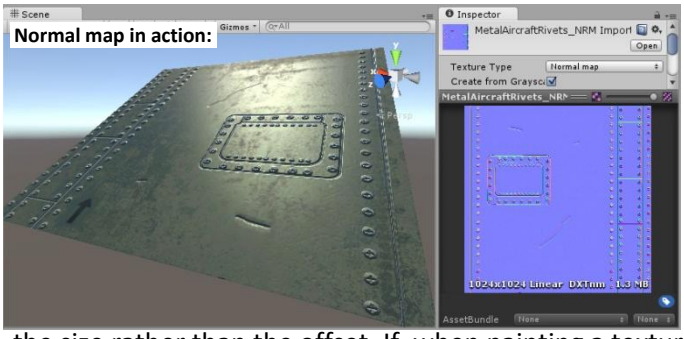


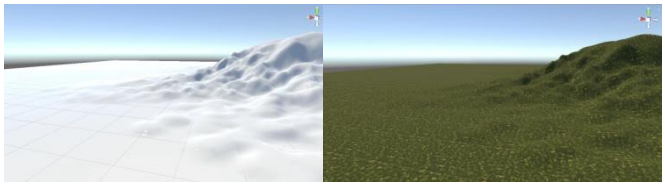
Albedo:

This will be the base texture. Whatever file is selected that is what will be drawn on the terrain.

Normal Map (Bump mapping):

A normal map allows you to add surface details such as bumps, grooves and scratches to the texture which catch the light as if they represent real geometry. Normal maps are a great way to add detail with a **minimal performance cost**.

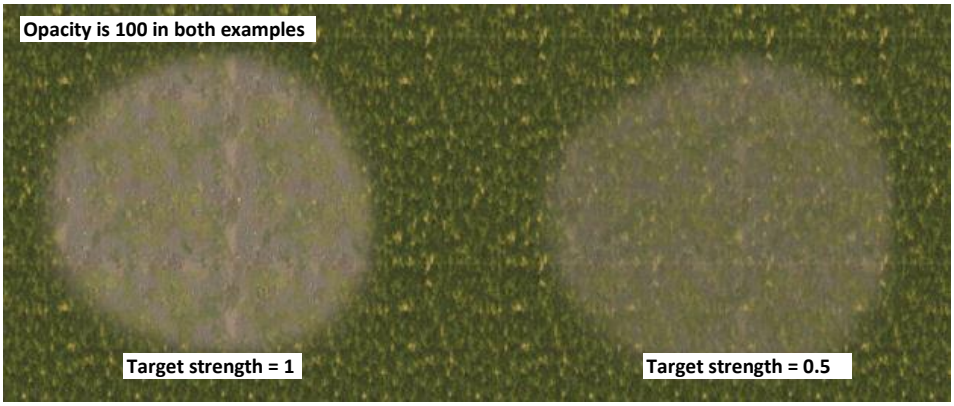




The **size** and **offset** components in the create texture panel will affect the texture itself. Most of the time you will be altering the size rather than the offset. If, when painting a texture it appears too large or too small then you would adjust these values (remember to change both as they represent the x and y axes of the texture). The **metallic slider** will apply a metallic effect, the higher the value the stronger the effect.

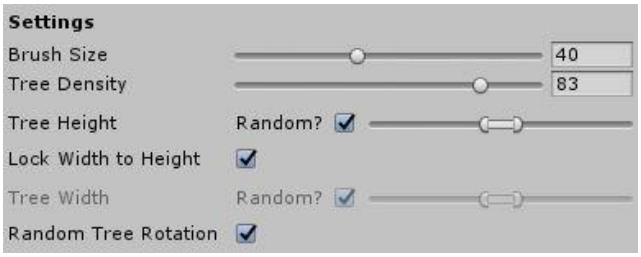
To paint a created texture select it in the inspector (it will have a blue highlight when selected) and similar to previous tools hold left-click and drag. The brush size words the same as previous tools.

The **opacity** and **target strength** work together to add small hints of a texture over the top of another (you can only have **4 textures** on a single splatmap). The target strength is the max opacity the texture can reach (i.e. if target strength is 1, the painted texture will be able to reach 100% opacity. If the target strength is 0.5, than the texture will only reach 50% opacity as its max meaning that, the base texture can still be seen). Although, you will probably leave your target strength at 1 most of the time.



Now we can start to really flesh out our terrain. This tool allows us to **place objects**, generally vegetation (trees, bushes, rocks etc). Although, this process can also be done manually via dragging models into the scene.

To create a tree for example click **Edit Trees... > Add Tree**, a new panel should appear with an option to add an object. Click the circle button or drag your model into the slot and press **Add** to create a new tree. The model should now appear in the **Trees** section within the inspector. Click on your model and click on the terrain to start placing.



In the **Settings** the brush size is the same as with previous tools. The tree density is similar to opacity as it will place trees within the brush size area, the higher the density the more trees will be placed (generally keep the tree density low). **Tree height** will determine the high of the model. If you have **Random** selected the height of the tree will vary between the two endpoints of the arrow slider (the endpoints can be moved independently if clicked and dragged). If **Lock Width to Height** is selected than the width of the tree will be scaled with the randomised height so that the overall model dimensions are not distorted. And finally, **Random Tree Rotation** will rotate the tree randomly when placed. These settings are useful for creating variation.

