2D Game Design

Sebastian Grygorczuk - STEM Institute at CCNY

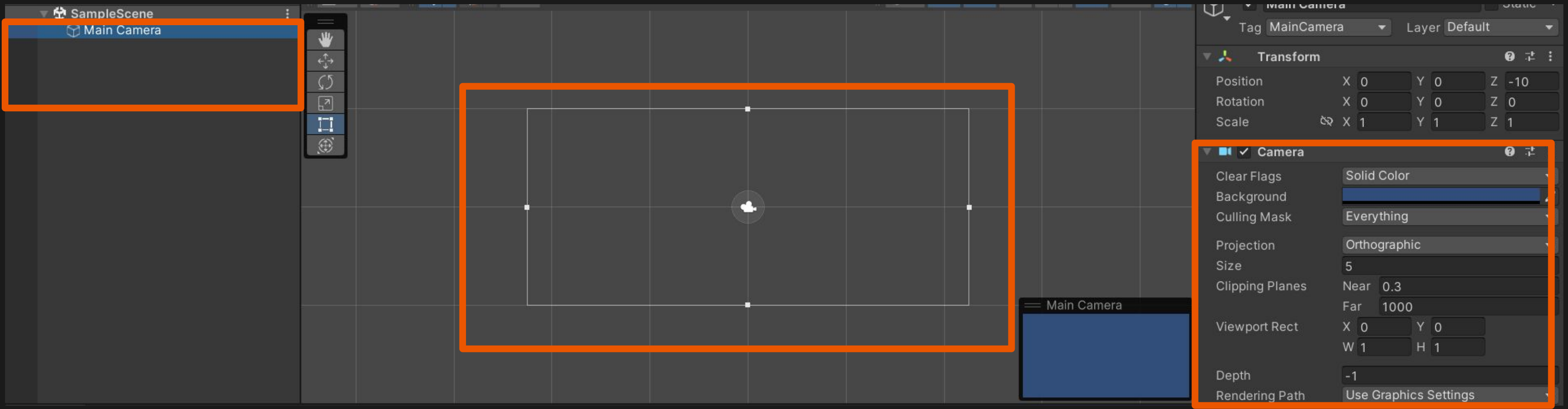
Today's Agenda

We're going to be going over Camera portion of Chapter 5: Lights and Camera

Chapter 12: 2D Game tools, and Chapter 13: Tilemaps

- Using Orthographic Cameras in a 2D Scene
- Learn about 2D Assets and Tilemaps
- Create Game Objects with 2D Collision and Physics
- Create and Share Your 2D levels

2D Game Project



Tag MainCamera Layer Default

Transform

Position	X 0	Y 0	Z -10
Rotation	X 0	Y 0	Z 0
Scale	X 1	Y 1	Z 1

Camera

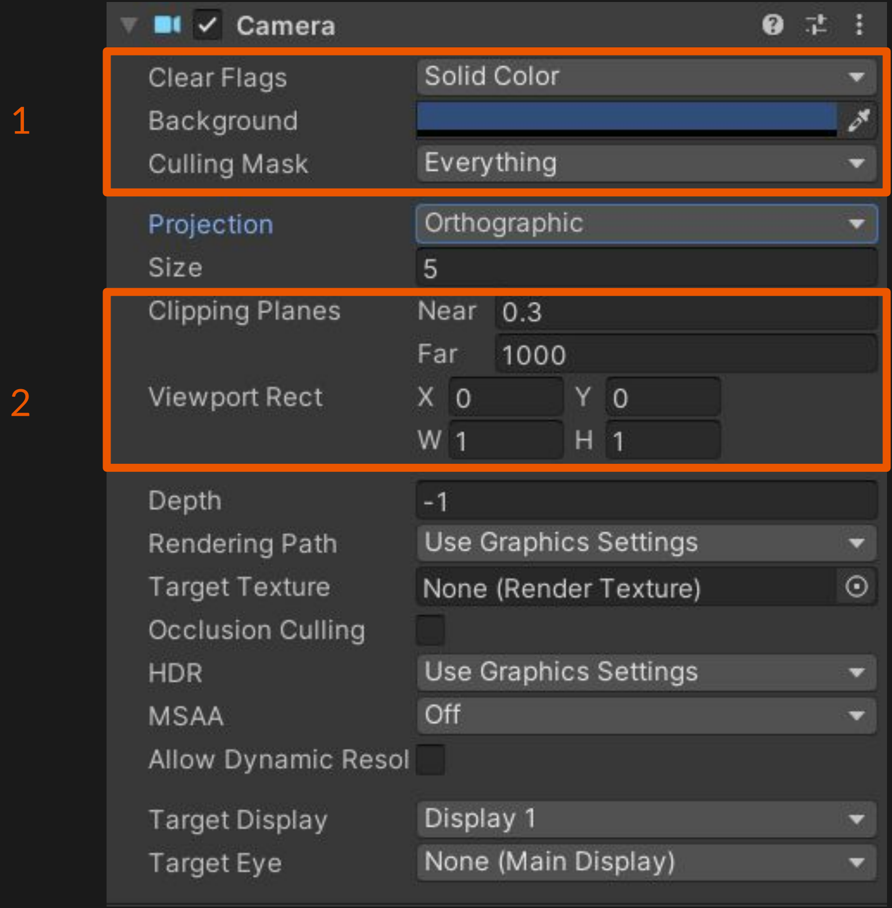
Clear Flags	Solid Color
Background	🟦
Culling Mask	Everything
Projection	Orthographic
Size	5
Clipping Planes	Near 0.3
	Far 1000
Viewport Rect	X 0 Y 0
	W 1 H 1
Depth	-1
Rendering Path	Use Graphics Settings

When we start a 2D Game Project there will be no light source and Camera set into Orthographic Projection. We don't need light because we're not loading any meshes and Orthographic Project is better for 2D Games.

Camera

There are two general areas we are [1] controls what's visible, Clear Flags describes the background type we have, normally we're used to using Sky Box but now we're going to use Solid Color defined by the Background. While Culling Mask defines what the camera should render. Currently is rendering everything.

[2] Controls the size of the camera and it's behaviors. Clipping Planes tells us how close or far we need to be for the camera to clip into it, Viewport defines how much of the screen this camera should take up, you could have two cameras taking up half the screen with it or so.



1

2

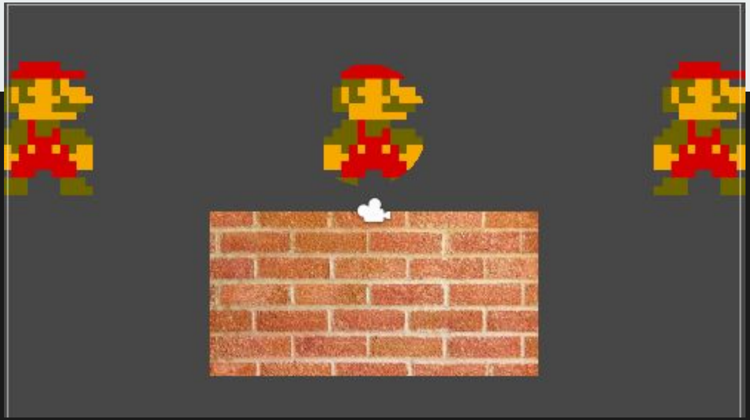
Camera

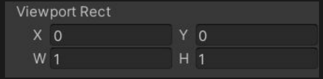
Clear Flags	Solid Color
Background	
Culling Mask	Everything
Projection	Orthographic
Size	5
Clipping Planes	Near 0.3
	Far 1000
Viewport Rect	X 0 Y 0
	W 1 H 1
Depth	-1
Rendering Path	Use Graphics Settings
Target Texture	None (Render Texture)
Occlusion Culling	
HDR	Use Graphics Settings
MSAA	Off
Allow Dynamic Resol	
Target Display	Display 1
Target Eye	None (Main Display)

Multiple Cameras

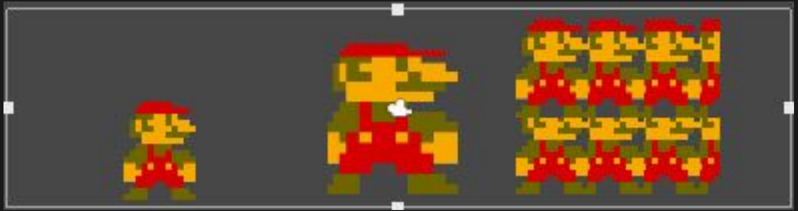
Having multiple Cameras with different Viewports will allow you to display two different areas of the scene at once.

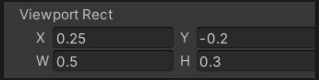
You could show the goals that the player is looking for or split the screen so that multiple players can play at once.



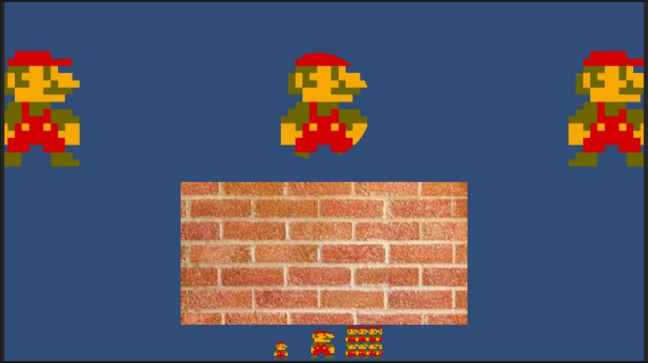


Viewport Rect
X 0 Y 0
W 1 H 1





Viewport Rect
X 0.25 Y -0.2
W 0.5 H 0.3

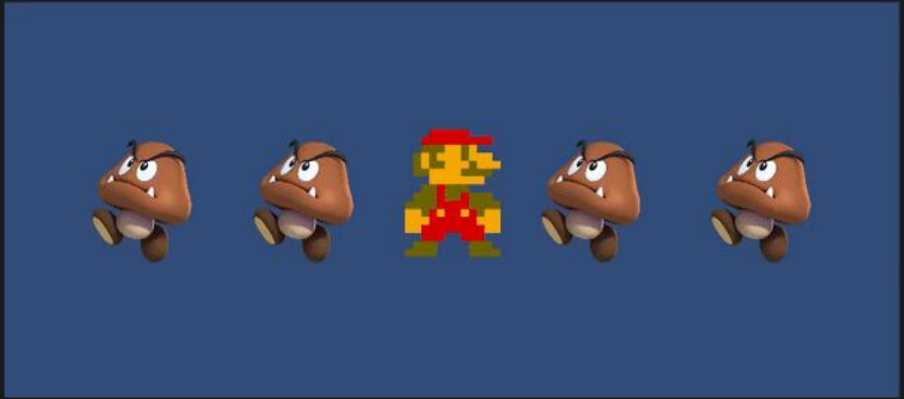


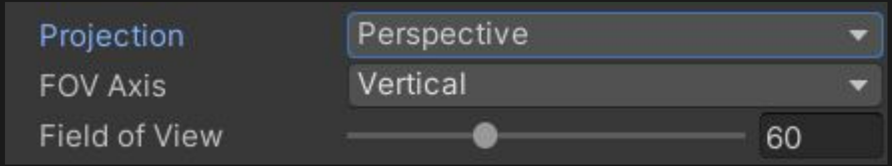
Sebastian Grygorczuk - STEM Institute at CCNY

Perspective vs Orthographic

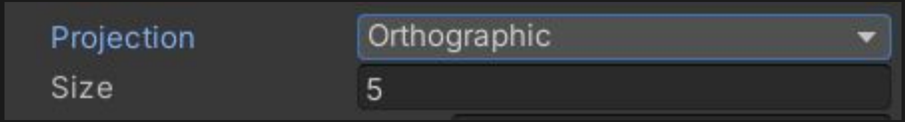
Perspective Projection is what we've been working with until now, it allows for depth on the 3D axis.

On the other hand Orthographic Projection removes the 3D axis and makes everything on the same 2D plane.





Projection	Perspective
FOV Axis	Vertical
Field of View	60



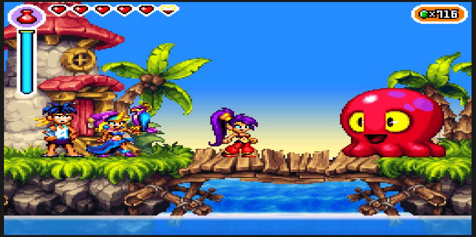
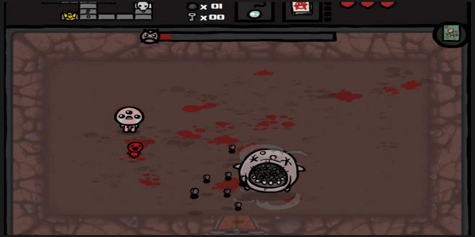
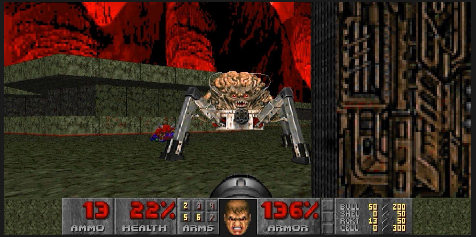
Projection	Orthographic
Size	5

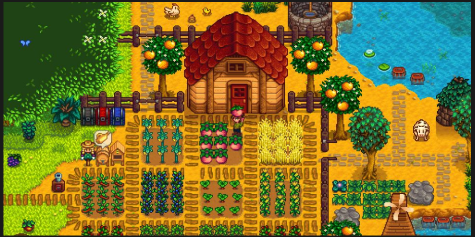
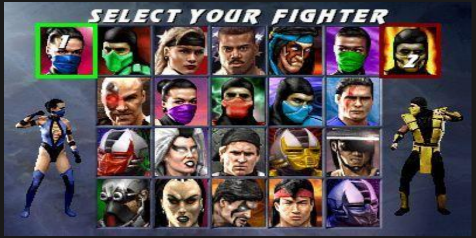
Sebastian Grygorczuk - STEM Institute at CCNY

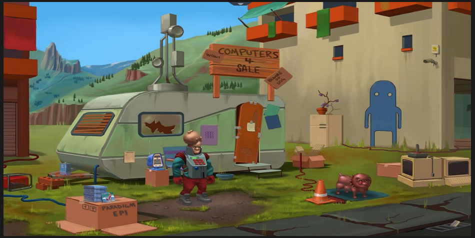
Sprites

2D Sprite are images that are flat on the screen, they can be anything from pixel art, to hand painted, to picture of real people.

So example of how you can use them, 2D Platformer - Shantae, RogueLite - Binding of Isaac, FPS - Doom Classic, Top Down Farm - Stardew Valley, 2D Fighting -Mortal Kombat, and Point and Click - Paradigm.

