Unity User Guide

About

This is a Unity User guide

I will start at the beginning and work my way through the variations avenues you could have about your game. I will go through 2D and 3D games along with general tips and tricks for solo and team-based projects. Without future ado, let's begin!

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1. Installation

Before installing, note that Unity is completely free forever, if you or your company makes less than $100 000 (USD).

Follow the link here and download the free installer (the plus version is definitely not necessary). Follow the instructions and download the installer. The installer is simple and easy however, if you run into trouble, go to this video for Windows. Also note that you will may need a Unity account or just use your Google/ Facebook account to sign in.

If you want a new version of Unity, go to the Unity Hub and click the **Installs** tab on the left and **add** (top right) the desired version. Afterwards, the installation will take quite a while, even with a fast internet connection.

When installing Unity, it might ask you to install **Visual Studio** along-side Unity. If you have Visual Studio, do not install again, it should automatically detect the current VS on the system. Otherwise, it is optional and I've heard that MonoDevelop (comes with Unity) is good enough for handling the task Unity puts forth.

2. General

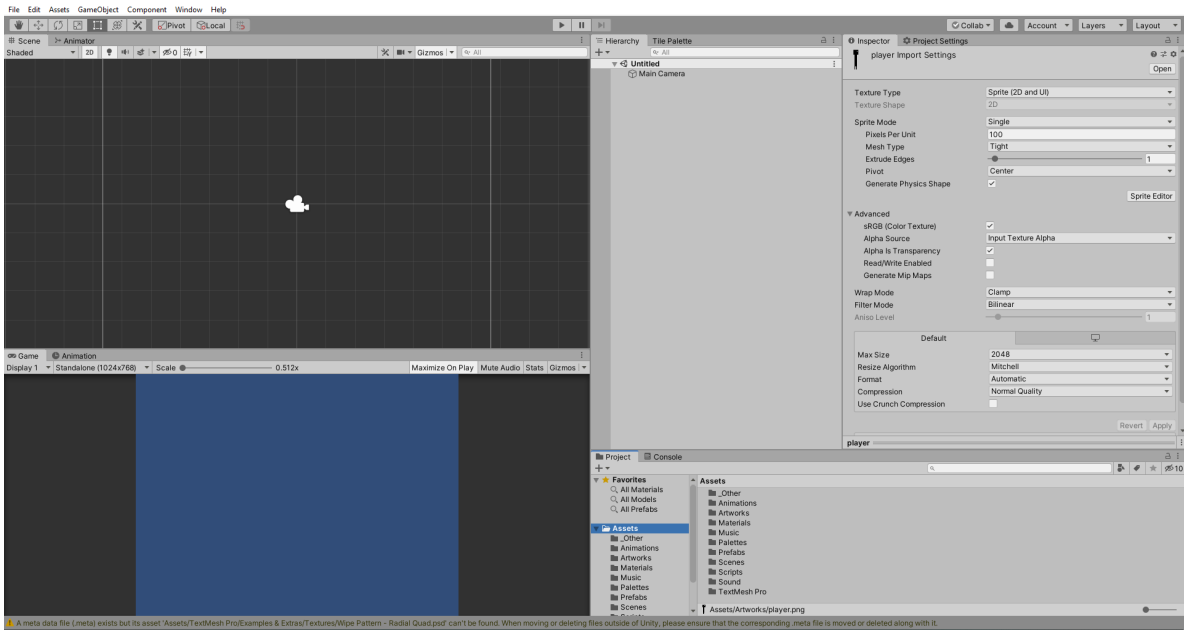
Unity is a 3D game engine built in **C#** but can be used for 2D. Before you freak out about programming, let me assure, you it is quite trivial. If you have programmed before especially in C++, it is a huge plus. If you have not, don't worry, it's just a bunch of copy and pasting. The most important thing is don't be frustrated and

```
Debug.Log() // logs to Unity console
```

is your friend. Also organize your scenes by naming them or using empties as folders (+1 organization). Now, it is time to pick, 2D or 3D. (As a beginner, start with 2D)

3. Unity Editor Overview

Unity is a panel based application. These panels can be rearranged however you like and saved as default.



This is my default setup. The **Scene** panel is the most important viewport. This is where you modify the scene. The **Game** scene only turns on if you hit play. It is a preview of what the user will see if you build the current scene.

On the right hand side, we have the **Project** directory (folder) panel on the bottom. This is where all your assets are (ie art, music, scripts, etc.). The **Hierarchy** is like a layers panel in Photoshop. It is an arrangement of all elements in the scene. For every element of the scene can be hidden from the view by hitting eye button when hovering on the element. The lock button is the pointer icon. The **Inspector** contains all modifiable aspect of an element along with info. This is where you drag scripts in the element.

Other panels include a console, which will output when the game is run. The **Animator** and **Animation** go hand in hand and creates animation for sprites.

4. 2D

4a General

So you've decide to make a 2D game. Great! Who needs modelling and lighting (It's a lot of work anyways)?

2D games are secretly 3D, what does that mean? Think of Unity 2D as a bunch of layers like in Photoshop, Gimp, After Effects, or Illustrator. The closest to the camera is picked up first and blocks the ones behind it. As a 2D world, lighting is global (unless you want enable an experimental local lighting feature). To start a new 2D game, click **New** and select 2D on the pop-up screen and use the desired directory (or follow my cloning guide so to not start from starch). This may take some time, but after Unity finishes installing itself, we can get started. Now let's make a player and make it move!