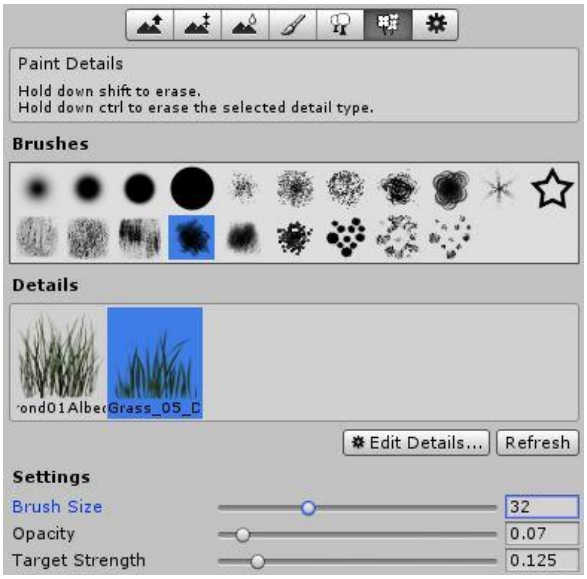
To remove a model select it and then click **Edit Trees... > Remove Tree.**

If you are looking for some models, Unity provides a built in environmental pack. Just navigate to: **Assets > Import Package > Environment** (Trees and textures in above images are from this package).

The next tool is similar to the previous but rather than being designed for the placement of models this tool is designed for the **placement of grasses** and other ground materials.

To add a grass texture select **Edit Details > Add Grass Texture**, this will open a new panel with many components but don't worry we will go through each component now. So firstly, the **Detail Texture**

component is where you will place you grass texture itself (Albedo), technically you can click add now and start placing however we want beautiful looking grass so we are going to play around with some other components. The next four components are to do with the size of the grass, depending on the scale of your terrain this can differ greatly (However, try to keep them at a similar size to the default as if the textures are too large they want be rendered far as your scene may be too large). Next we have **Noise Spread** this is the amount of spreading between individual grasses (noise is random and the value inputted doesn't account to the exact distance between each individual grass), I rarely adjust this value so let's keep it on **0.1**. We also have **colour** settings, Unity's default colours are awful so we are going to change the colour to **white**, if you want a some colour then only have a slight variation from white and have the saturation low (this will have the best realistic look). Finally, we have **Billboard**, this determines how the grass is viewed. If disabled then the grass will always look at the player, I do not like the effect as the player will notice the grass moving and if the player looks directly down the grass will disappear. So instead we will enable **Billboards**, this will make the grass stay static, therefore it will not move and will not disappear when looking straight down.

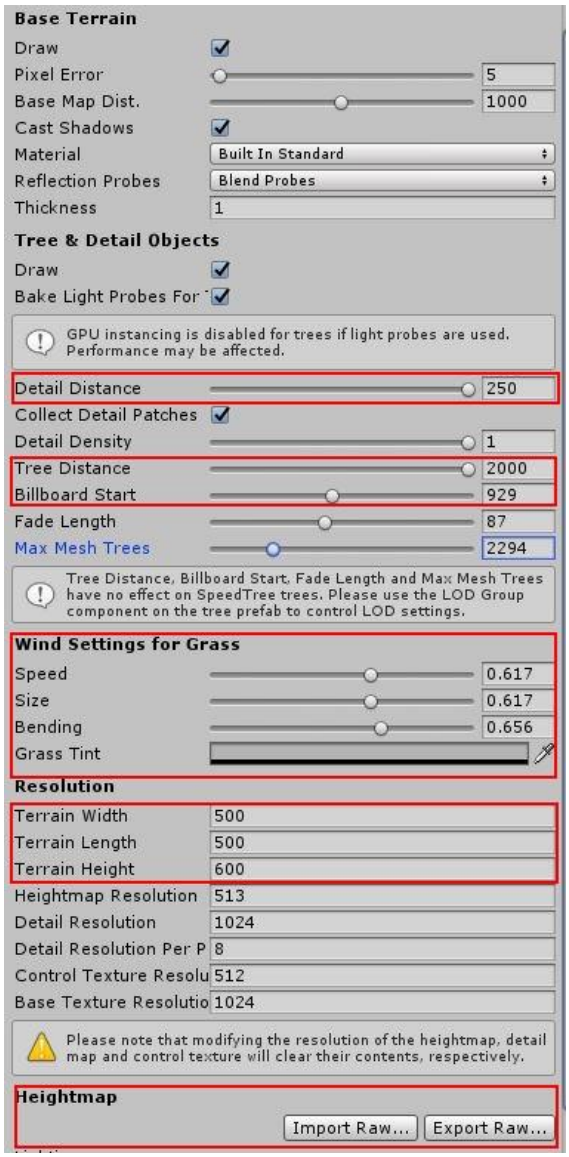


Brush size, opacity and target strength are similar to previous tools. I recommend having a low opacity as if the grass is too lush/dense than the game will become laggy as grass is **performance heavy!**

We have reached the final component of terrain, **the settings!** We will not being going over everything, instead we will look at the components that your mostly likely to be using during level design.