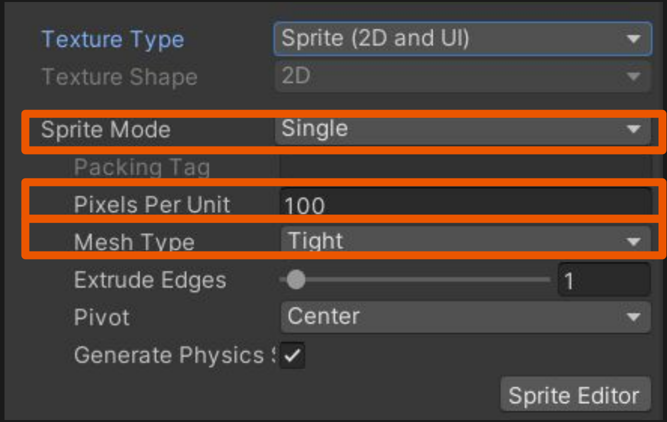


Sprites Import Settings

When working with sprites the import setting on the image has to be set to Sprite, unlike when we were working with Textures and it was set to Default.

With this we can edit how the image will be used in the Scene.

Sprite Mode allows us to cut up or keep the image as one, Pixels Per Unit tells us how much space should the image take in respect to the world space. Mesh Type tells us how the Scene should view it as a rectangle the size image width and height or the shape of the Sprite.



Texture Type	Sprite (2D and UI)
Texture Shape	2D
Sprite Mode	Single
Packing Tag	
Pixels Per Unit	100
Mesh Type	Tight
Extrude Edges	1
Pivot	Center
Generate Physics S	✓

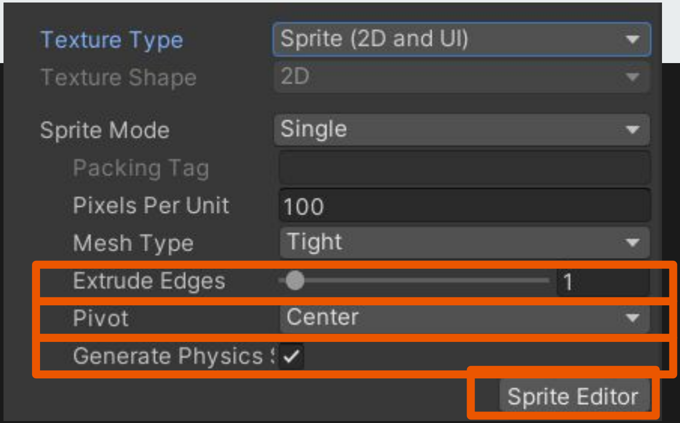
Sebastian Grygorczuk - STEM Institute at CCNY

Sprites Import Settings

Extruded Edges connect to Mesh type of figure out how much space off of the image should be considered the image.

Pivot is where you want to rotation to occur from and Generate Physics will build physics based on the Sprites look.

The Sprite Editor Button will bring you to the Sprite Editor View from which you'll be able to edit the 9-Slicing Box that we'll use in a moment.



Texture Type	Sprite (2D and UI)
Texture Shape	2D
Sprite Mode	Single
Packing Tag	
Pixels Per Unit	100
Mesh Type	Tight
Extrude Edges	1
Pivot	Center
Generate Physics S	✓

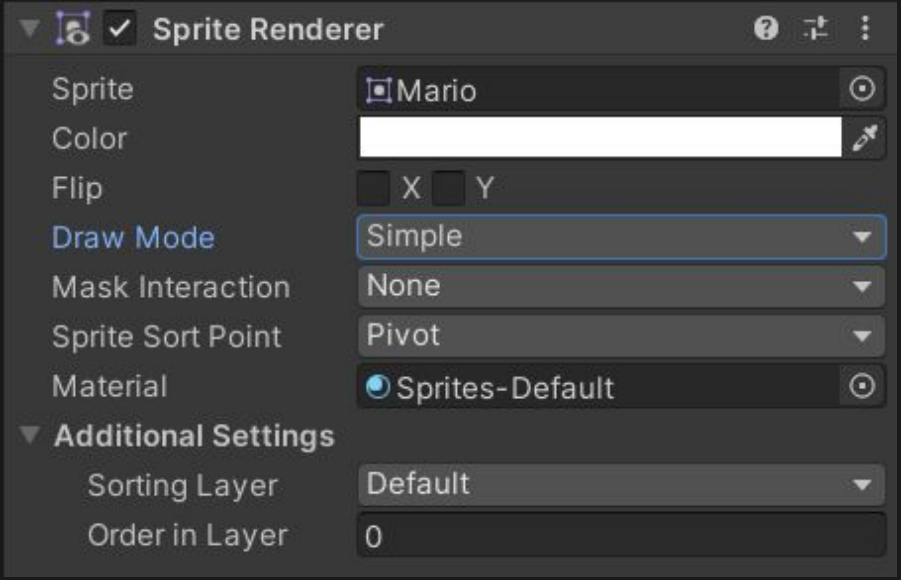
Sebastian Grygorczuk - STEM Institute at CCNY

Sprite Renderer

Sprite Renderer is the component through which we can draw the sprite.

The Sprite controls what Image is draw, like the mesh choosing the shape of the 3D object.

And Draw Mode dictates how it will be drawn and how scaling is dealt with. Simple will stretch and compress the image equally.

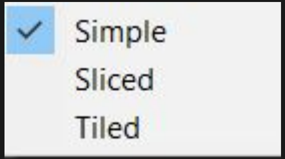


Sprite Renderer

Sprite	Mario
Color	
Flip	X Y
Draw Mode	Simple
Mask Interaction	None
Sprite Sort Point	Pivot
Material	Sprites-Default

Additional Settings

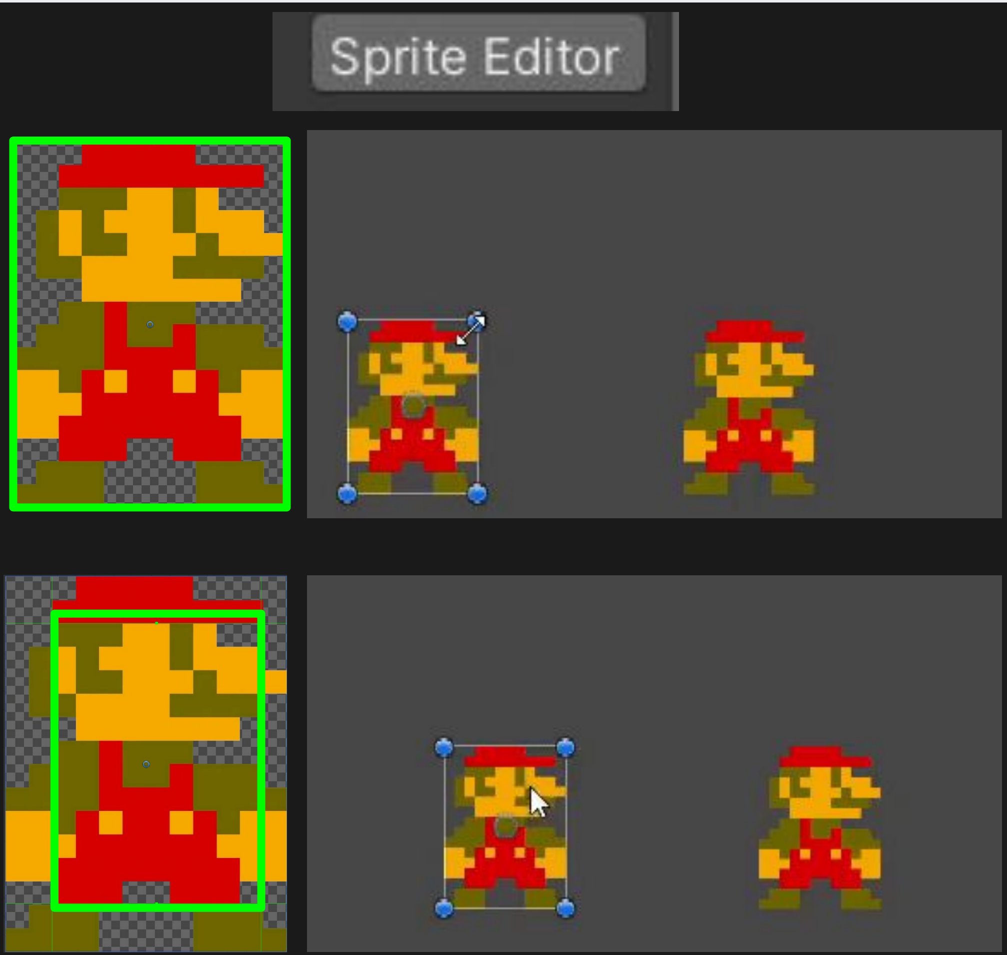
Sorting Layer	Default
Order in Layer	0



Sliced And Tiled

For Sliced and Tiled it's important to know that they are controlled by the 9 Slices box in the Sprite Editor while the Sprite is set for Single Sprite Mode.

Initially the box is filled out so that the center covers all of the image, however you can edit how it's framed such as making the center Marios body and that being are being affected by the Slice and Tiled Effects.



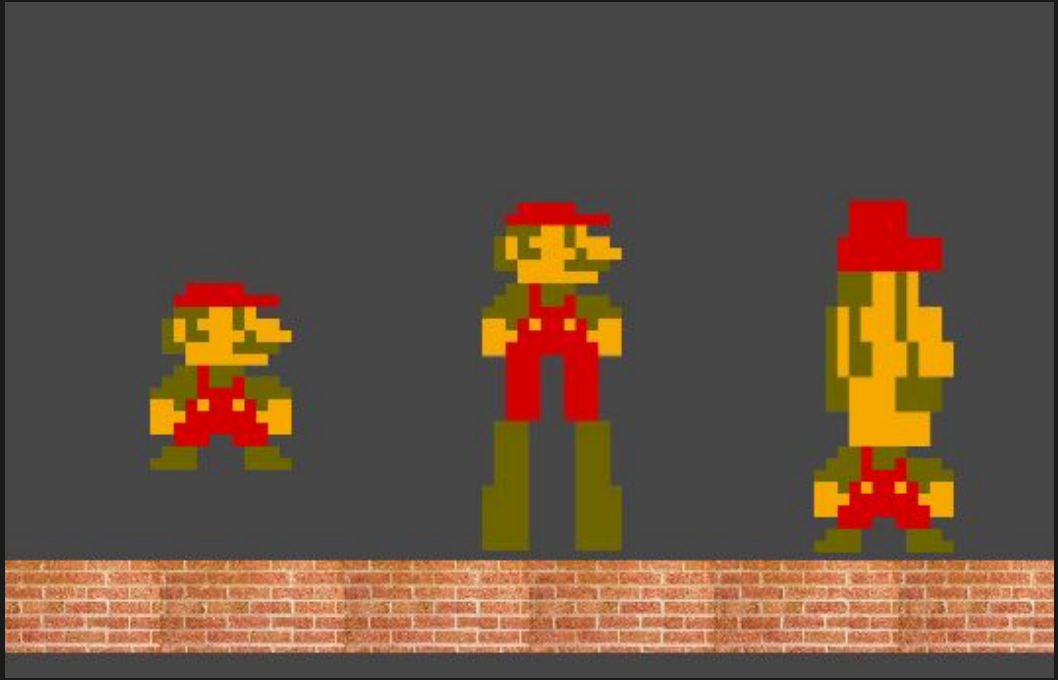
Challenge: Stretchy Mario

In Scene_Challange_0 there are three Marios and a brick wall sprite.

Each Mario has his own Sprite connected to him. Go into the Sprite Import Settings and Edit the 9 Points have center over leg and the other over the head.

Then in the Sprite Render for each Mario set them to Sliced and stretch the Marios.

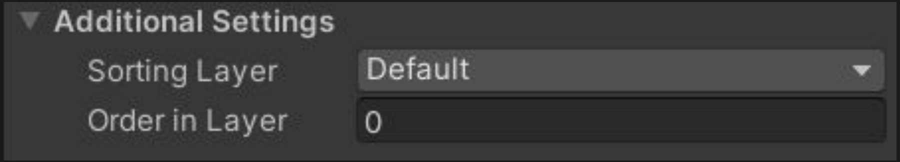
For the Brick set it to Tiled and build a platform for them to stand on.

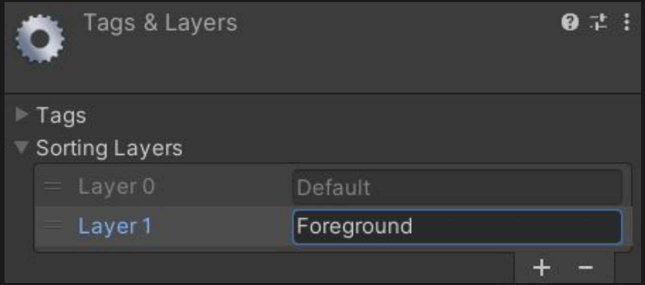


Layers

As there is no Third Axis for us to tell which image is further away from the camera the Sprite Renders has the Storting Layer option that tells us which Game Object has priority and should be drawn closer to the camera.

You can even make multiple sorting layers, for items in the foreground, background, or around the player.


Additional Settings
Sorting Layer: Default
Order in Layer: 0


Tags & Layers
Tags
Sorting Layers

Layer 0	Default
Layer 1	Foreground

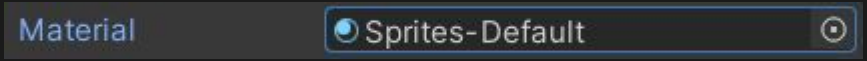
Sebastian Grygorczuk - STEM Institute at CCNY

Materials - Shaders

As you can see the Sprite Render uses a Material to draw you could swap in one of the Materials we've worked on but you will notice that the Sprite is distorted.

That's because the Material is meant for meshes not sprites. To give our sprite different ways of display you need to create a Shader.

Shaders are Scripts that calculator how the image should be drawn, in there you can specify that the material should cling to the Sprite while adding many material effects.



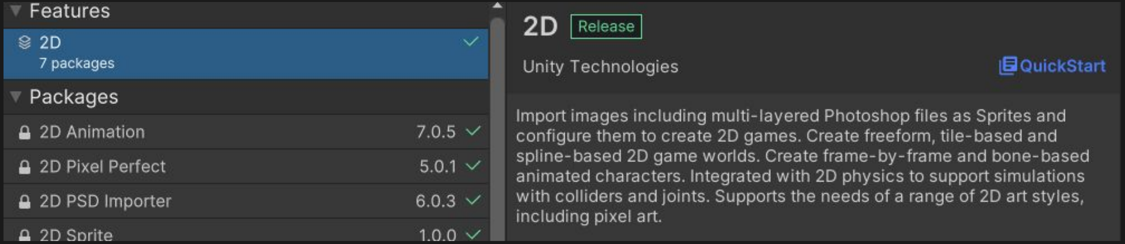
Material Sprites-Default

[Get started with 2D Shader Graph in Unity - Dissolve Tutorial]

2D Sprites Game Object

When Unity is created in 2D set up it also allows us to create premade 2D Game Objects, these weren't available to us in 3D beauce the 2D Package Manager isn't include in the set up.

You can always add this to the 3D projects but searching 2D in the Package Manager.