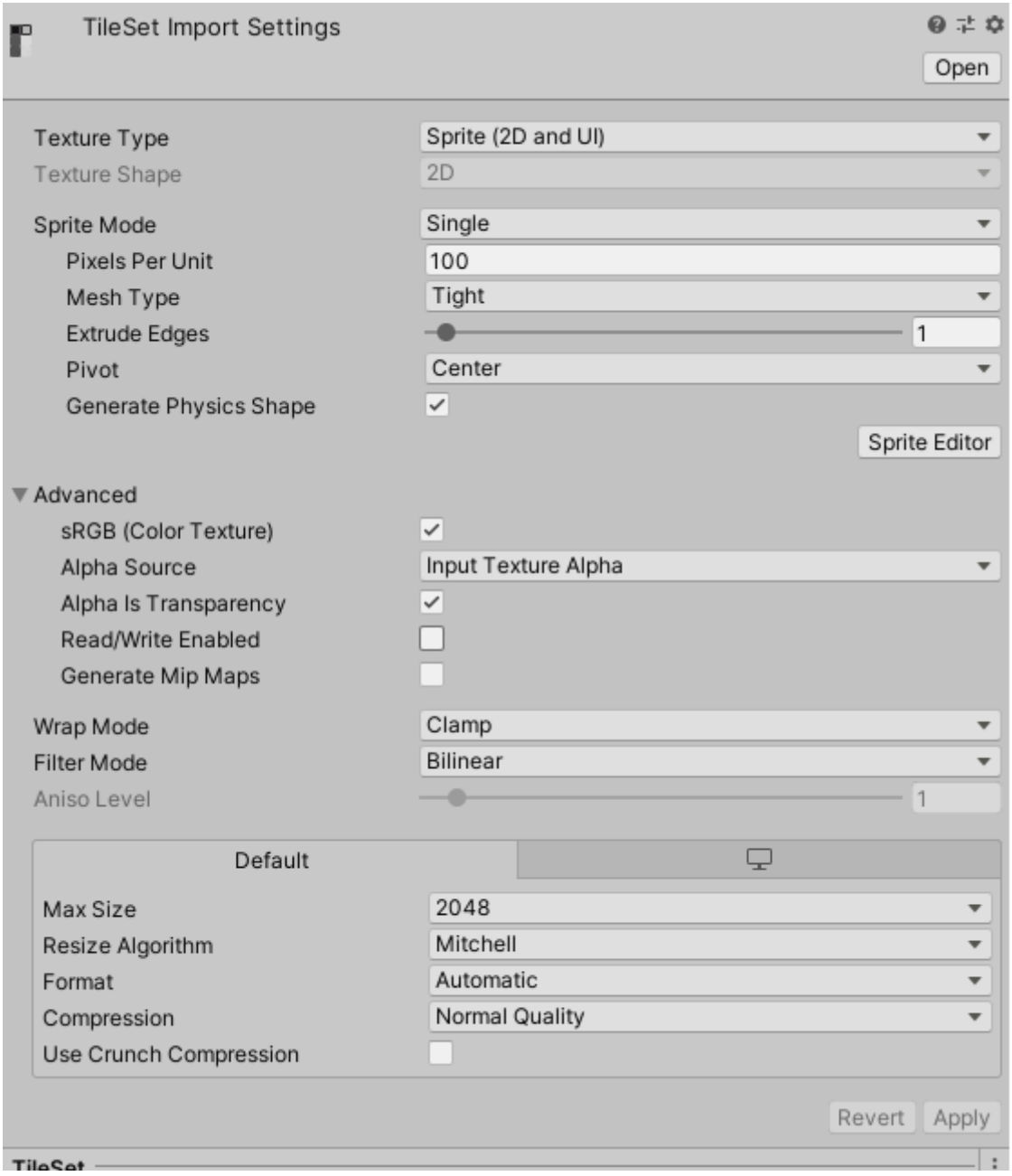
*Note, part of the tutorial (2D) follows this repo: Unity-Template-2D-2019_3

4b Sprites

Sprites are what make up the visuals of the game. These could be png or jpeg (recommended because of small size) file. You can make your own and drag them into an **Artworks folder**.

If you have multiple sprites on a picture file, you have what is called a sprite sheet. These could be useful because it saves space. Unity comes with a sprite editor that can cut the sprite sheet into multiple sprites.