The first component is the **Detail Distance** this is how far detail will be rendered, noticeable in grass render distance. If you are creating a level for a game it is best to keep this setting on the **low** end, for performance reasons. However, if your just showing off your terrain creation skills bump this up to max to get the best visuals (detail distance is on max in the above images). **Tree Distance** is the render distance of trees. **Billboard Start** is the minimum distance in which tree billboards can be

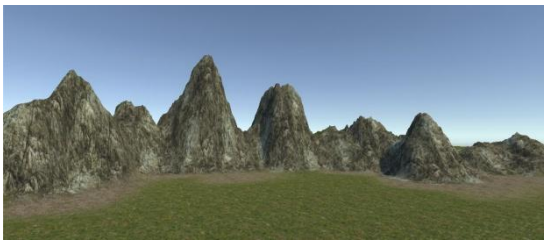
utilised. Tree billboards are images that represent the 3D model, they activate when the player is far away, if executed properly the player will not even notice the transition. Billboards and LODs are designed to increase performance. **Wind Settings for Grass** will affect how the grass moves to represent wind. The lower the collection of settings the weaker the wind and the greater the settings the greater the wind strength. **Grass Tint** is a colour placed over the grass textures when certain conditions are meet (i.e. view angle) this feature can create a realistic wind effect as a colour changes can be seen moving along the grass in uniform. **Terrain Width and Length** affect the overall size of the terrain. If you are leaving sections of the terrain empty you should reduce the terrain size to remove the empty spaces to increase performance. There is also a **Heightmap** option which will allow you to apply a heightmap to which the terrain will update to.

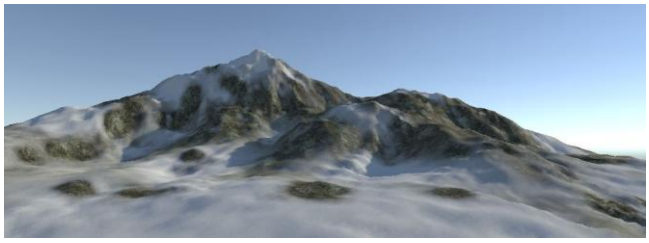


That's it! That's all you need to know about the terrain tools. Now, your all set to create spectacular landscapes! The next section of the manual is generally tips and techniques to achieve realism and aesthetically pleasing visuals.

How to realistically sculpt terrain:

Sculpting without models or heightmaps can be very hard. Often people have their brush opacity too high and end up creating unrealistic spikes in the terrain. So in this brief section we will go over some tips for creating a realistic terrain.

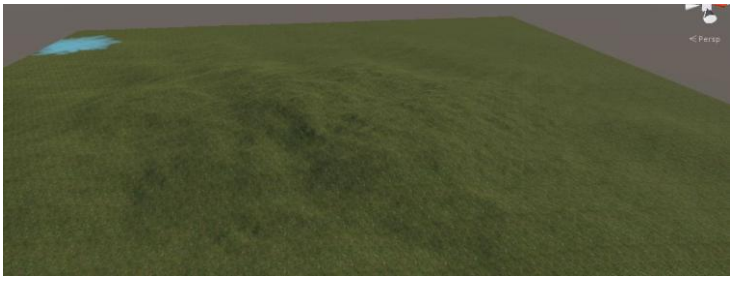




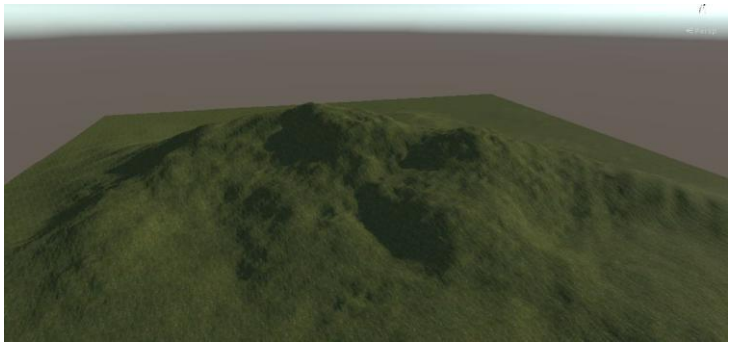
To start off let's have a quick gander at a couple real mountain ranges.

As you can see the mountains are steep however, not as steep as many seem to exaggerate. A good tip when creating a mountainous terrain is to view images like these prior. Although, in creating terrains with mountains similar to those in image 1 I would often use models. Later on I go through some amazing free assets that can be used.

The brushes you see here are the best in my opinion in creating a realistic landscape. To start lets **lower our opacity (<10)** and increase our **brush size to max**.
We need to construct our mountain in layers, this will give a gradual increase in steepness.

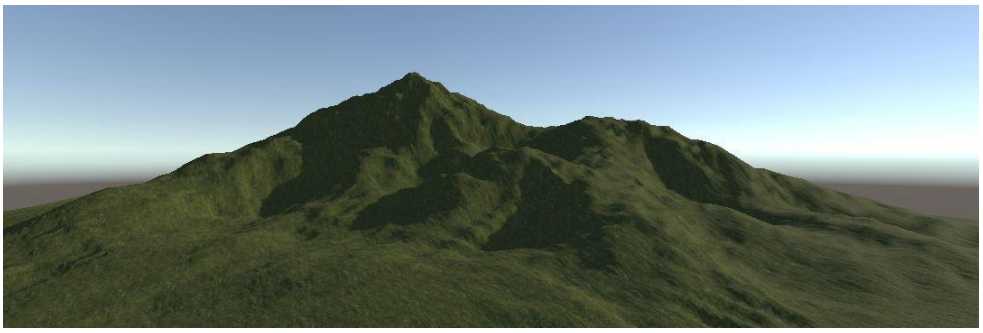


Start off with a large foundation. I used max brush size and an opacity of 6.