Features

2D
7 packages

Packages

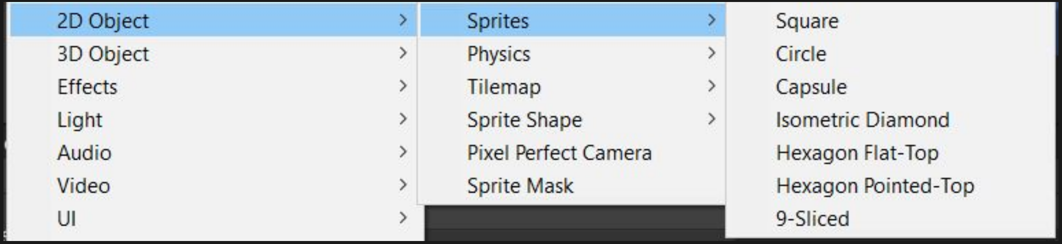
2D Animation	7.0.5	✓
2D Pixel Perfect	5.0.1	✓
2D PSD Importer	6.0.3	✓
2D Sprite	1.0.0	✓

2D Release

Unity Technologies

QuickStart

Import images including multi-layered Photoshop files as Sprites and configure them to create 2D games. Create freeform, tile-based and spline-based 2D game worlds. Create frame-by-frame and bone-based animated characters. Integrated with 2D physics to support simulations with colliders and joints. Supports the needs of a range of 2D art styles, including pixel art.

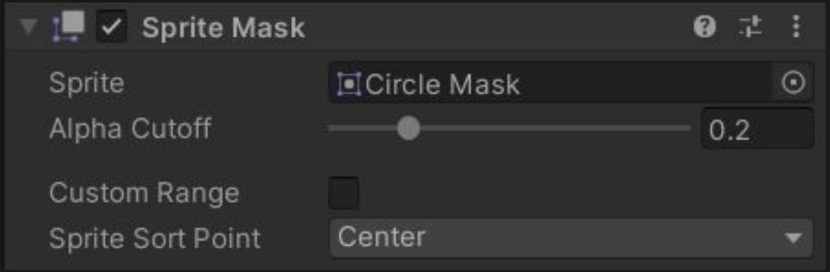


Sebastian Grygorczuk - STEM Institute at CCNY

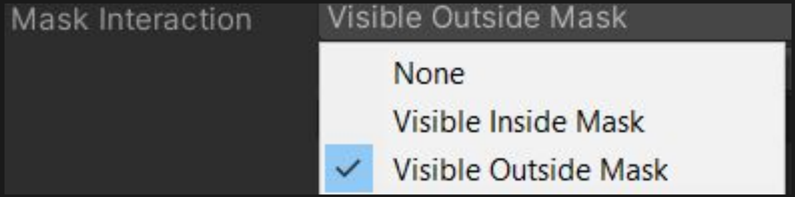
Sprite Masking

Sprite Masking is a great way to mess with the environment of the game. It allows items to be hidden until walked into, or disappear when you're near them, or even hide sprite behind sprites.

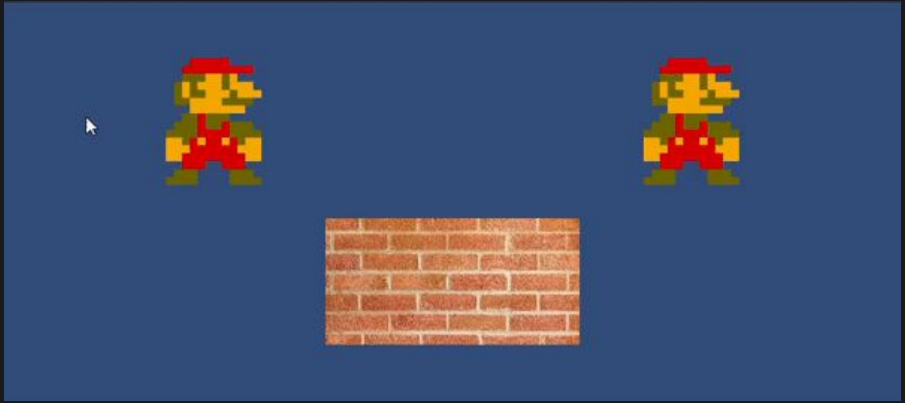
It's as simple as creating a Sprite Mask Game Object from the Hierarchy View, selecting what the shape you want the mask to be and then going to the Sprite Renders you want to be affect and selecting Inside, as second Mario or outside as third Mario.


Sprite Mask

Sprite	Circle Mask
Alpha Cutoff	0.2
Custom Range	
Sprite Sort Point	Center


Mask Interaction: Visible Outside Mask

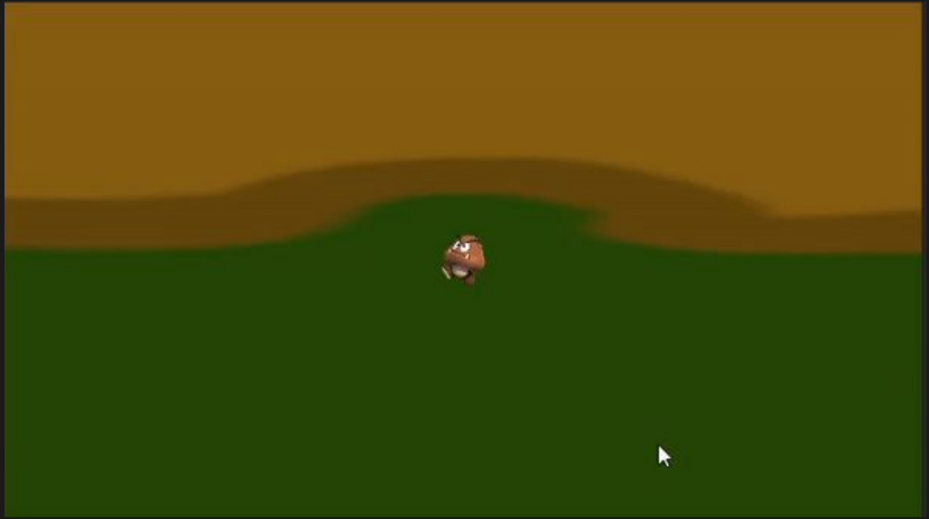
- None
- Visible Inside Mask
- ✓ Visible Outside Mask



Sebastian Grygorczuk - STEM Institute at CCNY

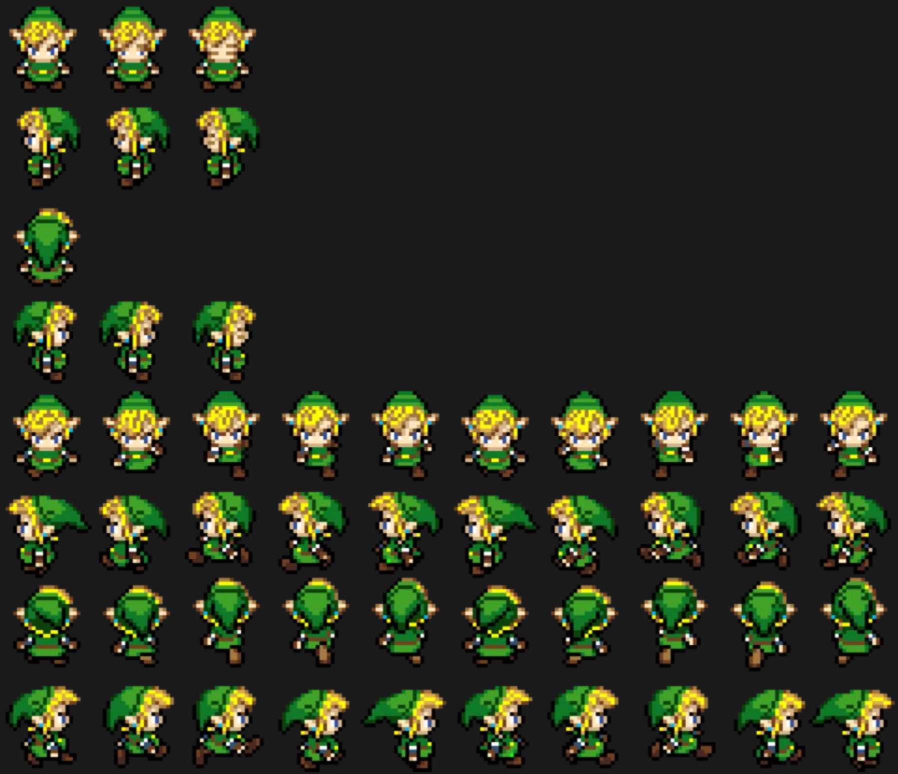
Challenge Masking

1. Go to Scene_Challange_1 and create a Masking Sprite, connect it to the Goomba.
2. Set the Roof Game Object Sprite Render to have the Visible Outside Mask that way the image is seen with cutouts whenever a Sprite Mask interacts with it.
3. Click Play and use WASD or Arrow keeps to move around and test out your mask.



Sprite Sheet

Having manage multiple of the same image can be headache. Many animation take several images to give the appearance of a character moving. For that we have Sprites Sheets. They're one image that has all of the desired sprites that we can divide up and use as it they we all individual image files.

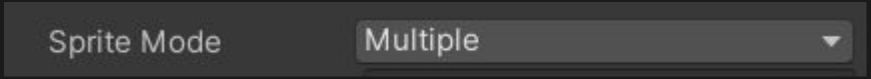


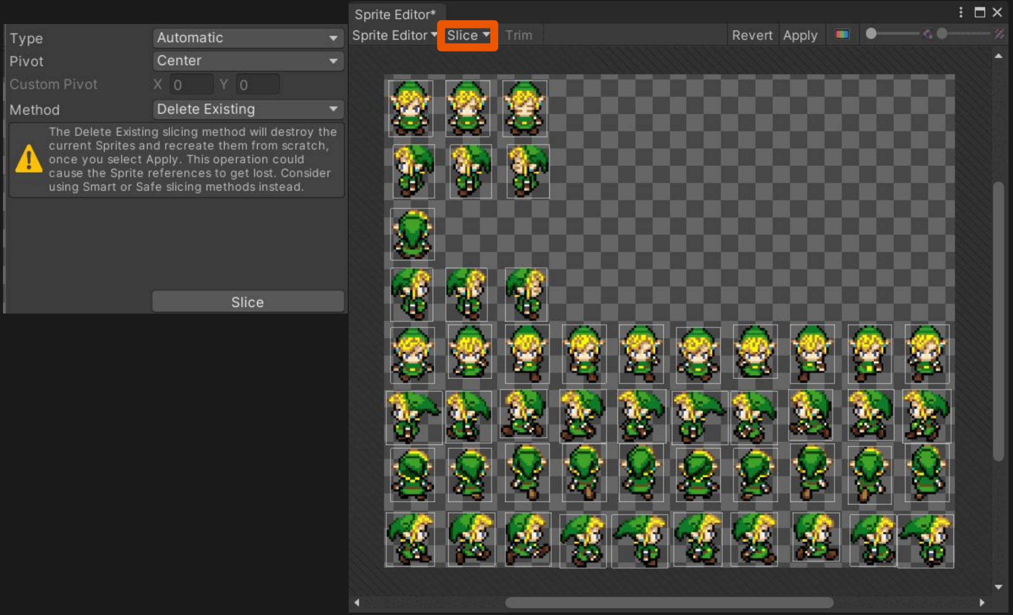
Sprite Editor

When you set your Image Import Setting of Sprite mode to Multiple and endter the Sprite Editor you will be able to slice the image into individual images.

You can do this by either Rubber Banding around the image or you can select Slice which will give you several ways to cut up the image. Automatic, by how big each cell should be or by how many cells you want in total.

Once you've separated all the images you will see that now you can see all of the individual images in the Project View.

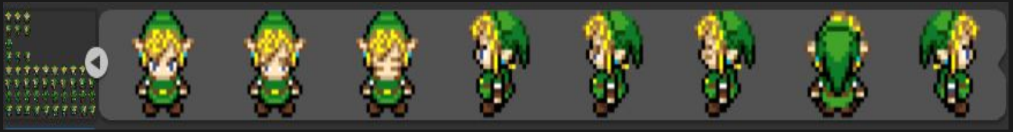

Sprite Mode: Multiple



Type: Automatic
Pivot: Center
Custom Pivot: X 0 Y 0
Method: Delete Existing

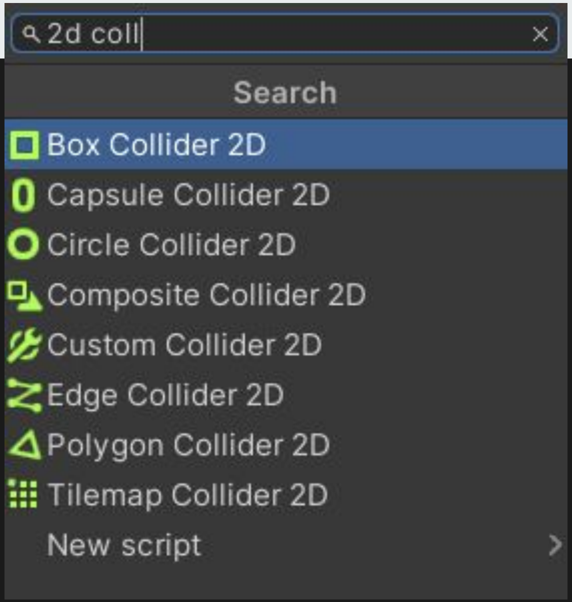
The Delete Existing slicing method will destroy the current Sprites and recreate them from scratch, once you select Apply. This operation could cause the Sprite references to get lost. Consider using Smart or Safe slicing methods instead.

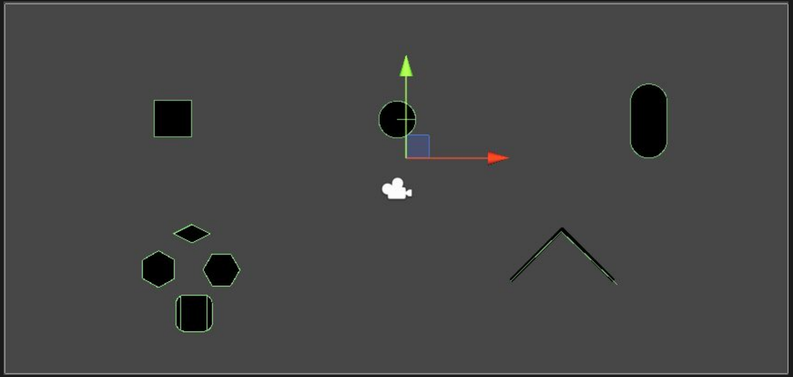
Slice



2D Collision

2D Colliders work very similarly to their 3D counterparts. With three basic one Box, Capsule and Circle with addition to Edge and Polygon collider that have exclusive properties.





Additional Resources: Collider 2D - Official Unity

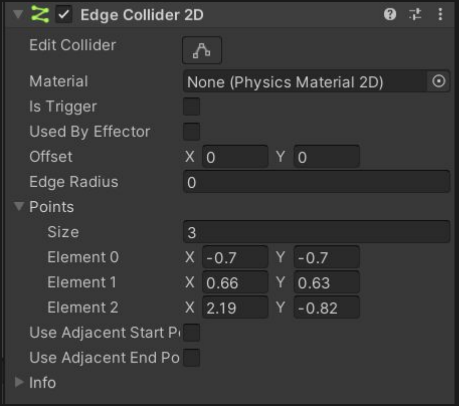
2D Edge and Polygon Colliders

The two new interesting colliders that we have at our disposal are the Edge and Polygon Colliders.