However, before we get to that, let us take a look at the Sprite setting



From the top header, we can see some info on the item

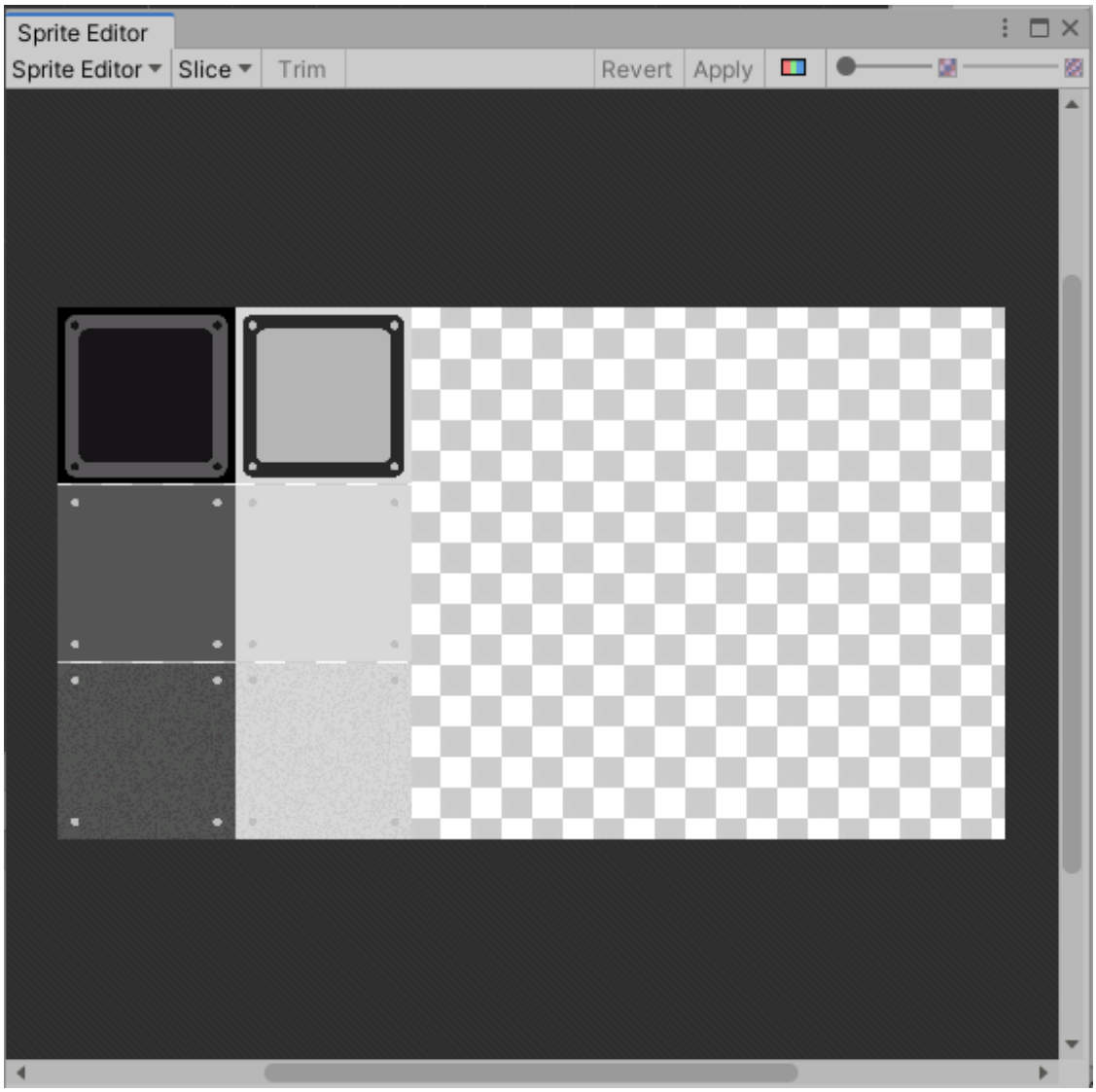
From the header we also see:

- Texture Type - Usually will only use sprite (2D image) or normal map (for 3D depth)
- Sprite mode - as single texture or sprite sheet
    - Adjust the pixels per unit (Pixels per unit should be 1-1) (In my case, it is 358 px per tile)
    - Pivot - where the center of object is
- Wrap Mode - how the image is displayed (ie repeated or clamped(/cut) at the board)
- Filter Mode - Point (equivalent to pixel perfect or nearest neighbour in Photoshop) or Bilinear (natural scaling with edge softening)
- Format - Format of image (8bit, 16 bit, 32 bit colour with or without alpha)

*Note, if a setting was not mentioned, it is not that important at the beginner level.

Multiple Sprites

1. Select Multiple in **Sprite Mode**
2. Click **Spirit Editor** button



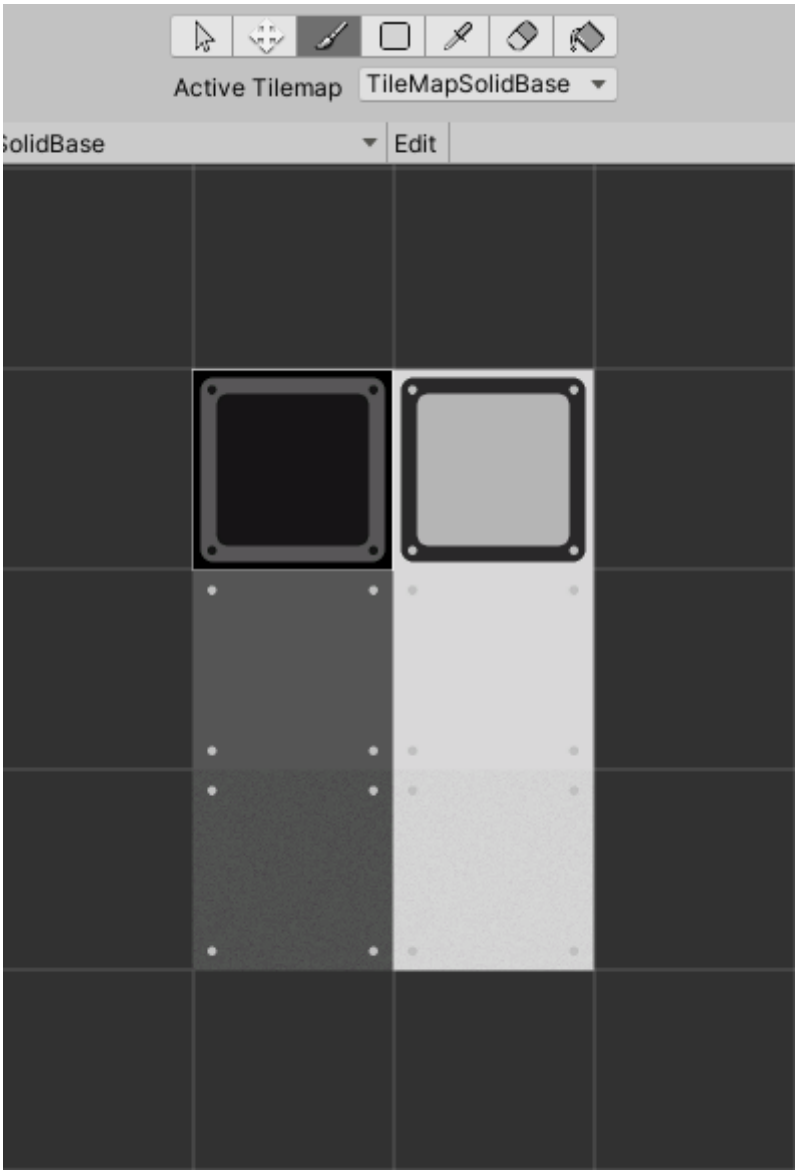
3. In sprite editor, click Slice -> Slice (This is an automatic slicer and is usually good enough, if not, manually move the transform bound boxes to fit or define split at distance apart (must change to **Grid by Size Count**, not **Automatic**) with the size of tile in **Pixel Size**.
4. Click apply
5. Close window or drag to some widget
6. You can inspect every tile by expanding the original image and a bunch of tiles with name pictureName_0 to # of tiles with be a child of it