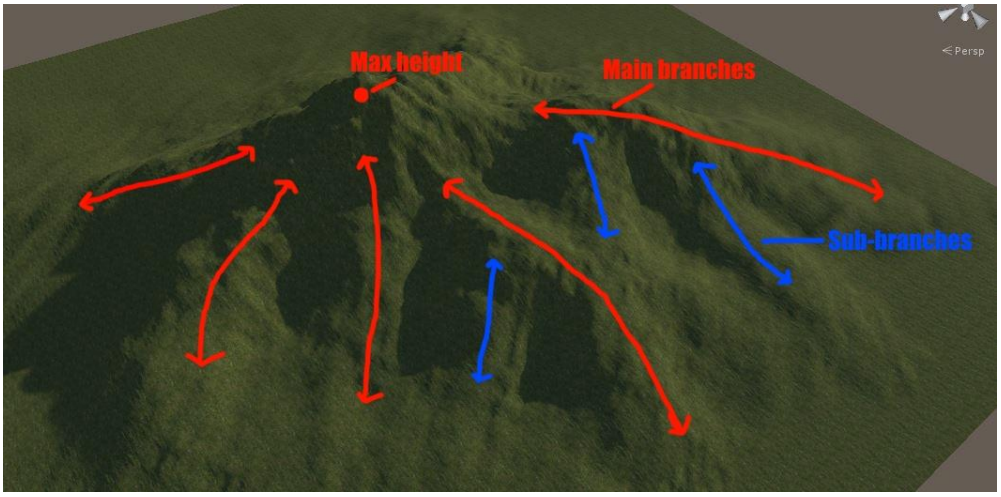


Now map out the overall shape that you want your mountain to resemble. It is good to **have branches and not isolate to a single point**.

This image represents the branching of my mountain seen above. The red dot represents the height max of my mountain.



Now the transition to this stage may seem like a big step but all I have done is **define the braches** and **add sub-branches** between the major ones. As discussed before I decided on a location that will reach my max height (red dot). It is important to note that there is a gradual steepness, **no sharp spikes!**



Now, we just need some good texturing and we have ourselves a decent terrain! Alright, let's have a quick summary of things to remember when creating your own terrain.

SUMMARY:

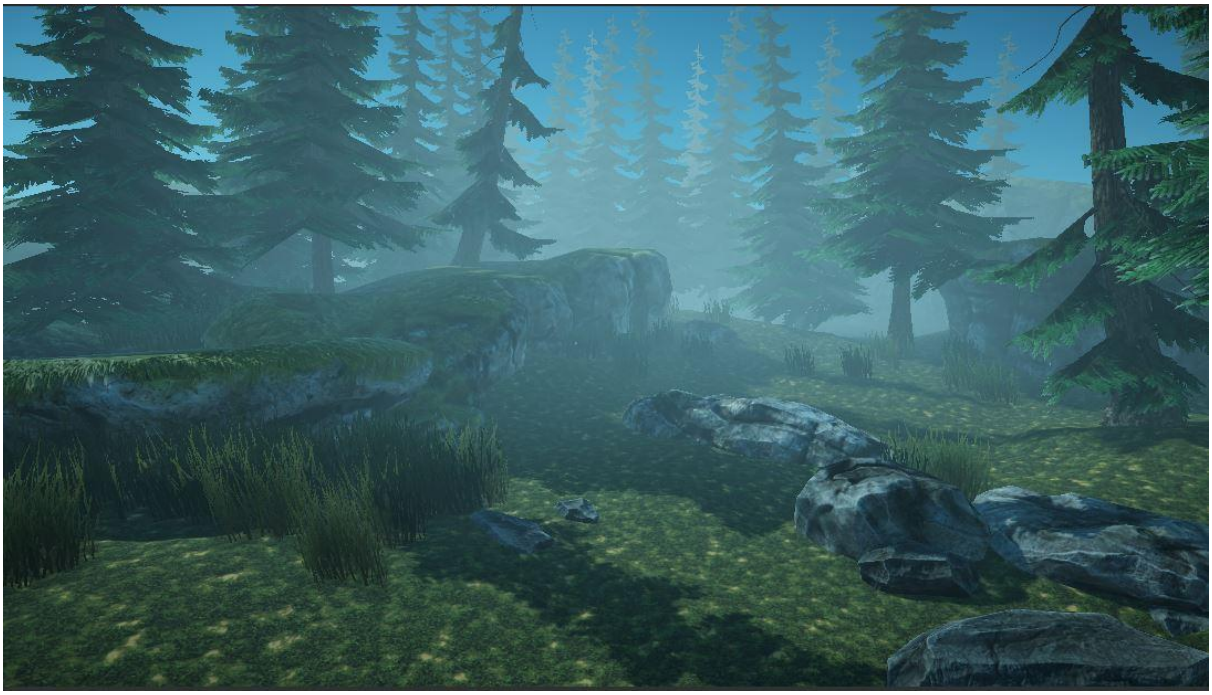
- Have a low opacity (<10) and a large brush size. Slowly decrease your brush size as you layer up your terrain.
- Do not use the first four circle brushes to avoid your terrain being too smooth.
- Develop your mountain from a central point with branches.
- Define your branches and add sub-branches to connect them.
- Have a gradual increase in height, avoid steep cliff.
- When sculpting **always be moving your mouse** to avoid strange height difference.