They share the same trait that you can just draw desired shape with main difference being that Edge Colliders can be left open while Polygon have to create a loop where the last point and first point connect.

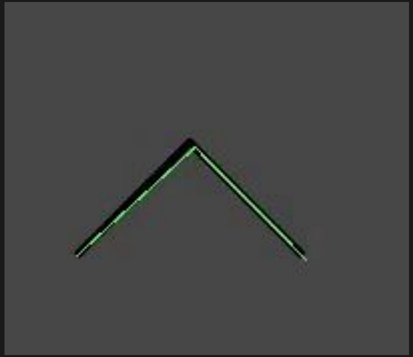
Adding a Polygon Collider to a given sprite will auto generate a composite that stimulates its shape.

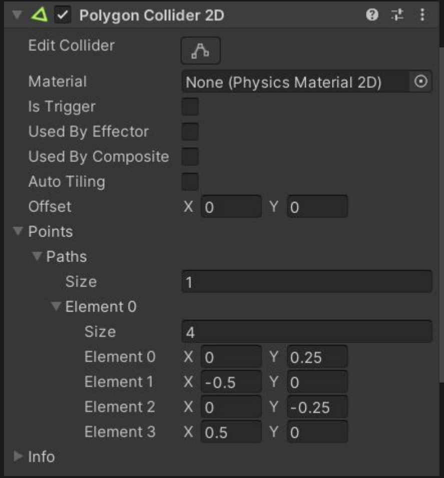
You can edit or add the vertices when Edit Collider Mode is toggles, and if you hold Left Ctrl you can delete the edges.



Edge Collider 2D

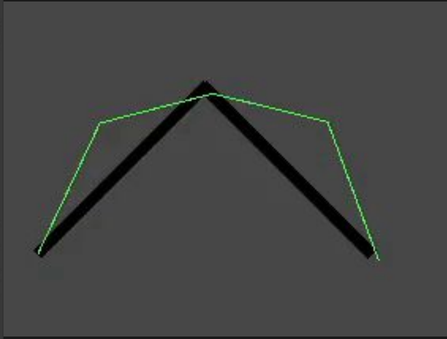
Edit Collider	
Material	None (Physics Material 2D)
Is Trigger	
Used By Effector	
Offset	X 0 Y 0
Edge Radius	0
Points	
Size	3
Element 0	X -0.7 Y -0.7
Element 1	X 0.66 Y 0.63
Element 2	X 2.19 Y -0.82
Use Adjacent Start P	
Use Adjacent End Po	
Info	





Polygon Collider 2D

Edit Collider	
Material	None (Physics Material 2D)
Is Trigger	
Used By Effector	
Used By Composite	
Auto Tiling	
Offset	X 0 Y 0
Points	
Paths	
Size	1
Element 0	
Size	4
Element 0	X 0 Y 0.25
Element 1	X -0.5 Y 0
Element 2	X 0 Y -0.25
Element 3	X 0.5 Y 0
Info	



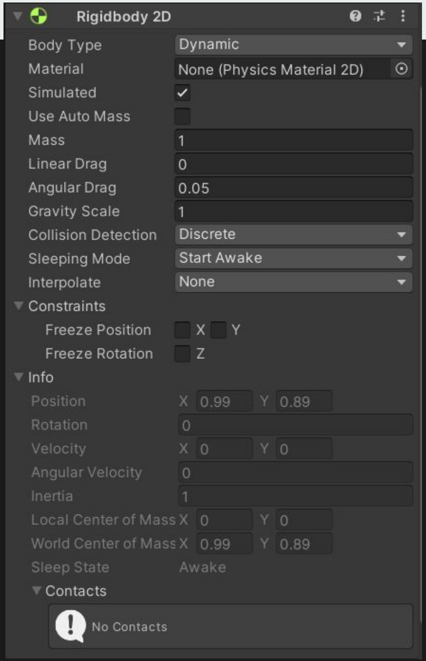
Sebastian Grygorczuk - STEM Institute at CCNY

2D Rigidbody

2D Rigidbody work very similarly to the 3D one. You may have notice that unlike 3D Rigidbody the component doesn't have a toggle next to the name, this one can be controlled using the Sleeping Mode.

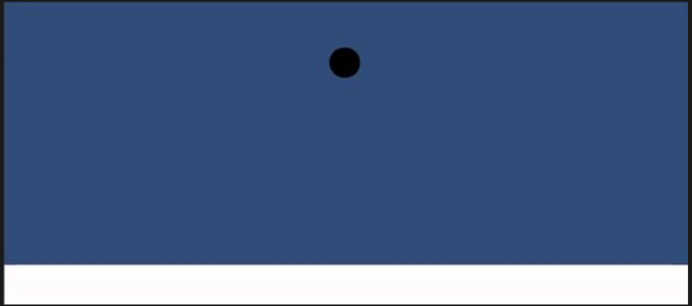
Additional Resources: Rigidbody 2D - Official Unity Tutorial

Sebastian Grygorczuk - STEM Institute at CCNY


Rigidbody 2D

Body Type	Dynamic
Material	None (Physics Material 2D)
Simulated	✓
Use Auto Mass	
Mass	1
Linear Drag	0
Angular Drag	0.05
Gravity Scale	1
Collision Detection	Discrete
Sleeping Mode	Start Awake
Interpolate	None
Constraints	
Freeze Position	X Y
Freeze Rotation	Z
Info	
Position	X 0.99 Y 0.89
Rotation	0
Velocity	X 0 Y 0
Angular Velocity	0
Inertia	1
Local Center of Mass	X 0 Y 0
World Center of Mass	X 0.99 Y 0.89
Sleep State	Awake
Contacts	

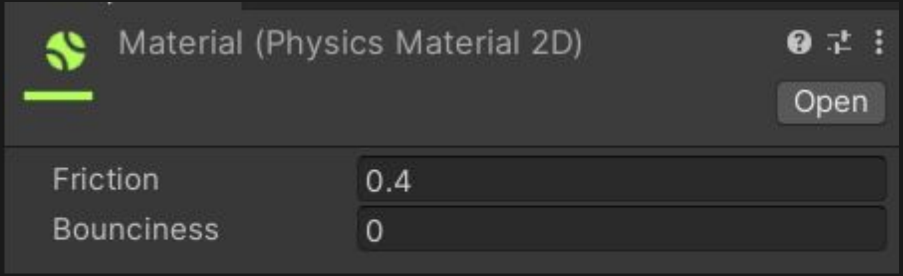
No Contacts



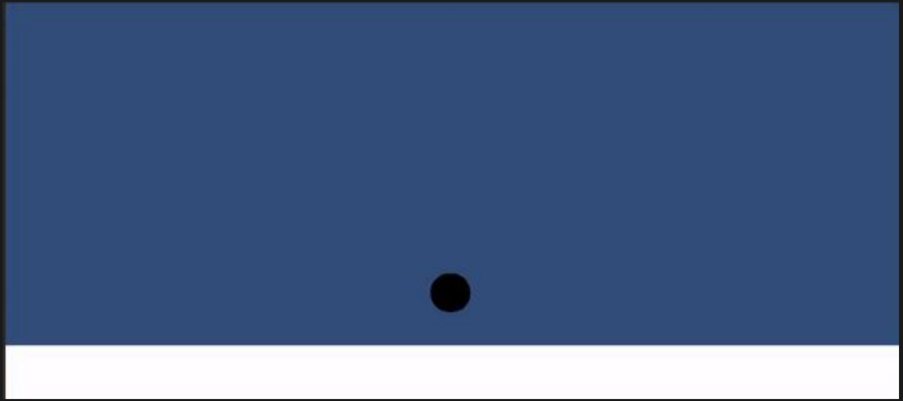
2D Physics Material

2D Object just like 3D have Physics Materials you can attach to them, work the same way with less options.

Just friction and bounciness you can attach to the object.

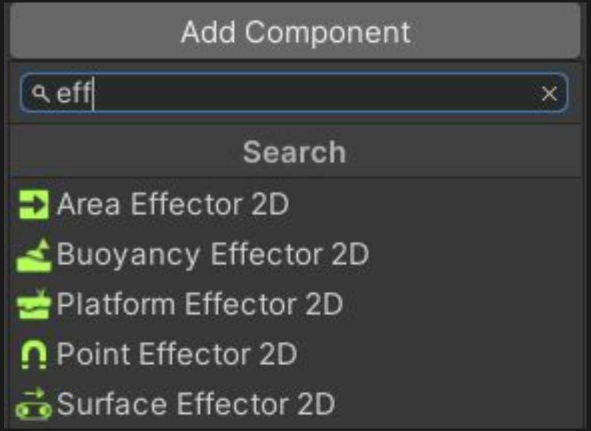

Material (Physics Material 2D)

Friction	0.4
Bounciness	0



2D Effectors

2D Colliders have a unique connection called Effectors, effectors are additional Physics components that continuously exert a force. There five of them, Surface, Area, Buoyancy, Platform and Point.



Additional Resources: [2D EFFECTORS in Unity - Tutorial]

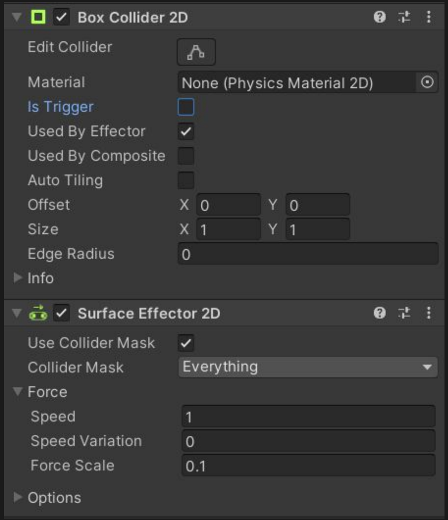
2D Effectors - Surface Effector

The Surface Effector gives a constant speed in the X axis, this is connected to the white platform and requires only the effect to be toggled on the box collider.

The Speed Variable will send it left or right depending on if the value is negative or positive.

The Force Scale is how fast the object accelerates towards the specivided speed

The Speed Variation is any sudden upticks that occur while accelerating toward given speed.



Box Collider 2D ✓

Edit Collider	
Material	None (Physics Material 2D)
Is Trigger	☐
Used By Effector	✓
Used By Composite	☐
Auto Tiling	☐
Offset	X 0 Y 0
Size	X 1 Y 1
Edge Radius	0
Info	

Surface Effector 2D ✓

Use Collider Mask	✓
Collider Mask	Everything
Force	
Speed	1
Speed Variation	0
Force Scale	0.1
Options	

Sebastian Grygorczuk - STEM Institute at CCNY

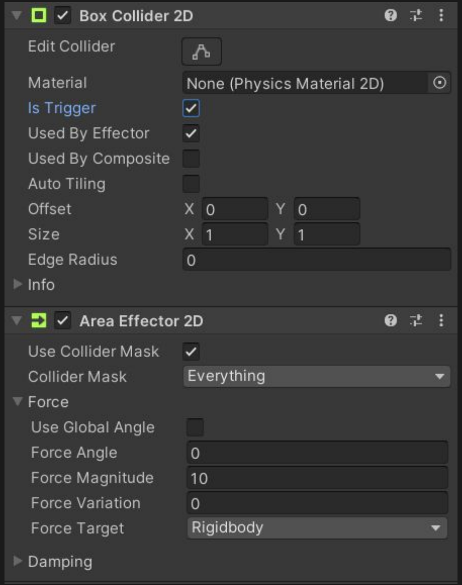
2D Effectors - Area Effector

The Area Collider will apply a force force in a give direction to any object that enters it. This requires the Box Collider to have both the Trigger and Effector Toggled.

The Force Angle is which way the object will be sent, with 0 being X axis.

The Force Mangicture is how much force is put into the object.

And Force Variation is how much can be randomly added to the force, if negative how much randomly will be taken away.

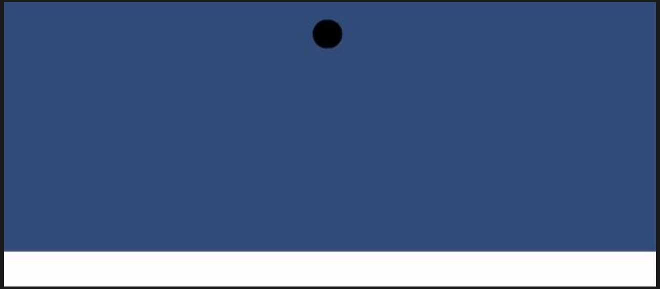


Box Collider 2D

Edit Collider	
Material	None (Physics Material 2D)
Is Trigger	✓
Used By Effector	✓
Used By Composite	
Auto Tiling	
Offset	X 0 Y 0
Size	X 1 Y 1
Edge Radius	0
Info	

Area Effector 2D

Use Collider Mask	✓
Collider Mask	Everything
Force	
Use Global Angle	
Force Angle	0
Force Magnitude	10
Force Variation	0
Force Target	Rigidbody
Damping	



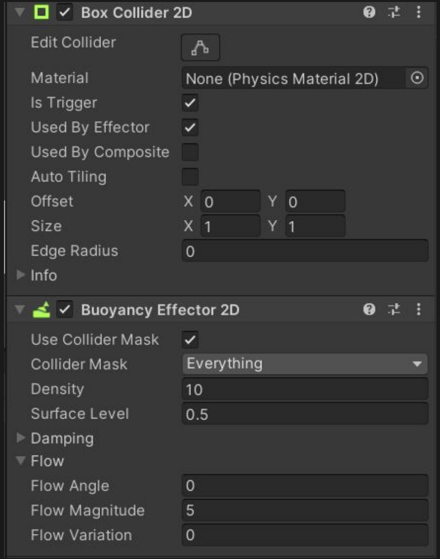
Sebastian Grygorczuk - STEM Institute at CCNY

2D Effectors - Buoyancy Effector

The Buoyancy Effector is great at simulating a bodies of water. It requires the Box Collider to have Trigger and Effector on.

Density determines how if the object that lands in it will sink or float. While Surface Level will determine how much of the object will stay above water when floating.

It also has Flow menu that use the same ideas as the Surface Effector adding force to left or right of the collider to push the object.