Now, with a sprite, you can drag it into the scene

To create a tile map, follow the following:

1. GameObject -> 2D Object -> Tile Map
2. Open Tile Palette, by going to Window -> 2D -> Tile Palette
3. Create New Palette and save it
4. Drag all individual tiles into widget or drag parent spritesheet (and save)

Now with the tile palette, you can draw on the scene, reorganize everything and many other things



From the top, there are many icons, we will go through each of them

- Curser - selects tiles from scene
- Move - Moves tiles in palette (Only if you click **Edit**)
- Brush - paints on scene
- Square/Rect - Selects multiple tiles or one to paint from
- Eye dropper - Selects tile from scene
- Eraser - Erases
- Paint Bucket - Floods with active brush (Like Photoshop)

To layer tiles,

- Right click on the tile map -> 2D -> Tilemap for however many more layers you need

To set a layer as a solid with collision,

1. go to the layer you want to make solid
2. Add Component -> search add Tilemap Collider 2D

Resources: Brackeys

4c Movement

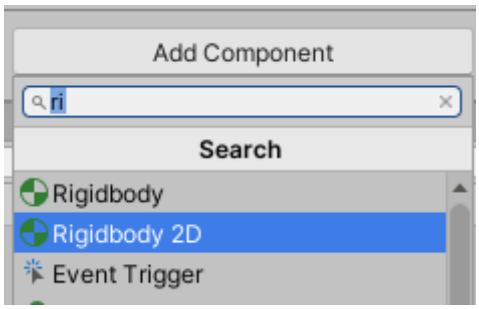
Movement is critical in all games, whether the movement is limited to left or right, or games that in 3D. On the internet there are may sources that claim the perfect jump, but only you can decide that based on the gameplay.

To start off with;

Set your player to be a rigid body with colliders

This can be done if you;

1. Select the player and add a Rigidbody 2D



2. Open up the Rigidbody 2D and go to constraints. If you want the player to not rotate in 2D, then select **Freeze Rotation Z**
3. Otherwise, add a **Collider 2D** to fit the player. Depending on how your player's form, different shapes may be better. Try the different collider options to see which ones fit best. Most of the time, a **Box Collider 2D** will work just fine. Also note that you can use multiple colliders, but remember, this is computationally more expensive.
4. Also note that if you are not satisfied with Unity's default collider size, you can change the size by changing the **size** attribute

Now for the movement:

1. make a new folder called **scripts**
2. right click -> Create -> C# Script -> call it movement or something

Next, you want to open the script by double clicking on it

This will either open the script in MonoDevelop or Visual Studio (to find out more about scripting, go to the scripting section)

In the movement class, put

```
// inits
// hoziontal speed
public float speed = 10f;

// vertical jump
public float jumpForce = 10f;

// different jump heights for how long jump button is pressed
// change it as you change gravity
public float jumpCheck = .2f;
// is ground check
public float checkRadius = 0.3f;

// ground jump check
public bool isGrounded;
```

```
public Transform feetPos;
public LayerMask whatIsGround;

// so that infin jumps are not a thing
private float jumpCheckCounter;
private bool jumping;
private float moveInput;

// inits rigid body
private Rigidbody2D rb;

void Start() {
    rb = GetComponent<Rigidbody2D>();
}

void Update() {

    // bool to see if overlap of floor layer and feet object
    isGrounded = Physics2D.OverlapCircle(feetPos.position, checkRadius,
whatIsGround);

    // if is touching ground and jump button pressed, add jump force
    if (Input.GetButtonDown("Jump") && isGrounded == true) {
        jumping = true;
        jumpCheckCounter = jumpCheck;
        rb.velocity = Vector2.up * jumpForce;
    }

    if (Input.GetButton("Jump") && jumping == true) {
        // can jump only once
        if (jumpCheckCounter > 0) {
            Debug.Log(jumpCheckCounter);
            rb.velocity = Vector2.up * jumpForce;
            jumpCheckCounter -= Time.deltaTime;
        }

    }
    else {
        // once jumping is not true, set jump to false
        jumping = false;
    }

    if (Input.GetButtonUp("Jump")) {
        jumping = false;
    }

    // flips player
    if (moveInput > 0) {
        transform.eulerAngles = new Vector3(0, 0, 0);
    }
    else if (moveInput < 0) {
        transform.eulerAngles = new Vector3(0, 180, 0);
    }
}
void FixedUpdate() {
    // gets horizontal input from Unity (1 = right, -1 = left)
    moveInput = Input.GetAxisRaw("Horizontal");
    rb.velocity = new Vector2(moveInput * speed, rb.velocity.y);
```

```
}
```