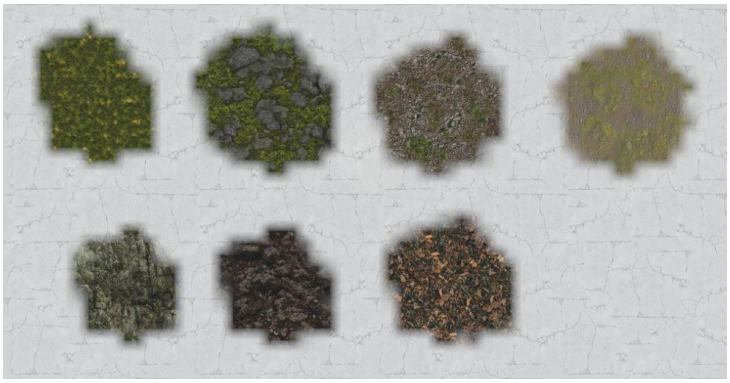
Painting terrain:

One of the most important elements of creating amazing landscapes is texturing. It is important to have a **large array of textures** for variation while also **paint in accordance to the terrain**.

When I say 'paint in accordance to the terrain' I infer that you should consider the steepness and bumpiness of the terrain mesh to determine which texture would best fit. For example, you would not have a grass texture on a steep part of your terrain.

Alright, lets actual show a representation of these tips. I have created a quick scene seen below. It contains a few models and the post processing stack (we look into that later on) however, there is only the single grass texture.





Alright, so I have now added a few textures that I would like to add to my scene.

The main texture will be the grass and the others are just to add slight variation.

As you can see the textures add greater depth to the entire scene. Grounds are very important to consider in your scenes if you do not have many models or grasses, utilising textures are a great way to attain detail. A **low opacity** was also used which allows the textures to blend between one another, I almost never use a full opacity when painting.

It is important to note that I used more stony textures near the rocks and a dried leaf texture under the trees, correct placement of textures can greatly increase realism.

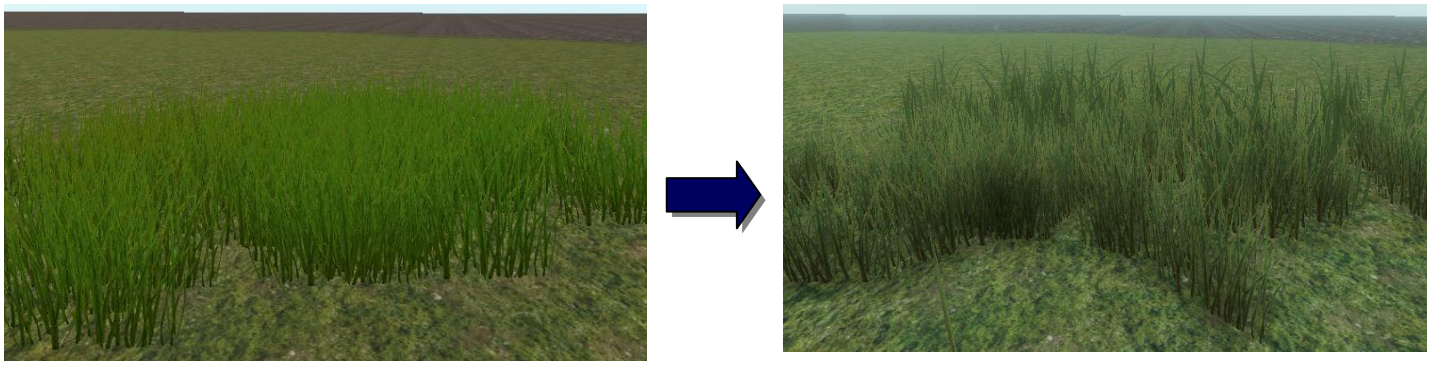
Here, I created a rough terrain I then textured it in accordance to the mesh. The steep areas become stone and the flatter areas become the grass. The transition from grass to stone was accommodated with the inclusion of a gravel texture. This method is useful as it creates greater depth within the mesh itself.

SUMMARY:

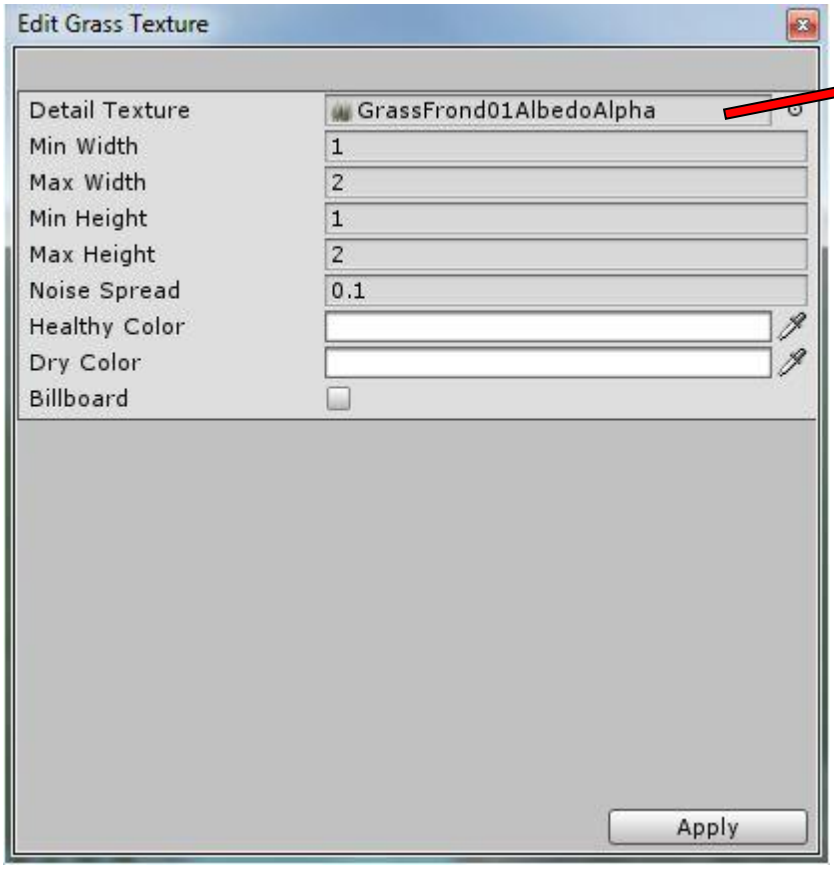
- Use a large array of textures to create variation.
- Use the geometry of the terrain and the inclusion of props to choose the dominance of a texture in a particular area.
- Use a **low opacity** when painting/texturing.

Realistic grass:

Grass is an important component of level design. However, the default setup for grass provided by Unity is horrible! So in this brief section I will transform your grass to be lush and beautiful.



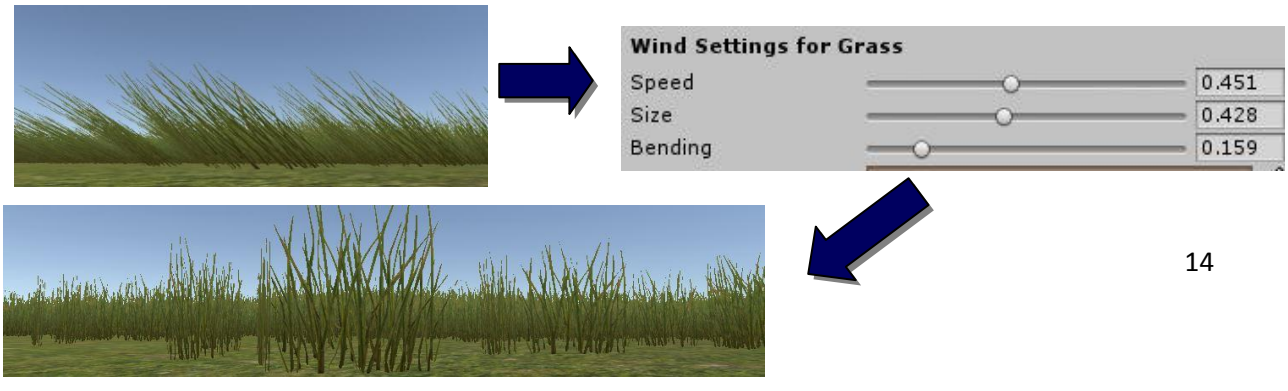
Basing off the standard Unity environment pack (**Assets > Import Package > Environment**) these are the values I would use:



I find this texture fuses well with the default grass (painted texture) and also has a soft look in comparison to the other provided grass texture. Softness is important as it can create a lush illusion.

The healthy colour and dry colour are set to **white** to allow the raw green of the texture to be seen.

Note that **billboard is not ticked!** This will disable the grass from continuously facing the player. If you run the game you may find that non billboard grass will dramatically stretch. Do not worry, all you have to do is go into the terrain settings (cog icon) and decrease the **wind settings** values.



Another terrain setting to consider is the **Detail Distance,** this will increase the distance at which grass is rendered. The greater the value the better results however, the great the **reduction in performance**.

That's basically everything you need to know in the aspect of the creation of the grass. Although, another useful tip is to **have variation** in your grasses, this will increase interest and realism to your scenes. You can achieve variation with a single texture by changing grass height and colour (remember to keep colour changes subtle).

Variation created with single default grass texture

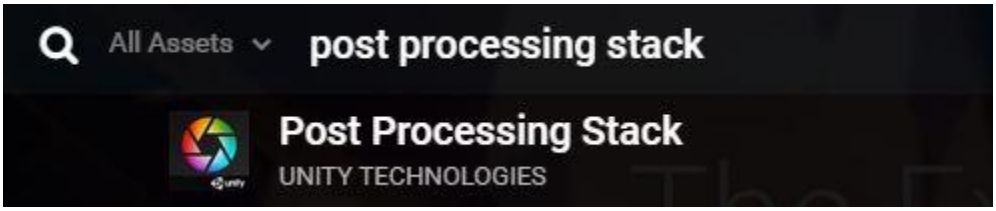
To achieve the darkness at the bottom of the grass you have to download the post processing stack and enable ambient occlusion. I discuss this as the next topic.