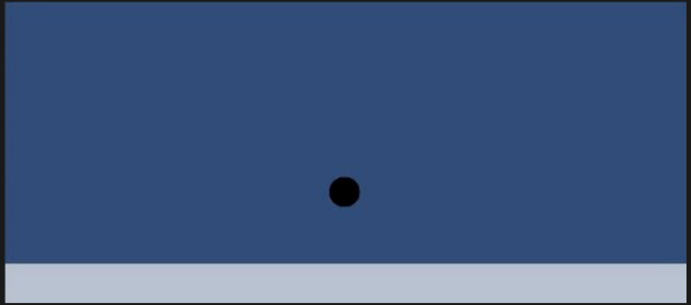


Box Collider 2D

Edit Collider	
Material	None (Physics Material 2D)
Is Trigger	✓
Used By Effector	✓
Used By Composite	
Auto Tiling	
Offset	X 0 Y 0
Size	X 1 Y 1
Edge Radius	0
Info	

Buoyancy Effector 2D

Use Collider Mask	✓
Collider Mask	Everything
Density	10
Surface Level	0.5
Damping	
Flow	
Flow Angle	0
Flow Magnitude	5
Flow Variation	0



Sebastian Grygorczuk - STEM Institute at CCNY

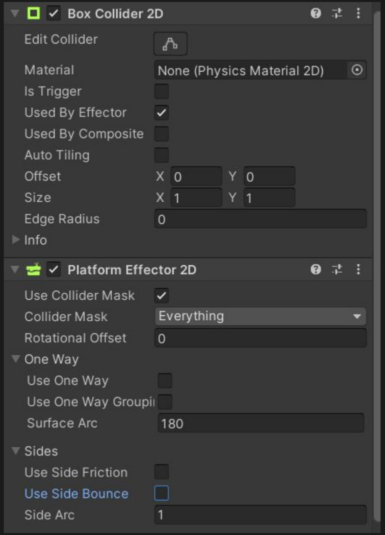
2D Effectors - Platform Effector

Platform Effector or One Way Platform allows us to create the effect where the play can jump through one side of the platform while keeping the other one solid.

Rotation Offset set which direction it should be facing.

Surface Arc determines which area should count as solid surface.

Sides allow you to control what the behavior should be when something collides with the platforms side.

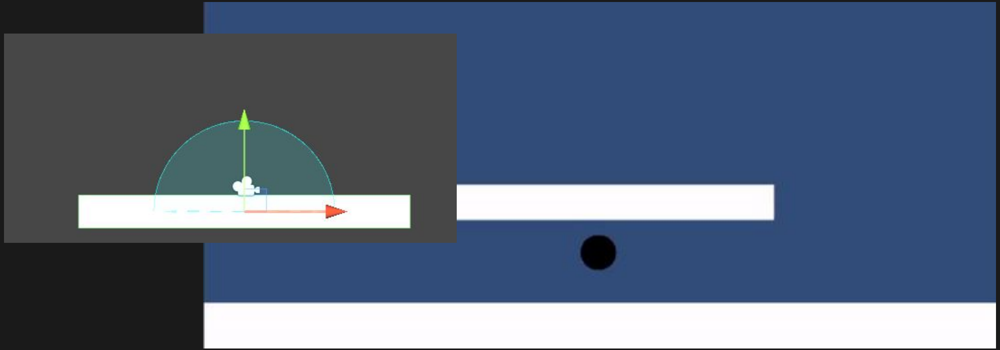


Box Collider 2D

Edit Collider	
Material	None (Physics Material 2D)
Is Trigger	☐
Used By Effector	✓
Used By Composite	☐
Auto Tiling	☐
Offset	X 0 Y 0
Size	X 1 Y 1
Edge Radius	0
Info	

Platform Effector 2D

Use Collider Mask	✓
Collider Mask	Everything
Rotational Offset	0
One Way	
Use One Way	☐
Use One Way Groupi	☐
Surface Arc	180
Sides	
Use Side Friction	☐
Use Side Bounce	☐
Side Arc	1



Sebastian Grygorczuk - STEM Institute at CCNY

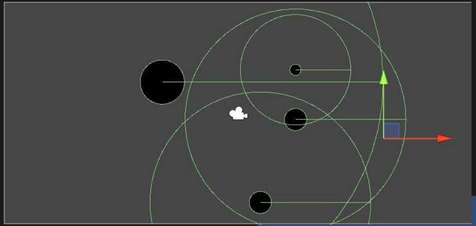
2D Effectors - Point Effector

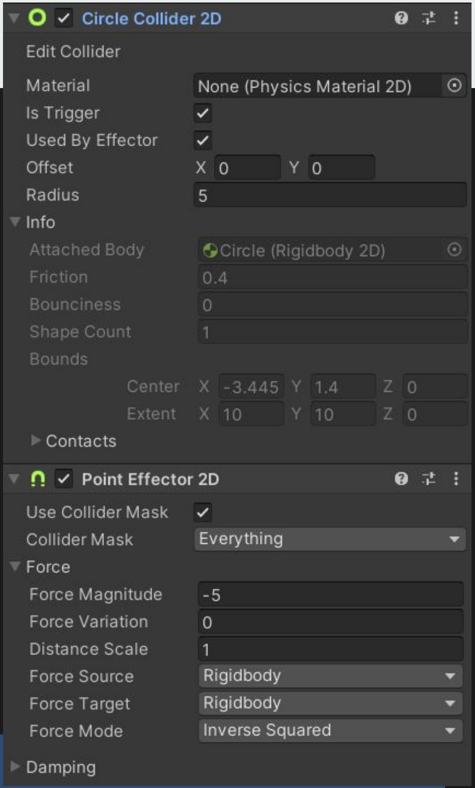
Point Effector is very different from others, it create attraction or repulsion force between objects.

Force Magnitude tell us how strong the pull/push is.

And Force Mode allows us to determine at what rate should the force be applied.

As you see the circles have two colliders, on for actually colluding and a larger one for the effector to give range for the force to act upon.





Circle Collider 2D

Edit Collider

Material	None (Physics Material 2D)
Is Trigger	✓
Used By Effector	✓
Offset	X 0 Y 0
Radius	5
Info	
Attached Body	Circle (Rigidbody 2D)
Friction	0.4
Bounciness	0
Shape Count	1
Bounds	
Center	X -3.445 Y 1.4 Z 0
Extent	X 10 Y 10 Z 0
Contacts	

Point Effector 2D

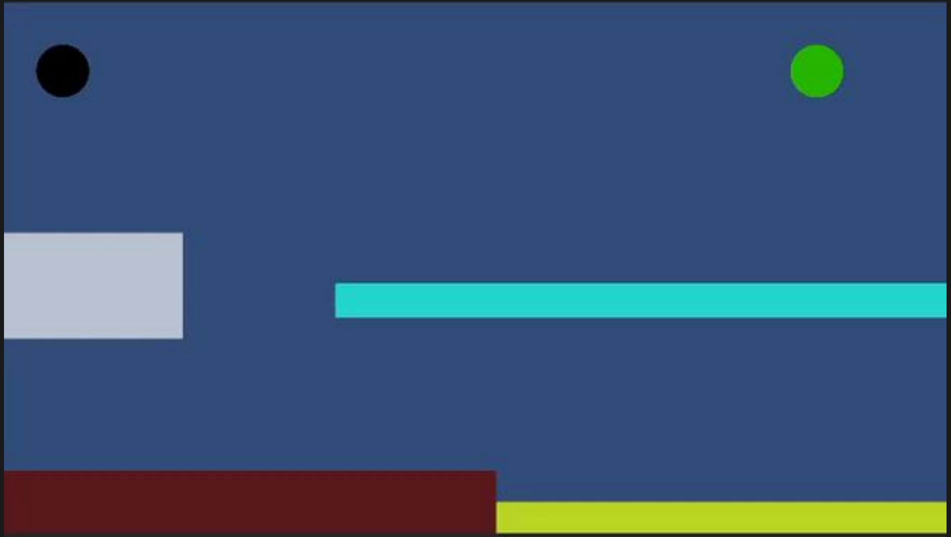
Use Collider Mask	✓
Collider Mask	Everything
Force	
Force Magnitude	-5
Force Variation	0
Distance Scale	1
Force Source	Rigidbody
Force Target	Rigidbody
Force Mode	Inverse Squared
Damping	

Sebastian Grygorczuk - STEM Institute at CCNY

Challenge Effectors

Using the different effectors have the black circle move around the level. By:

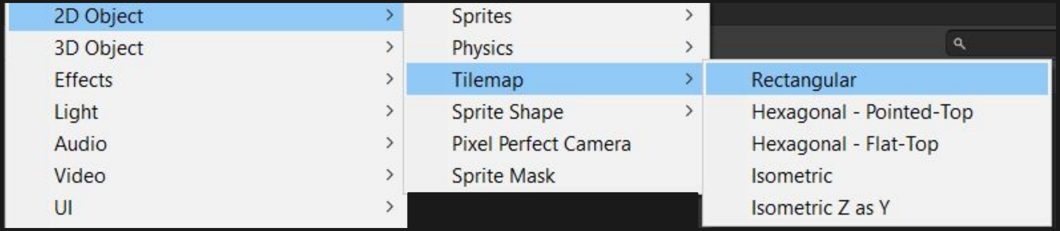
1. Connect the Buoyancy Effector to the White Rectangle to slow down the fall of the Circle.
2. Connect Surface Effector to the Red Rectangle to move the Circle to the Right
3. Connect Area Effector to the Yellow Rectangle to send the Circle Flying Upwards
4. Connect Platform Effector to the Teal Rectangle so the Circle can pass through it.
5. Connect Point Effector to the Green Circle so the Black circle can orbit it.

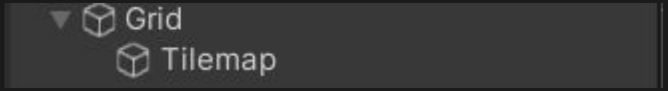


What is a Tilemap

Tilemap is a map draw from tiles. We take small sprite and line them up together to create the world of the game.

When creating a tilemap you will also instantly create a Grid that the tile map will be a child to. Everything that's draw on the tilemap will link to the Grid.



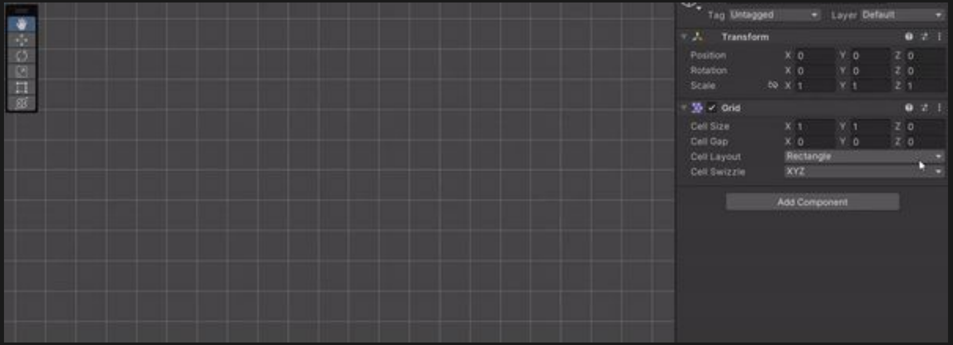


Sebastian Grygorczuk - STEM Institute at CCNY

The Gird

The Grid can be configured in three ways, Rectuagl, Hexagonal and Isometric. Depending on the style of game you should choose appropriate grid type. The main three being Rectangular, Hexagonal, and Isometric.

You also can control the size of each cell in the grid and if there should be any spacing between the tiles.



Tag: Untagged — Layer: Default

Transform			
Position	X 0	Y 0	Z 0
Rotation	X 0	Y 0	Z 0
Scale	X 1	Y 1	Z 1

✓ Grid			
Cell Size	X 1	Y 1	Z 0
Cell Gap	X 0	Y 0	Z 0
Cell Layout	Rectangle		
Cell Swizzle	XYZ		

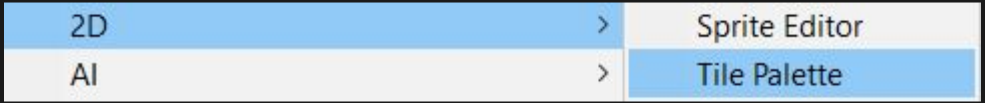
The Palette

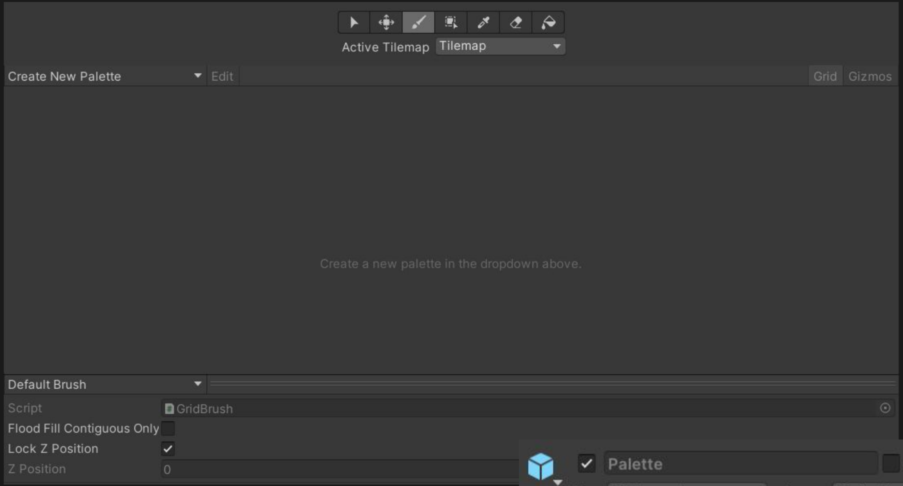
To draw on the tilemap you will first have to open up the Tile Palette View. Go to Window -> 2D -> Tile Pallet.

This give you the control screen that will allow you to crate a pallet.

Choose appropriate dimensions for the pallet that work with the gird you created.

This will create a Palette Prefab that will have same components as the grid.



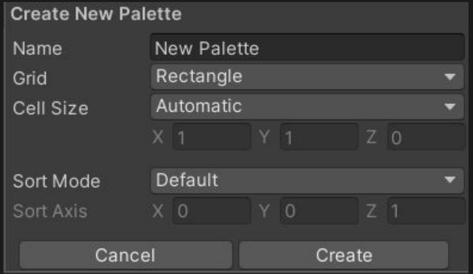

Active Tilemap: Tilemap

Create New Palette | Edit | Grid | Gizmos

Create a new palette in the dropdown above.