Save and exit. Now, when you click on the player, movement script, there will be options for you to tinker with. Note, you will need to make a isGrounded empty object to be placed at the feet of the player to see if there is **ground layer** (must set ground layer to ground objects that can be jumped on) beneath the player to jump off of. Also note that this script has a jump that can be a multitude of heights depending on how long the jump button is held down for.

Also, for the player to not stick to the walls while jumping, you must add a new physics material 2D. Change friction to 0 and bounciness to whatever you want it to be and apply to player in the collider

from https://www.youtube.com/watch?v=j111eKN8sJw

4d Camera

The camera will capture things on from the scene to project onto the play window.

The most important setting for a camera object is the size. Changing the size will change the view for the user.

Background

A background can be achieved by placed in the camera and setting the **Order in Layer** to some negative number, such that it is behind the foreground objects

Camera Follow

When implementing a camera, there are two options, however, we will through the harder option first to get use to how cameras work

1. We will create a camera follow script with the following:

```
// selects targe to be fixed on
public Transform target;
public float smoothing = 0.12f;

// because it is fixed to player, we want to move in from by 10 layers be
default
public Vector3 offset = new Vector3(0f,0f,-10f);

void FixedUpdate() {
    Vector3 desiredP = target.position + offset;

    // interpolate movement
    Vector3 smoothP = Vector3.Lerp(transform.position, desiredP, smoothing);
    transform.position = smoothP;

    // will move in direction of target
    // comment out if you don't like the jitters
    transform.LookAt(target);
}
```

   You will have to drag the player to target and change the smoothing if you like

   OR

2. Use the Cinemachine Extension

To use Cinemachine, one must first install the extension as it does not come in with Unity natively. To do this,

1. window -> Package Manager -> **Search:** Cinemachine -> click install

Now to use it

1. Cinemachine -> Create 2D Camera
2. Embed CM vcam into main camera (optional)
3. Go to CM vcam and put the player in the **Follow**
4. Try it out
5. If you want the character directly in the center of the camera, turn down all **damping** and **dead zone** to 0 (these settings are in **Body**)
6. **Screen** x and y, offsets from center
7. **Soft zone** changes the max distance from center before snapping the player to edge
8. **Dead zone** is how far you can move the character before the camera moves along-side the player
9. **Damping** is the smoothness of the camera movements
10. **Look ahead** is the direction the player is moving towards
11. Play around with these setting

Resource: https://www.youtube.com/watch?v=MFQhpwc6cKE or https://www.youtube.com/watch?v=2jTY11Am0Ig

4e Prefab

A prefab is simply a clone that can be dragged to the scene

This means that things in other scenes can be reused

To make a prefab, just drag the desired prefab object from scene to the prefabs folder

4f Particle System

A particle system adds an extra layer of immersion that is quite simple in Unity.

To add a particle system;

1. Right click hierarchy -> Effects -> Particle System
2. Remember, default is some circled with soft edges
3. To make custom particles,
    1. Go to photo editor of chose (Adobe Photoshop, illustrator, or GIMP work great)
    2. Make your single particle or collection of particles
    3. Save
4. To use the custom particles, goto renderer -> material -> sprite default
5. Now enable **Texture Sheet Animation**
6. Mode -> ~~Grid~~ -> sprites
7. Select objects

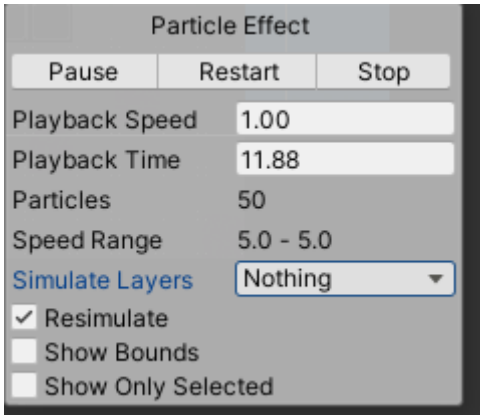
To customize particle system,

There are near infinite options in the inspector. Most options are self explanatory. Some of the common options changes are

- Loop - for ambient particles that need to on screen all the time
- Start Color Options
    - Random Color -> randomly selects a color
    - Gradient -> flows from one color to the next
    - Random between two colors/gradients -> randomly picks a color in gradient or one of the two colors
- Prewarm - already has some particles and does not start with no particles
- Start Speed - Speed of particles
- Start Lifetime - how long the particle lives in the scene
- Start Size - size of particle
- Emission -> Rate over Time - how many particles spawn over time
- Rotation over Lifetime -> rotates over time
- Collision -> collides with solid objects
- Trail -> creates trails of particle as it moves
- Color over Lifetime -> you can fade the particles in and out
- Shape -> Randomize Direction - changes starting velocity vector
- Shape -> Spherize Direction - Moves out from center