Post Processing Stack:

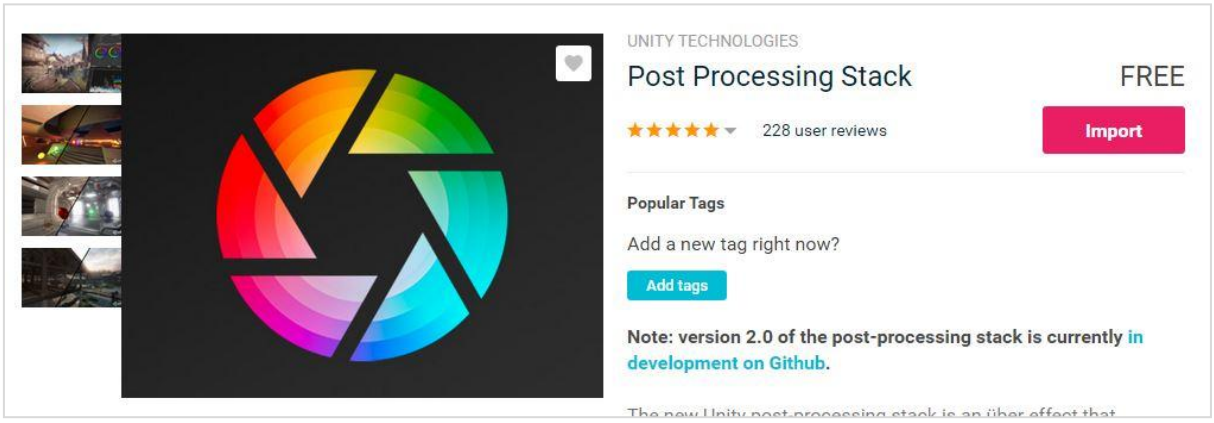
The post processing stack is an asset provided by Unity, that allows for post processing effects to be enabled on your camera. These effects can drastically change the look and feel of your scenes. In this section we will look briefly into the components of the post processing stack as well as my own recommendations to achieve certain visuals.

To download the post processing stack click the **asset store tab** in your project. If the tab doesn't exist navigate to: **Window > Asset Store**

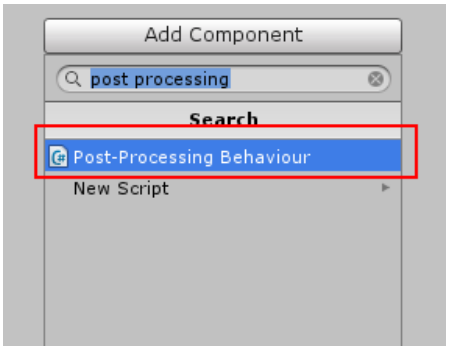
Then type: 'Post Processing Stack' in the search bar.



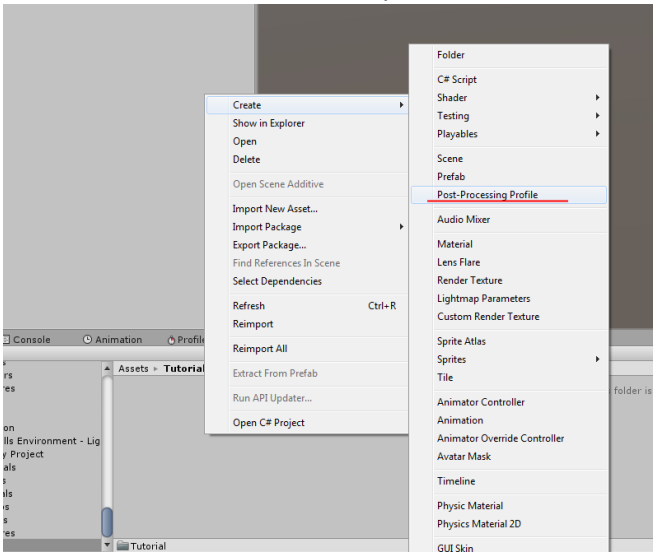
Download the asset that looks like this:



Awesome, we should now have the post processing stack installed within our project. However, we still need to set up some stuff until we can see the effects.

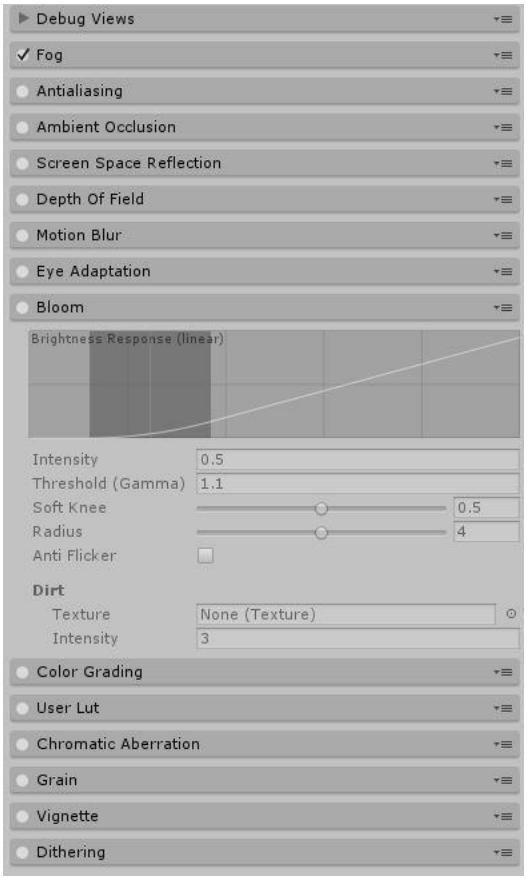


Click on your camera and press **Add component,** type in post process... and select the script that is titled **Post Processing Behaviour.** This should now be added with a **profile** option.