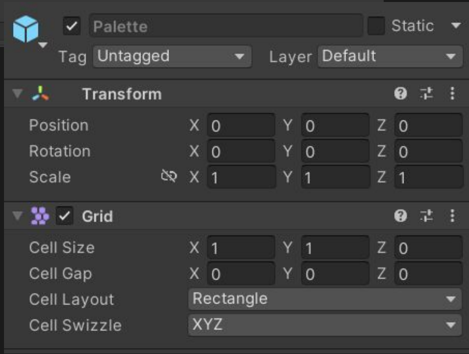
Default Brush

Script	GridBrush
Flood Fill Contiguous Only	
Lock Z Position	✓
Z Position	0


Create New Palette

Name	New Palette
Grid	Rectangle
Cell Size	Automatic
	X 1 Y 1 Z 0
Sort Mode	Default
Sort Axis	X 0 Y 0 Z 1

Cancel | Create


✓ Palette | Static

Tag Untagged | Layer Default

Transform

	X	Y	Z
Position	0	0	0
Rotation	0	0	0
Scale	1	1	1

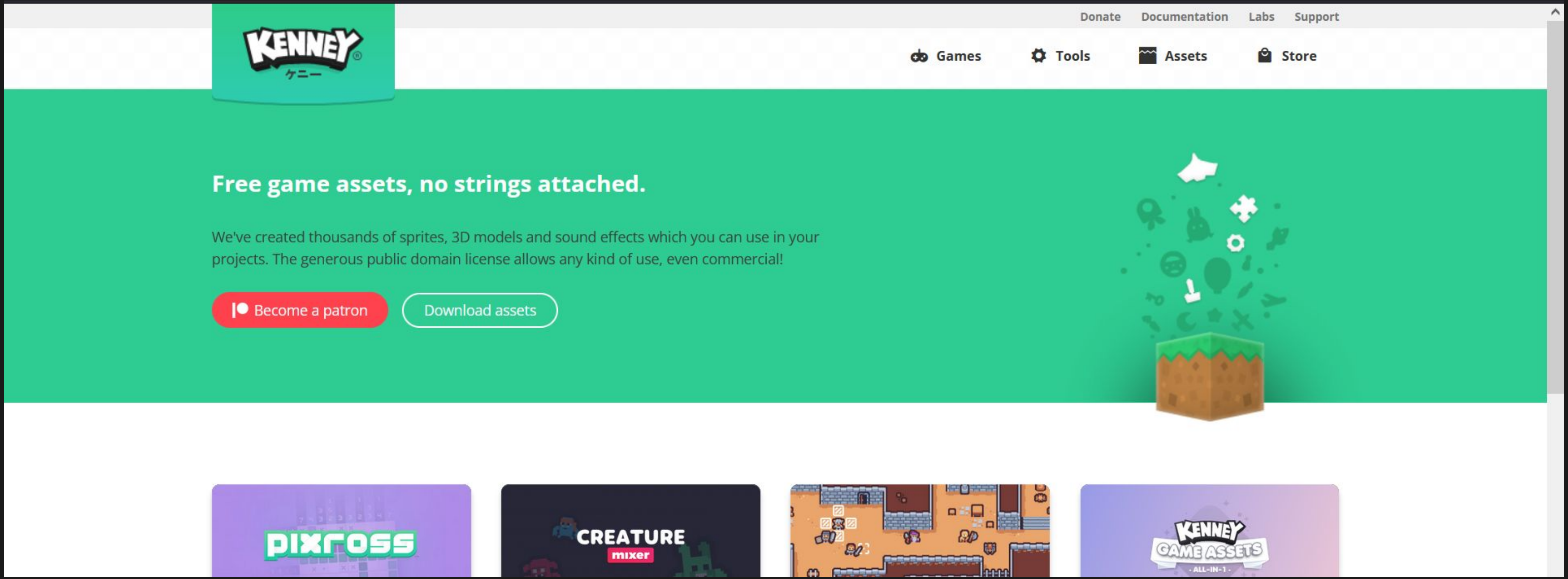
✓ Grid

	X	Y	Z
Cell Size	1	1	0
Cell Gap	0	0	0

Cell Layout	Rectangle
Cell Swizzle	XYZ

Sebastian Grygorczuk - STEM Institute at CCNY

Kenney



Free game assets, no strings attached.

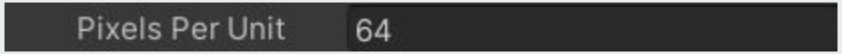
We've created thousands of sprites, 3D models and sound effects which you can use in your projects. The generous public domain license allows any kind of use, even commercial!

Kenney is a game asset creation group from which you can get assets for your 2D and 3D games.

Feel free to explore the website: https://www.kenney.nl/

We're going to be using Top-down Tanks Redux Asset Set for tiling

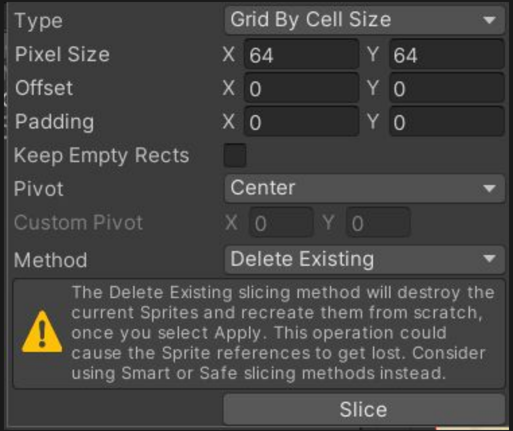
Tile Sheet



Pixels Per Unit 64

Once you have the palette set up you will need the Tile Sheet, the sprite that you will input into the Palette.

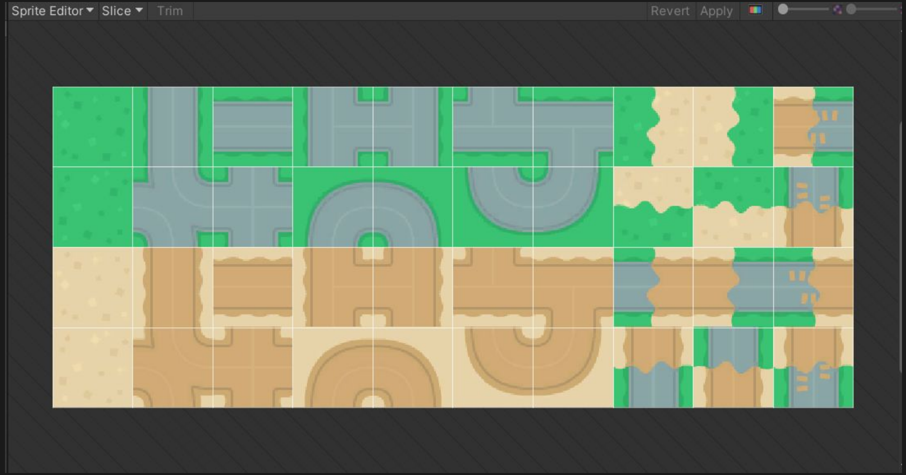
To make sure your image works correctly first make sure that the Pixel Per Unit is equal to the size of each cell, in this case the cells are 64x64.



Type	Grid By Cell Size			
Pixel Size	X	64	Y	64
Offset	X	0	Y	0
Padding	X	0	Y	0
Keep Empty Rects				
Pivot	Center			
Custom Pivot	X	0	Y	0
Method	Delete Existing			

The Delete Existing slicing method will destroy the current Sprites and recreate them from scratch, once you select Apply. This operation could cause the Sprite references to get lost. Consider using Smart or Safe slicing methods instead.

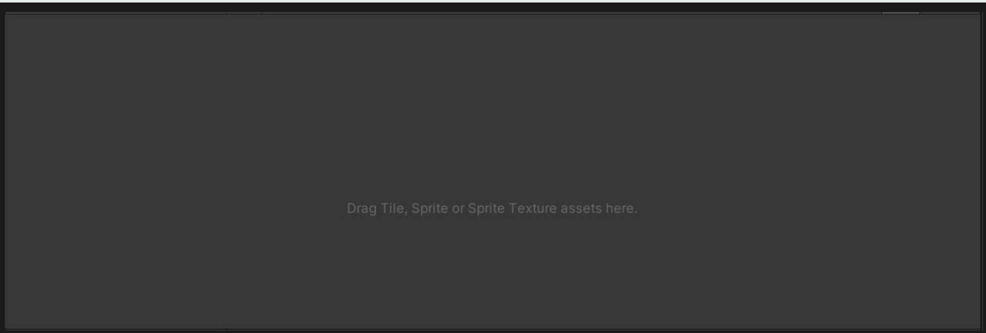
Slice

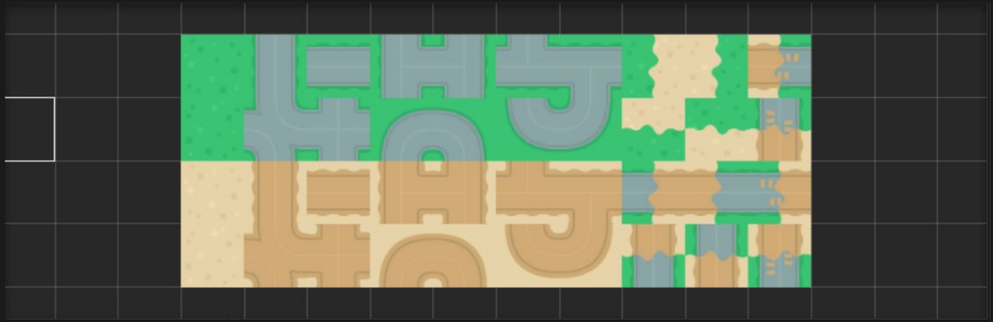


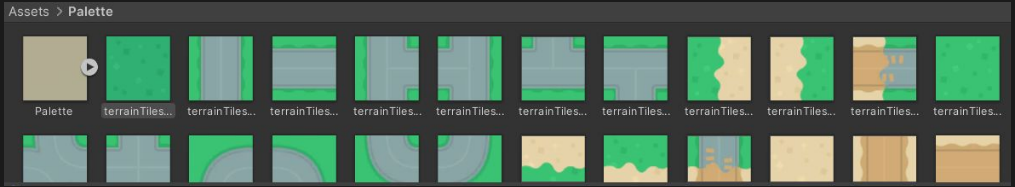
Sebastian Grygorczuk - STEM Institute at CCNY

Tile Sheet

Once your Sprite is correctly configured you can drag the parent sprite to the Pallet window and it will create Tile Assets. Have a folder ready as each cut out will have its own asset created.


Drag Tile, Sprite or Sprite Texture assets here.

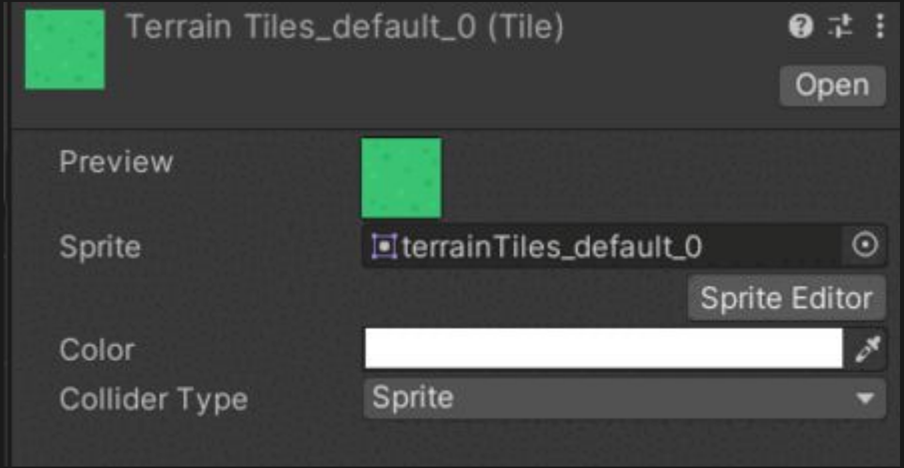




Tile Asset

The Tile Asset gives you control over changing what sprite is used and in what color it should be rendered.

Any changes you make will be immediately reflected in the pallet.


Terrain Tiles_default_0 (Tile)

Open

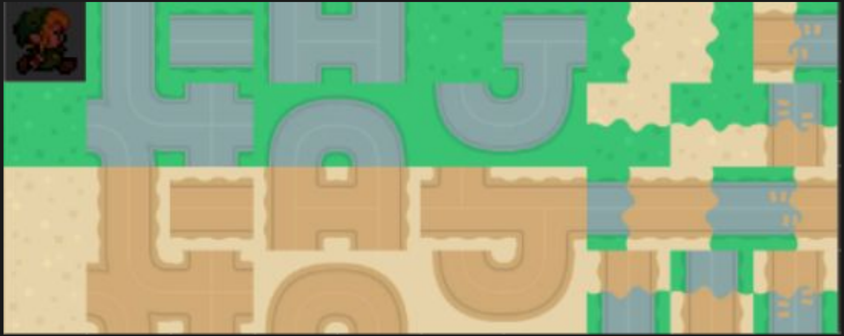
Preview

Sprite: terrainTiles_default_0

Sprite Editor

Color

Collider Type: Sprite



Challenge: Create a Tilemap

Create Tilemap from this Sprite in Sprite Folder.

1) Go to the Sprite Import Settings and change the mode to Multiple
2) The tiles in this Image are 16x16 so make sure that Pixel Per Unit is set to 16 other side the tiles won't fill up the entire square.
3) Open Sprite Editor and set it to Slice with 16x16 grids.
4) Create a new folder to store the Palette.
5) Create a new Palette using the Tilemap View and place it in your folder.
6) Drag and Drop the Sprite Sheet into the Palette.

0 1 2 3 4
5 6 7 8 9

Tilemap Components

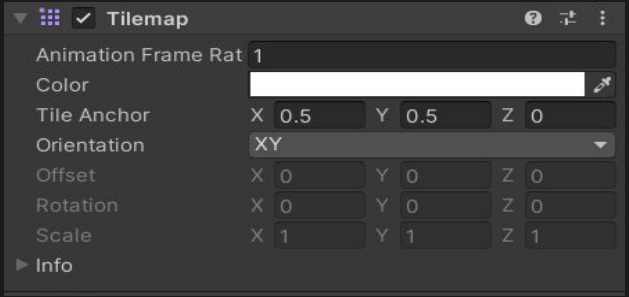
A Tilemap always comes with two components, Tilemap and Tilemap Render.

Tilemap acts as an internal Transform for the tiles draw on, with few rendering actions such as color and Animation Frame Rate, which we won't bother with at the moment.

You also have the power to change the plane the tiles are drawn on using Orientation.