*Note for some options like start speed, lifetime, size, etc, you can pick from an interval

Else, look in Unity docs. To test particles, use the Particle Effects window. This will control preview



4g Collectibles

There are two parts to a collectible,

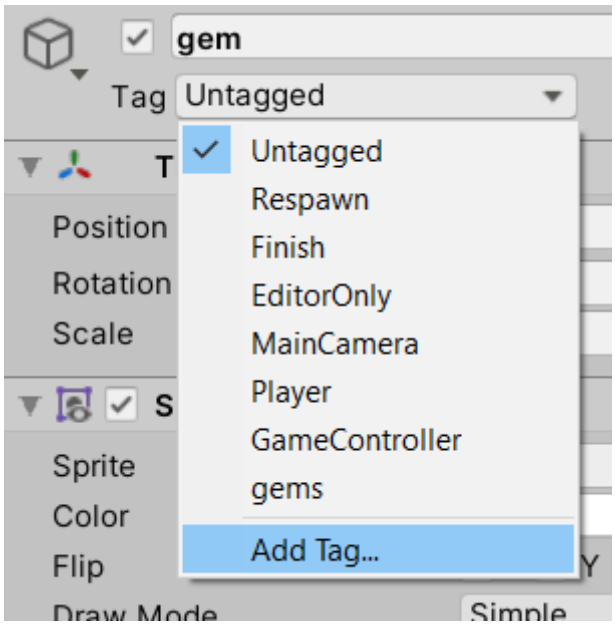
a. collection of the item

b. the storage of the item in inventory

We will start with a. the collection of an item

1. Find a sprite or animation to use as collectable. For simplicity, I will use a sprite like this:

2. Drag gem into level
3. Add collider (I think box collider works best here) and check **Is Trigger**
4. Add a new tag and select it of the gem



5. Within the player movement, we need to detect the collision overlaps and if an element of the tag overlaps the player, destroy object

   The is done by putting the following code somewhere in the player movement class (not in an update or start method)

```
private void OnTriggerEnter2D(Collider2D collision) {
    if (collision.gameObject.CompareTag("gems")) {
        Destroy(collision.gameObject);
    }
}
```

6. (Optional) If you want to reuse the gem, drag in Prefab folder

Now we must consider the storage of the item in inventory. Note this can be as easy as a counter or a full fledged inventory

I will do a counter for simplicity

1. While we are adding a counter, it is also a convenient time to add a sound of collecting the item.
2. Resources for audio clip: here & here but I used PlayOneShot
3. Optionally, a collecting animation or particles could also be implemented
4. However, we will jump directly to a collectables counter
    1. Create a text layer by clicking UI -> Text - TextMeshPro
    2. Click on canvas -> Render Mode -> Screen Space - Camera

3. Assign Render Camera to current Main camera
4. Change layering order on canvas so it is in front
5. Position it right. You may also chose to have a image accompanying the counter
6. Create a collectablesManager script with the following:

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
using TMPro;

public class collectablesManager : MonoBehaviour
{
    public static collectablesManager instance;
    public TextMeshProUGUI text;
    public int score = 0;
    // Start is called before the first frame update
    void Start()
    {
        if (instance==null) {
            instance = this;
        }
    }

    // Update is called once per frame
    public void changeScore(int gemValue) {
        score += gemValue;
        text.text = "x" + score.ToString();
    }
}
```

7. Create empty to house the collectablesManager script and drag the script in
8. Drag the text score into the Text field
9. Now gems script and populate with the following:

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class gems : MonoBehaviour
{
    // Start is called before the first frame update
    public int value = 1;
    private void OnTriggerEnter2D(Collider2D collision) {
        if (collision.gameObject.CompareTag("Player")) {
            collectablesManager.instance.changeScore(value);
        }
    }
}
```

*Note by using this, you must have one collider with the player tag or the collectable might count twice. Optionally, you can make a new empty game object with the player tag than triggers the collection

Resource: https://www.youtube.com/watch?v=DZ-3g31jk90

4h Animation

Animation is critical in creating any game that does not look static. In Unity, animation is handled by

4i Events

4j Pixelated

4k Music & Sounds

4l Parallax

4m Odds and Ends

For changing controls, go to Project Settings -> Input Manager and you can change your input from there

Linking Scenes

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5. 3D

5a General

3D, it's where we live. Good for you for deciding to go 3D. Before we go any further, it is not recommended that you start off with a 3D project if you just started game design.

5b 3D Models & Bodies

5c

5 Music & Sounds

6. Title Screen

One of the last things to do is to create a title screen

7. Scripting

Unity is based on C# and is very much a c-styled programming language. That means it resembles programs that are written in C, C++, F#, or Java.

The main thing to know though is Unity's implementation of C#

If you create a script, automatically, it will be drawn from a template that looks similar to the following:

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class movement : MonoBehaviour
{
    // Start is called before the first frame update
    void Start()
    {