Now we need to create a profile. **Right-click** in your project and select **Create > Post Processing Profile.** Name the created profile whatever you want and drag it onto the **Post-Processing Behaviour** script under the **profile** section. This script should be on our scene camera (remember to only have a single camera in your scene).

If we now click on the profile within the project this window should appear:



It is this window in which we enable/disable and adjust effects.

I will now quickly go through each component:

Fog:
Is the effect of overlaying a colour onto objects dependant on the distance from the camera. If you run the game with this enabled nothing will happen. To have the effect appear navigate to: **Window > Lighting > Settings**, this will open a new panel, scroll down until you find **Other Settings.** Here you will see a fog option (tick this). Upon ticking more options will appear these options deal with the colour of the fog and the density (basically how far away or close the fog will be).

Anti-aliasing:
Reduces the prominence of jagged lines in models by surrounding them with intermediate shades of colour. Be careful as anti-aliasing will lower performance.

Ambient Occlusion:
Darkens creases, holes, intersections and surfaces that are close to each other. Drastically, makes your scenes more realistic, I almost always have this enabled.

Screen space reflection:
Refusing screen space data to calculate reflections. Commonly used to create more subtle reflections such as wet surfaces or puddles. A material must have **max smoothness** for reflections to occur.

Depth of Field:
Simulates the focus properties of a camera. Objects near or further away from the camera will be unfocused (blurred) depending on the inputted values.

Motion blur:
Simulates cameras in which objects moving at a fast speed will be blurred. It create a great representation of motion.

Eye Adaptation:
Effect dramatically adjusts the exposure of the image according to the range of brightness levels it contains. For example, imagine your outside in the middle of the day but then find a cave, you go inside and it is really dark. Your eyes soon adjust but now when you look at the entrance at which you came from it is now extremely bright. The change in brightness is this effect.

Bloom:
The effect produces fringes of light extending from the borders of bright areas in an image, contributing to the illusion of an extremely bright light overwhelming the camera or eye capturing the scene

Colour Grading:
A category that can dramatically adjust the feel of your scene. Provides a filter like affect over your scene.

User Lut:
Is a less advanced version of colour grading. You will rarely use it.

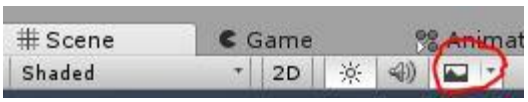
Chromatic aberration:
Fringes of colour appear along boundaries that separate dark and bright parts of an image.

Grain:
Adds film grain, which is a random optical texture of photographic film due to presence of small particles in the metallic sliver of the film stock.

Vignette:
Darkening and/or desiderating towards the edges of an image compared to the centre.

Dithering:
Prevents large scale patterns such as colour banding in images.

Alright, that took a while but it is important to go through each component as the post processing stack is an extremely important element of level design. The best way to learn is to just mess around with values and see its effect on the screen. Ensure that the **screen toggle is enables** to see your changes within the editor.



I cannot necessarily give you certain values that are the *best,* as it will drastically change depending on the feel your going for or your overall visual taste. Instead, I would offer that you spend most of your time looking into the **Colour grading** as it is this component that will have the largest effect.

Useful free assets:

Here is a collection of assets (model focused) that will allow you to build a library of detailed models ready for level design.

Essentials > Tutorial Projects

UNITY TECHNOLOGIES
Adam Exterior Environment
★★★★★ (232)
FREE

Templates > Packs

UNITY TECHNOLOGIES
ADAM EP2/EP3 - Photogr...
★★★★★ (6)
FREE

Essentials > Tutorial Projects

UNITY TECHNOLOGIES
Book Of The Dead: Enviro...
★★★★★ (37)
FREE

Essentials > Tutorial Projects

UNITY TECHNOLOGIES
3D Game Kit
★★★★☆ (95)
FREE

3D > Environments

MANUFACTURA K4
Rock & Boulders
★★★★★ (442)
FREE

3D > Props > Exterior

MANUFACTURA K4
Rock and Boulders 2
★★★★★ (476)
FREE

3D > Environments > Landscapes

TOBYFREDSON
Rocky Hills Environment - ...
★★★★★ (67)
FREE

3D > Environments > Landscapes

PROASSETS
Free Snow Mountain
★★★★☆ (39)
FREE

3D > Environments > Landscapes

GAMEWARMING
Autumn Mountain
★★★★★ (167)
FREE

3D > Environments

SHAPES
Nature Starter Kit 2
★★★★★ (1174)
FREE

3D > Environments > Fantasy

KARBOOSX
Mega Fantasy Props Pack
★★★★★ (171)
FREE

3D > Environments > Fantasy

3DFORGE
Blacksmith's Forge
★★★★★ (181)
FREE

Essentials > Asset Packs

UNITY TECHNOLOGIES
The Blacksmith: Environ...
★★★★☆ (1022)
FREE

Essentials > Asset Packs

UNITY TECHNOLOGIES
Unity Particle Pack
★★★★★ (494)
FREE

Essentials > Tutorial Projects

UNITY TECHNOLOGIES
Viking Village
★★★★☆ (839)
FREE

3D > Environments > Landscapes

MESHZONE3D
Winter Zone Mini
★★★★★ (6)
FREE