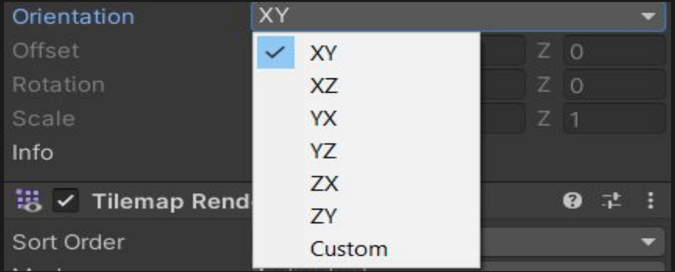
Additional Resources: Tilemap

Sebastian Grygorczuk - STEM Institute at CCNY

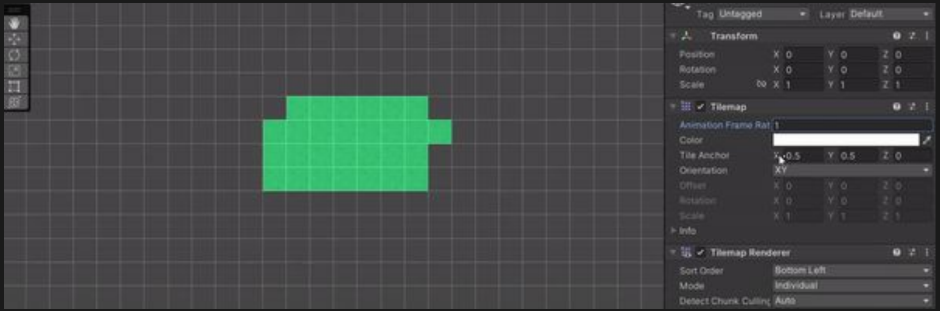


Tilemap

Animation Frame Rat	1					
Color						
Tile Anchor	X	0.5	Y	0.5	Z	0
Orientation	XY					
Offset	X	0	Y	0	Z	0
Rotation	X	0	Y	0	Z	0
Scale	X	1	Y	1	Z	1
Info						



Orientation: XY



Tag: Untagged Layer: Default

Transform

Position	X	0	Y	0	Z	0
Rotation	X	0	Y	0	Z	0
Scale	X	1	Y	1	Z	1

Tilemap

Animation Frame Rat	1					
Color						
Tile Anchor	X	0.5	Y	0.5	Z	0
Orientation	XY					
Offset	X	0	Y	0	Z	0
Rotation	X	0	Y	0	Z	0
Scale	X	1	Y	1	Z	1
Info						

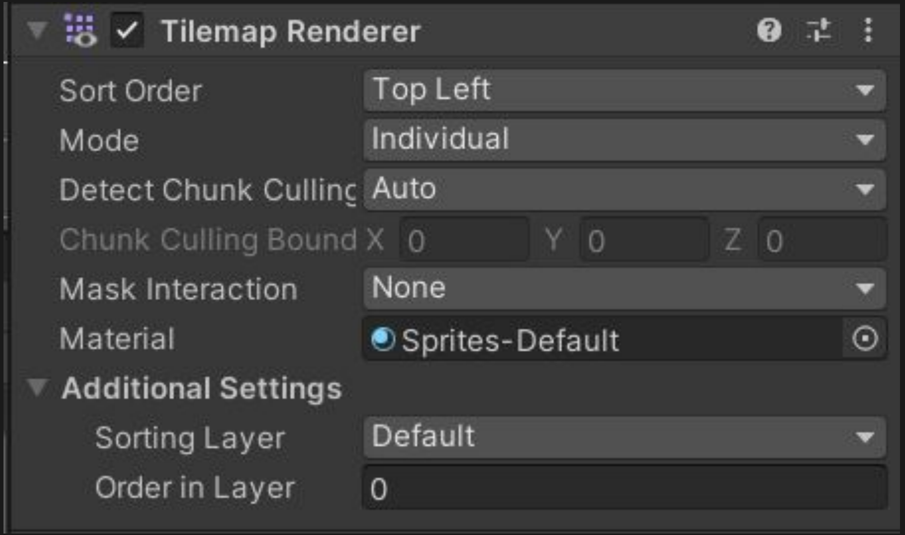
Tilemap Renderer

Sort Order	Bottom Left
Mode	Individual
Detect Chunk Culling	Auto

Tilemap Renderer

Tile Renderer controls what get drawn and how. Sort Order tells us which Tiles will be drawn first, so if Top Left is Sort order that's where the drawing starts. Mode tells us how should they be draw, each tile on its own or in chunks. And Detect Chunk Culling will tell Unity how close the player has to be for it to be drawn. Think of it as Billboarding in 3D.

In addition to that it has our familiar Sprite controls of material, masking and layer sorting.



Tilemap Renderer

Sort Order	Top Left
Mode	Individual
Detect Chunk Culling	Auto
Chunk Culling Bound	X 0 Y 0 Z 0
Mask Interaction	None
Material	Sprites-Default

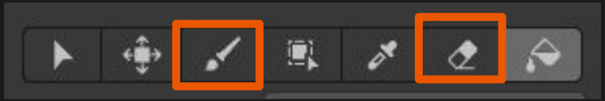
Additional Settings

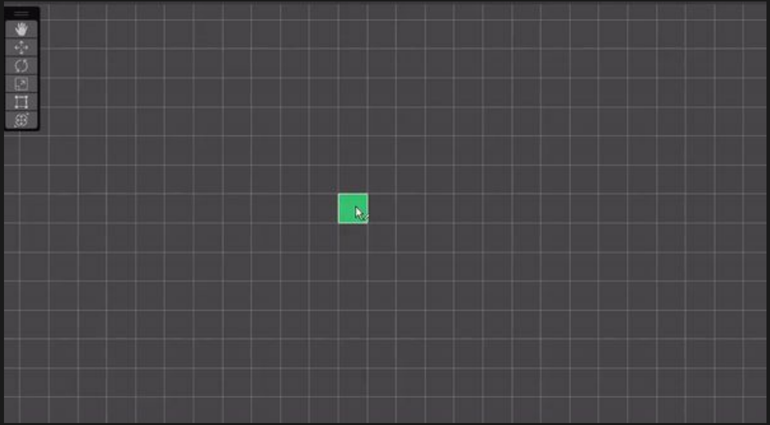
Sorting Layer	Default
Order in Layer	0

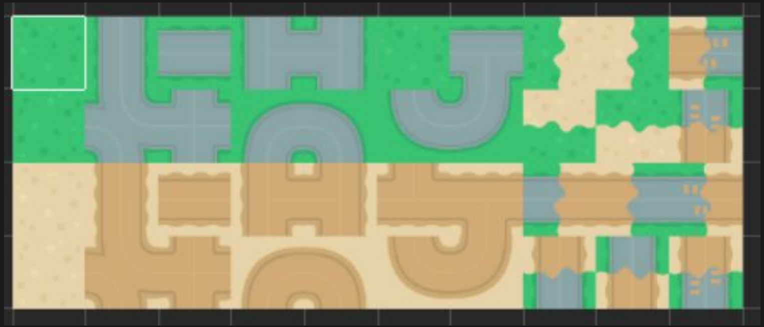
Painting

Now that we're all set up select a tile and use the Brush Tool to start painting your map.

You can also erase any tiles drawn by either selecting the Eraser Tool or holding Left Shift while painting.





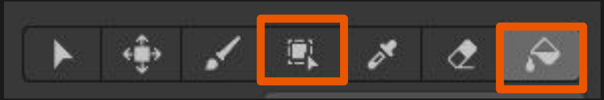


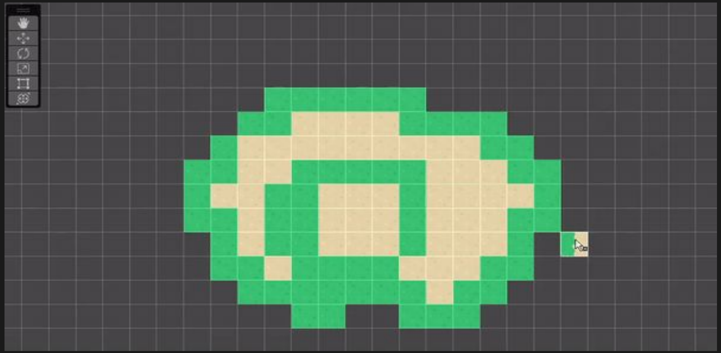
Sebastian Grygorczuk - STEM Institute at CCNY

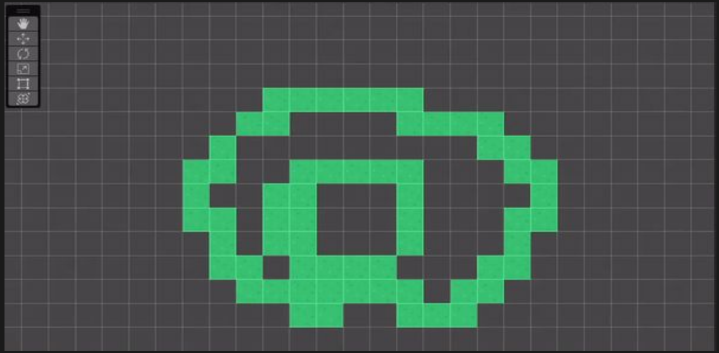
Rectangle and Fill Tool

At your disposal you also have the Rectangle Tool which will copy the same Tile or Tiled Area of the Rectangle Spot you create.

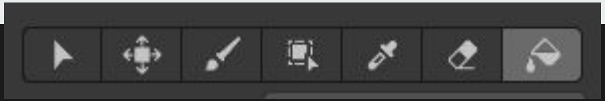
And the Fill Bucket which will paint all of the tiles that color as long as there's a space connecting them.

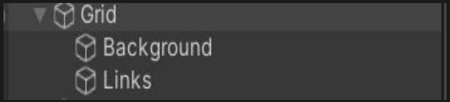


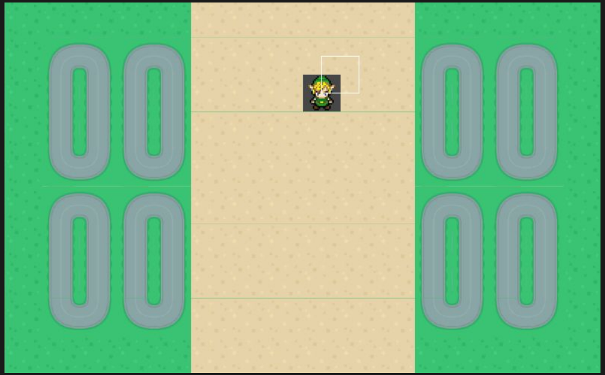




Layering Maps

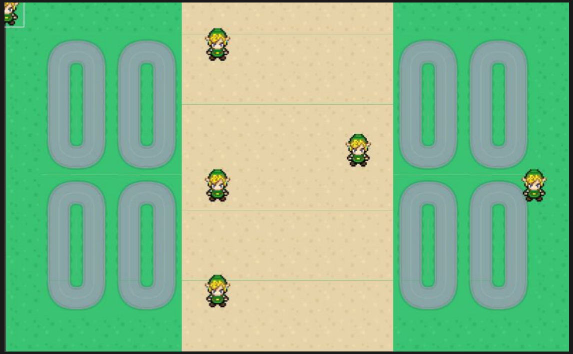




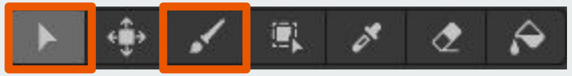


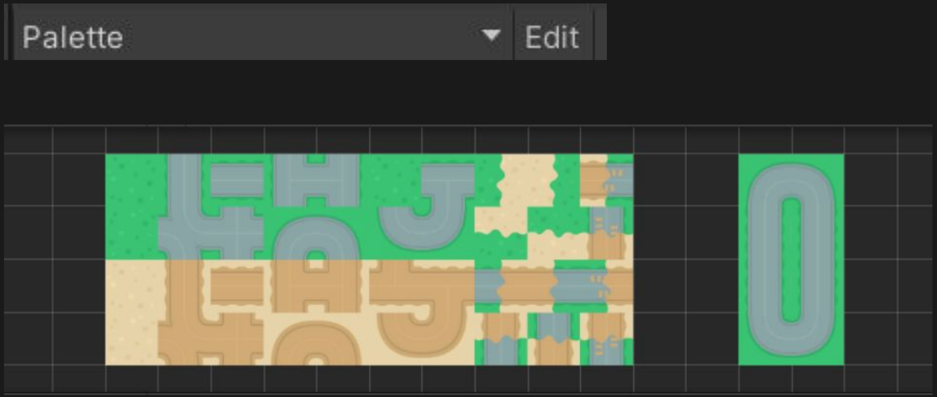
If you try to place a tile on top of something you've already draw on and that tile has nothing draw on it the emptiness will be part of the tile.

To fix this you will have to create a new tilemap who's layer will be rendered on top.



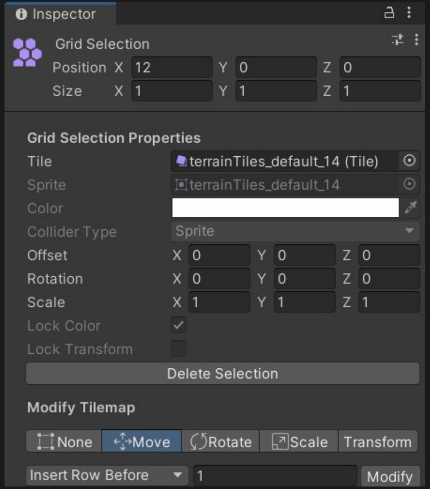
Editing Tile Sheet





Your pallet might give you a lot of option on the grid but it can take time to create complicated areas by placing the tiles one by one.

Thankfully you can create template for areas by going into the Edit Mode and painting in the pallet.



Inspector

Grid Selection

	X	Y	Z
Position	12	0	0
Size	1	1	1

Grid Selection Properties

Tile	terrainTiles_default_14 (Tile)
Sprite	terrainTiles_default_14
Color	
Collider Type	Sprite
Offset	X 0 Y 0 Z 0
Rotation	X 0 Y 0 Z 0
Scale	X 1 Y 1 Z 1
Lock Color	✓
Lock Transform	

Delete Selection

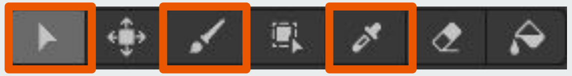
Modify Tilemap

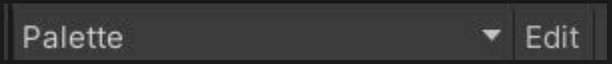
None Move Rotate Scale Transform

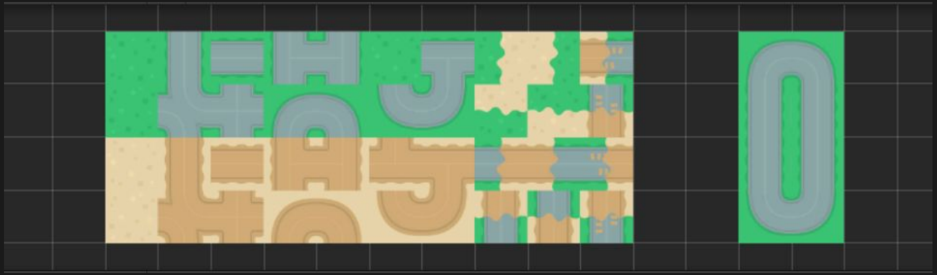
Insert Row Before 1 Modify

Sebastian Grygorczuk - STEM Institute at CCNY

Editing Tile Sheet

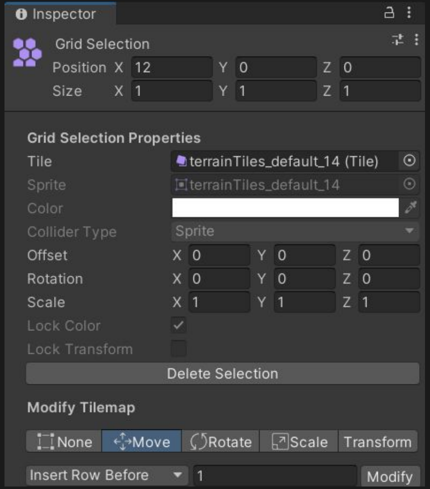






Once you're in Edit mode you can use the Eyedropper Tool to copy or modify the selected tile. Once you have one Selected you can use the Brush Tool to paint in the palette.

And to edit the variables of the tile you can use the Select Tool for the tile giving the Inspector view controls to rotate, translate and scale the tiles.