    }

    // Update is called once per frame
    void Update()
    {

    }
}
```

You will notice that at the top there are imports from Unity's other libraries using the **using** keyword. Afterwards, Unity defines the script as a class*. The class is defined as public so other scripts and Unity can assess and utilize this class. The name you gave the script will follow the **class** keyword. Afterwards, **MonoBehaviour** is defined as what movement inherits from. Think of this as your script **extending** from class MonoBehaviour.

Below that and indented, we see void Start() and void Update(). As the comments suggest, void Start() occurs before the first frame update and void Update() is called once per frame. Note **void** means there will not be a return value (ie no return statement).

Also, there are different methods of MonoBehaviour such as **FixedUpdate()** that may update more or less than once per frame. This will be important for any physics related functions

* A class is a data structure that holds a collection of information on the class (ie, its attributes and methods).

A list of other functions and methods that can be used can be found on the Unity Documentation site, however, the most important thing about learning and debugging Unity is to use

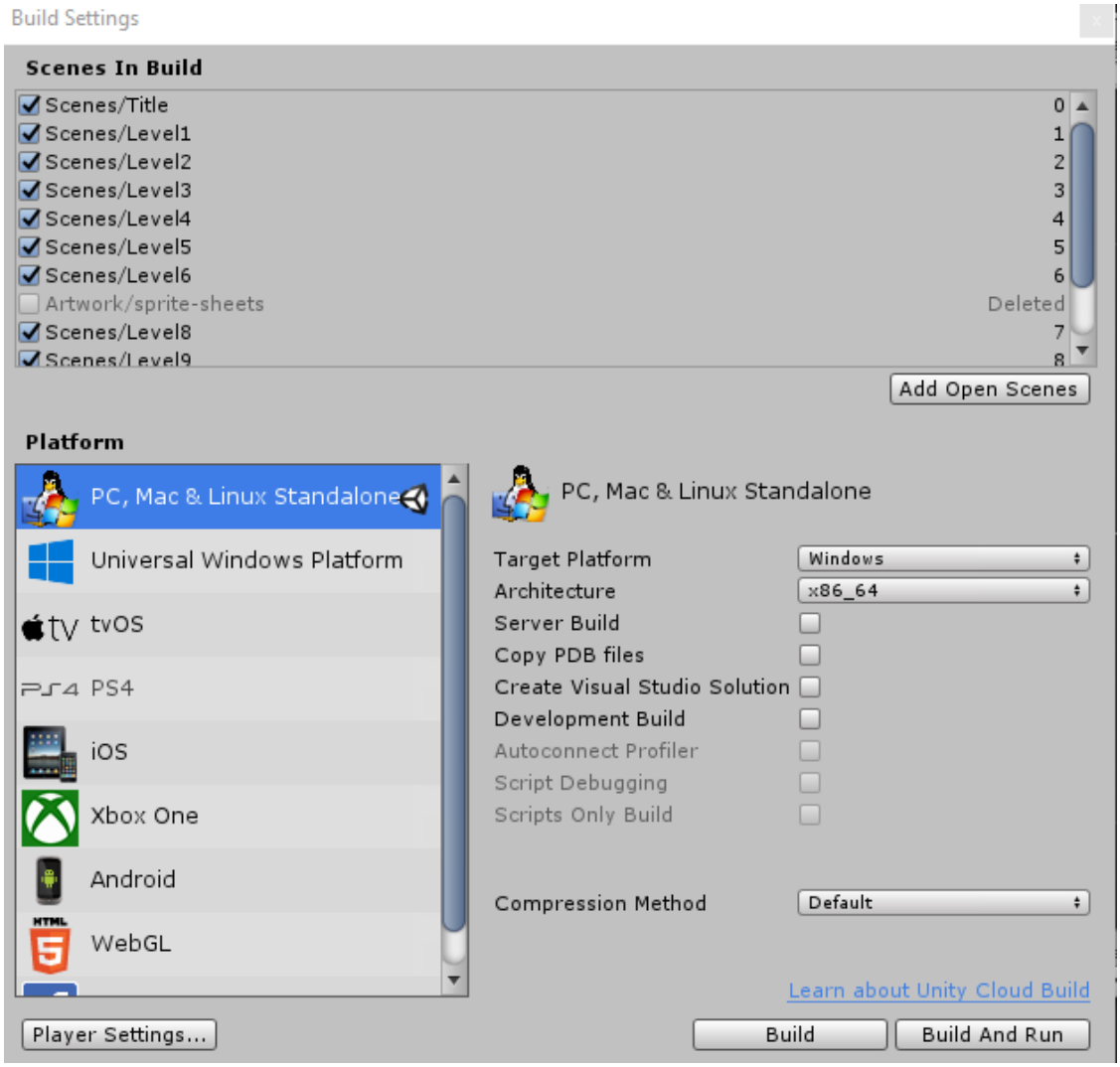
```
Debug.Log() // logs to Unity console
```

When using this, after running the game, it will output to Unity's debug console

8. Build

So you are finished your game. You need to disturbed the game. This is done through building the game.

1. Go to **File**, **Build Settings...**
2. Select the scenes that you want to build

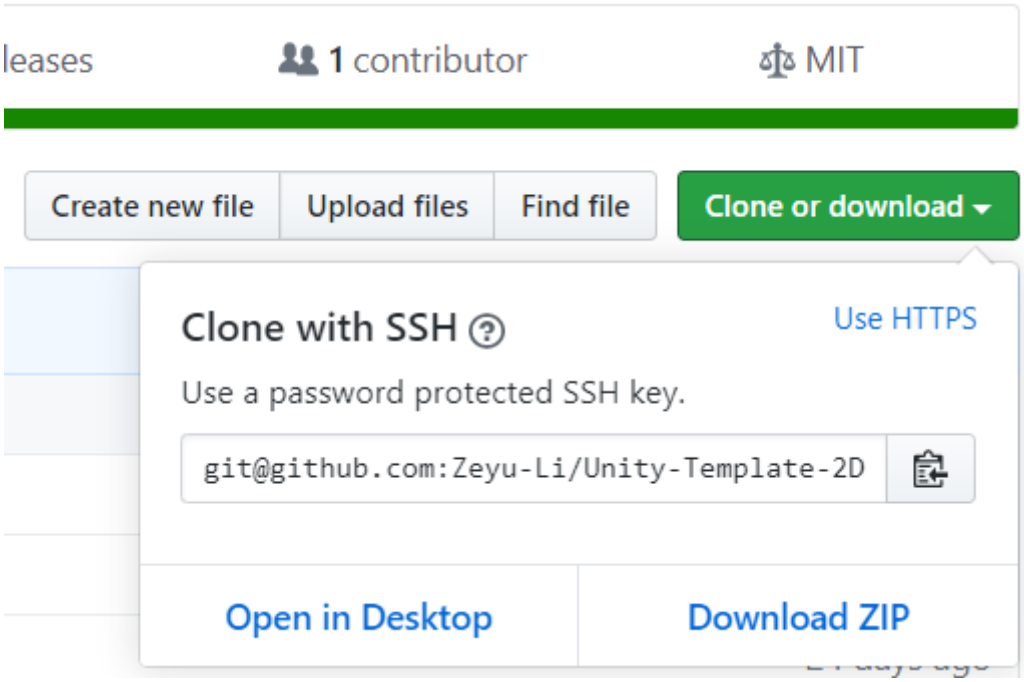


3. Select the desired **Platform**
4. You can customize the company name, product name, icon, and cursor
5. **Build** (**And Run** if you want to run it)
6. Select the folder and wait for it to build