Inspector

Grid Selection

Position	X	12	Y	0	Z	0
Size	X	1	Y	1	Z	1

Grid Selection Properties

Tile	terrainTiles_default_14 (Tile)
Sprite	terrainTiles_default_14
Color	
Collider Type	Sprite
Offset	X 0 Y 0 Z 0
Rotation	X 0 Y 0 Z 0
Scale	X 1 Y 1 Z 1
Lock Color	✓
Lock Transform	

Delete Selection

Modify Tilemap

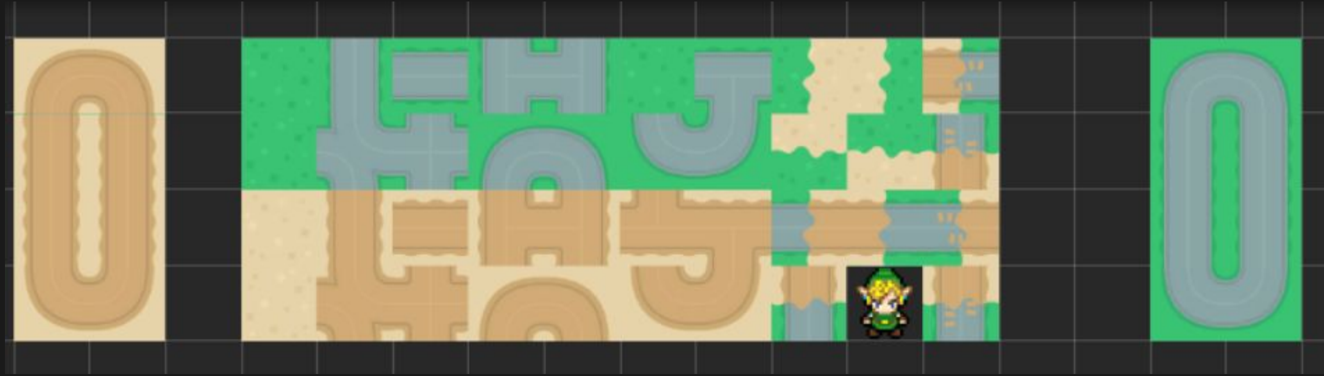
None | Move | Rotate | Scale | Transform

Insert Row Before | 1 | Modify

Sebastian Grygorczuk - STEM Institute at CCNY

Challenge Edit Palette

Using the Edit Mode create a round about using the Dirt Road Tiles.

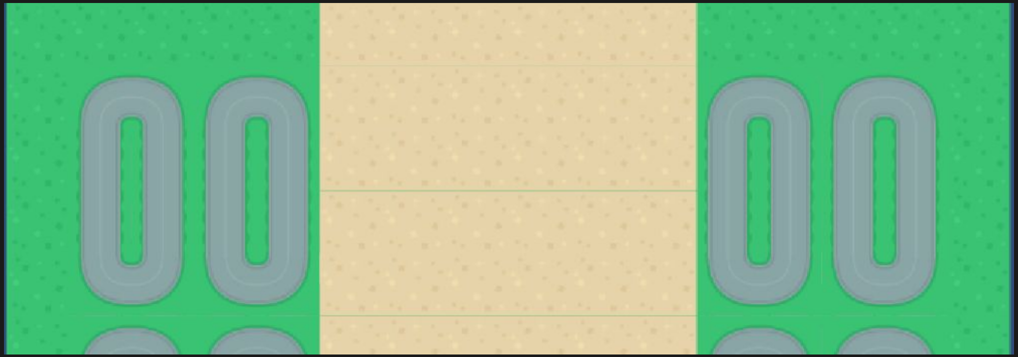


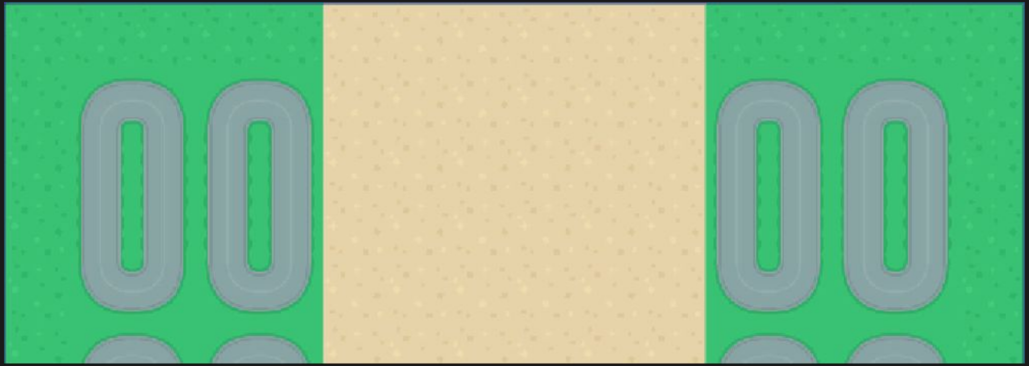
Tearing Between Tiles

You may have noticed that some of the tiles have gaps between them.

The reason behind this is that each sprite is called from the Asset Folder individual, [they may all have been connected to the big Sprite but when we split them they became individual Sprites] and the amount of work it takes for the Computer to grab the individual images and draw them on screen it creates small tears.

Sprite Atlas fixes this by connecting all of the images into one big image that will be referenced when drawing any sprite.



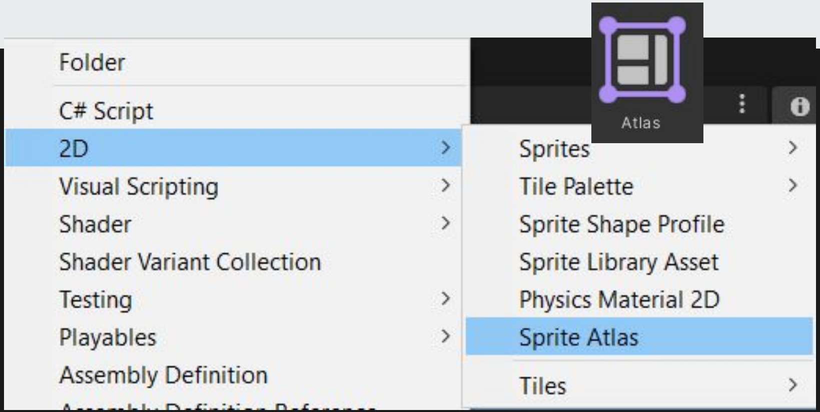


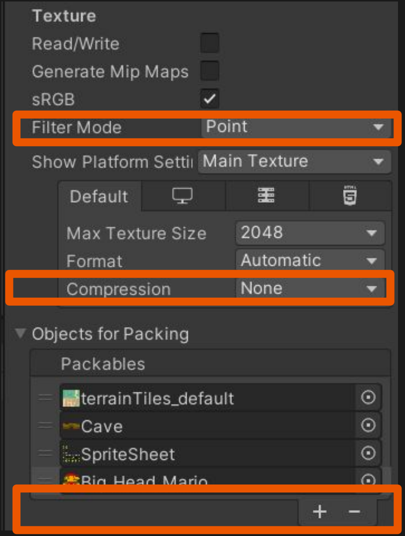
Sprite Atlas

Sprite Atlas is Game Asset, so you can create it by creating a new Asset in the Project View and going to the 2D section.

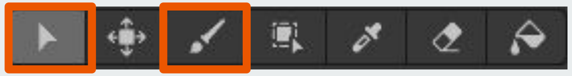
In the Atlas Settings you want to make sure the Filter Mode is set to Point that way the textures keep to their pixels when scaled and you want to set Compression to None so nothing be becomes blurry.

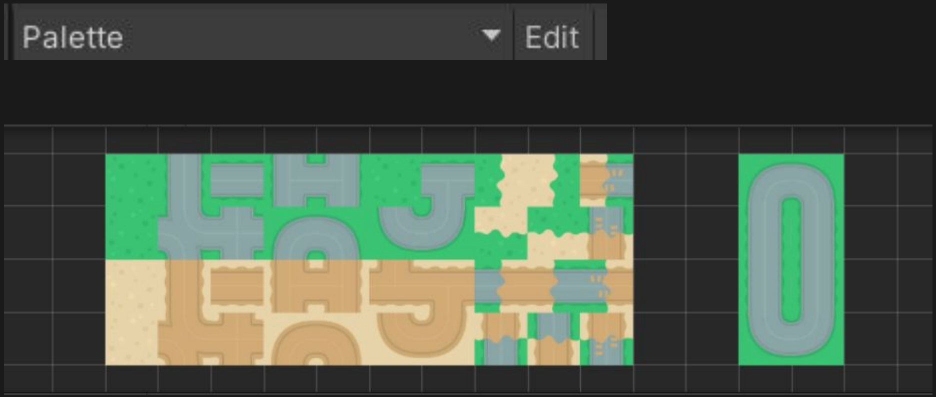
After that you can add the Sprites you want to be part of the Atlas and it will automatically generate a new Texture that Unity will be able to directly use.




Texture
Read/Write
Generate Mip Maps
sRGB ✓
Filter Mode: Point
Show Platform Setti: Main Texture
Default
Max Texture Size: 2048
Format: Automatic
Compression: None
Objects for Packing
Packables
terrainTiles_default
Cave
SpriteSheet
Big Head Mario

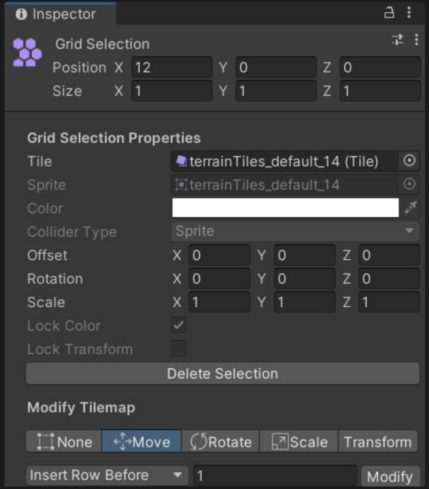
Editing Tile Sheet





Your pallet might give you a lot of option on the grid but it can take time to create complicated areas by placing the tiles one by one.

Thankfully you can create template for areas by going into the Edit Mode and painting in the pallet.



Inspector

Grid Selection

	X	Y	Z
Position	12	0	0
Size	1	1	1

Grid Selection Properties

Tile	terrainTiles_default_14 (Tile)
Sprite	terrainTiles_default_14
Color	
Collider Type	Sprite
Offset	X 0 Y 0 Z 0
Rotation	X 0 Y 0 Z 0
Scale	X 1 Y 1 Z 1
Lock Color	✓
Lock Transform	

Delete Selection

Modify Tilemap

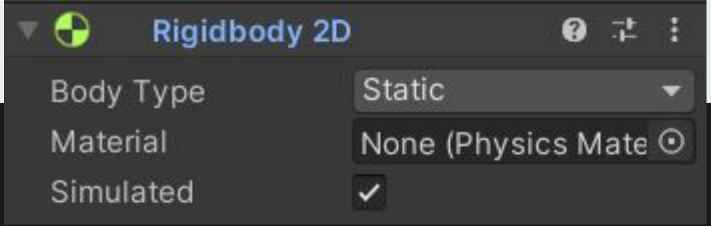
None | Move | Rotate | Scale | Transform

Insert Row Before 1 Modify

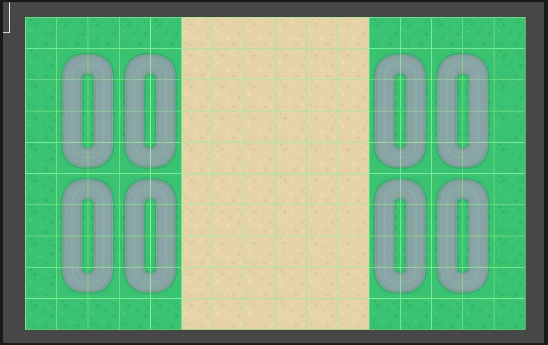
Tilemap Collision

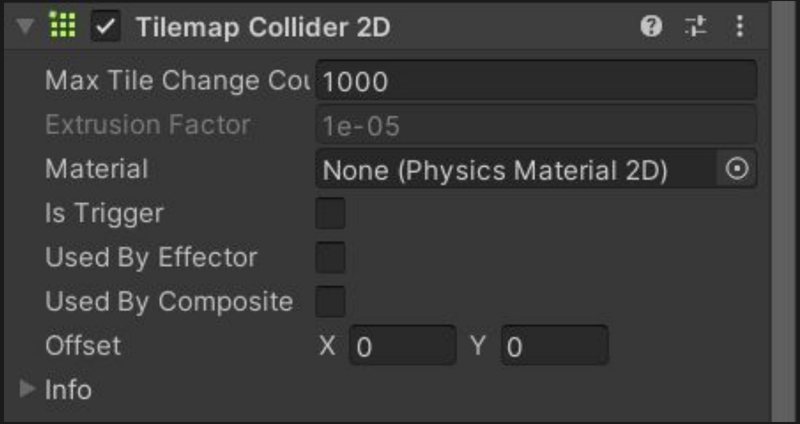
Tilemap have a special Collider that you can attach to it allowing you to create platform or pathways for the player to interact with.

Add the Tilemap Collider 2D component is a start but for it to fully work it does require a Rigidbody 2D and since we don't want it to move in any way leaving it as Static is enough.


Rigidbody 2D

Body Type	Static
Material	None (Physics Mate
Simulated	✓




Tilemap Collider 2D

Max Tile Change Cou	1000
Extrusion Factor	1e-05
Material	None (Physics Material 2D)
Is Trigger	
Used By Effector	
Used By Composite	
Offset	X 0 Y 0

Info

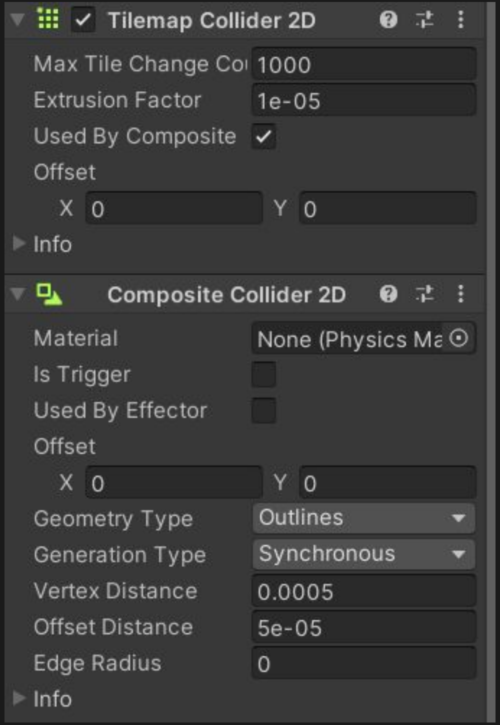
Composite Collider

When you create a Tilemap collider you'll notice that each tile gets its own collision box.

Similar to how drawing individual tiles isn't the best simulating all of the collision boxes isn't either.

So you are making one large area it would be best to use a Composite Collider that will combine all of the nearby colliders into one.

This can be done to a collation of 2D Box Colliders and Polygon Colliders as well.



Tilemap Collider 2D

Max Tile Change Co	1000
Extrusion Factor	1e-05
Used By Composite	✓
Offset	X 0 Y 0
Info	

Composite Collider 2D

Material	None (Physics Ma
Is Trigger	
Used By Effector	
Offset	X 0 Y 0
Geometry Type	Outlines
Generation Type	Synchronous
Vertex Distance	0.0005
Offset Distance	5e-05
Edge Radius	0
Info	

Challenge: Build a Level

Using the Tilemap create a level for the Goomba to traverse. Use the basic color tiles to create ground and use the Roads as walls.

If you want to mess around with different tilesets download them from https://www.kenney.nl/