9. Cloning Guide

From my GitHub:

1. Find the right Unity Repo to clone from my account (ie Unity-Template-2D-2019_3, Unity-Template-3D-2019)
2. Download ZIP after clicking Clone or download



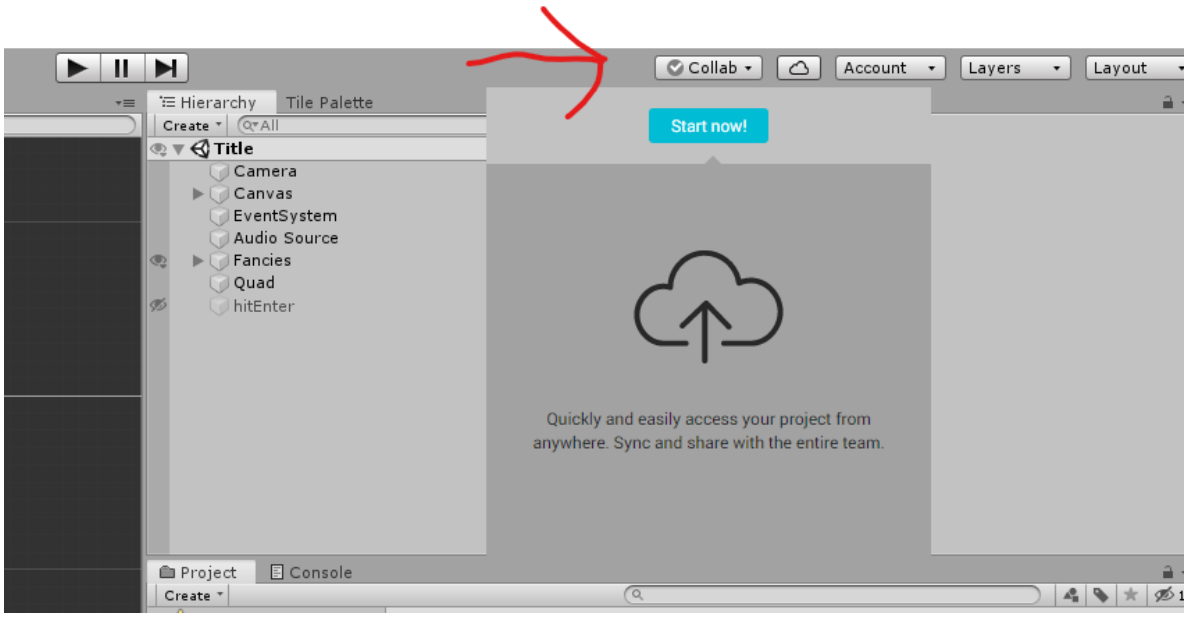
3. Unzip and move to desired directory
4. Go on Unity Hub and click **Add** and located to directory
5. The project should appear in Projects and it is done
6. Click on the project to open it

10. Collaboration

Unity's Collab

Collaborating will friends can be tough will Unity, especially with git/GitHub, but it you are careful, things could turn out fine.

If you need to collaborate, the best way is to use Unity's Collab feature



However, note that this only supports 4 people (which is usually enough because only people that will contribute to the codebase should need it)

GitHub

Otherwise if you are a masochistic and decide to GitHub, here are some general practices:

1. Everyone should work on there own branches and work on there own scenes working towards **Prefabs** (ie one person on movement, one on moving platforms, etc.)
2. Optionally, have one person on the master (final) level to peace it together
3. Use this gitignore or clone from my projects on GitHub
4. Have the core gameplay done first (especially at a Game Jam)
5. Get to know Git/GitHub and how version control works
6. Remember you can go back to a previous working version
7. Have fun and don't fight with your team members

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11. Resources

- The Unity User Manual provides some great documentation with code that can for the most part be copied and pasted
- Brackeys YouTube channel
- Lynda.com - If you have a library card, there is a high probability that you have access to Lynda with their organization deal
- Google is your best friend
- Ask on Reddit or Stack Exchange, don't worry they won't bite