2D Animation & State Machine

Jo Chung

Spiritfarer

2D Animation Overview

Demo: Sprite Animation

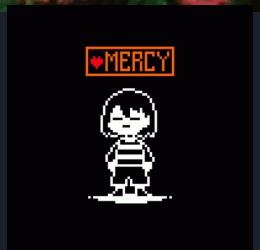
Demo: Mecanim State Machine

Additional Uses

Overview of Unity 2D Animation

2D Animation in Unity

Sprite animation (frame by frame)

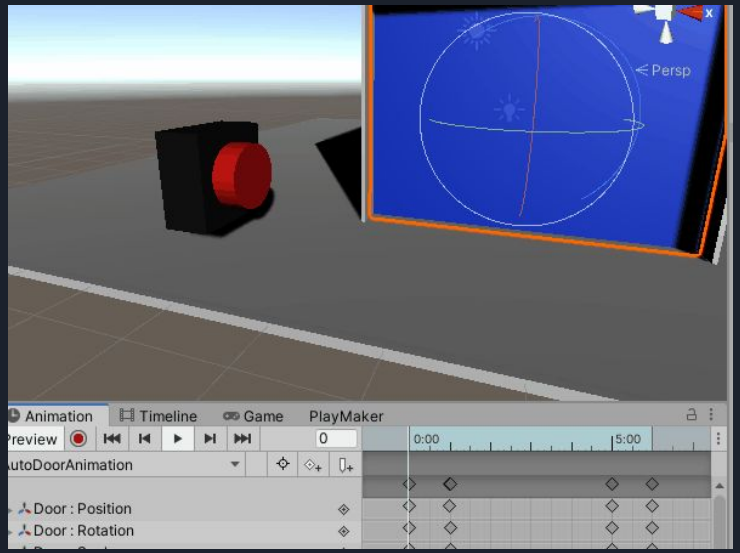


2D Animation in Unity

Sprite animation (frame by frame)

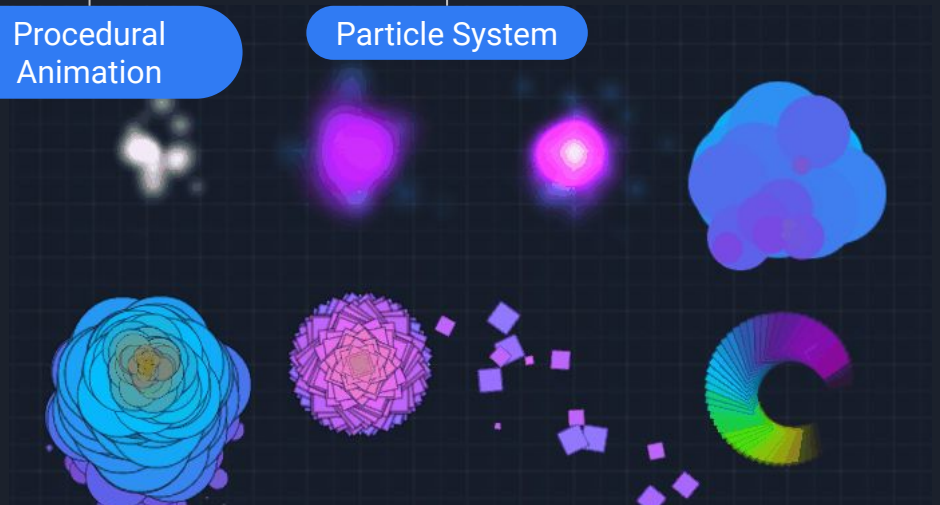
Programmatic

- Rigid-body Animation
- Procedural Animation



2D Animation in Unity

- **Sprite animation (frame by frame)**
- Programmatic
  - Rigid-body Animation
    - Procedural Animation
  - Physics-based
    - Particle System

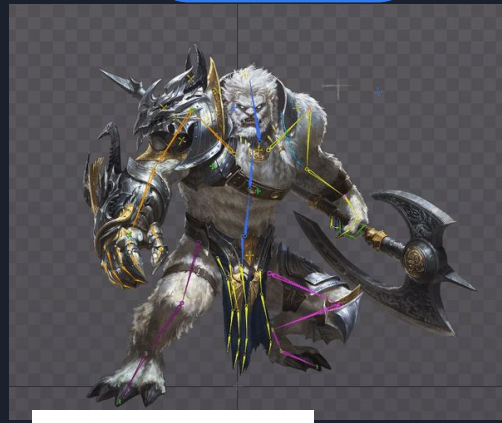


2D Animation in Unity

Sprite animation (frame by frame)

Programmatic

- Rigid-body Animation
  - Procedural Animation
- Physics-based
  - Particle System
- Bone-based Animation

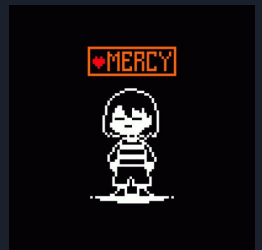


Live2D Cubism

spine

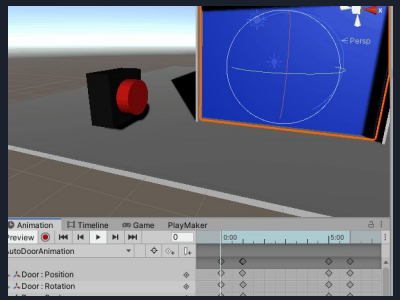
2D Animation in Unity

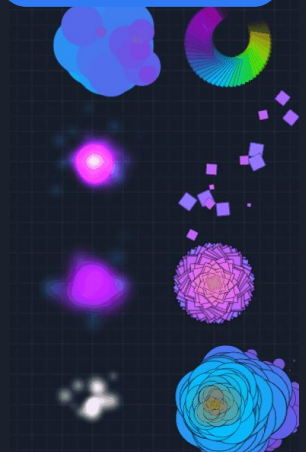
Sprite animation (frame by frame)

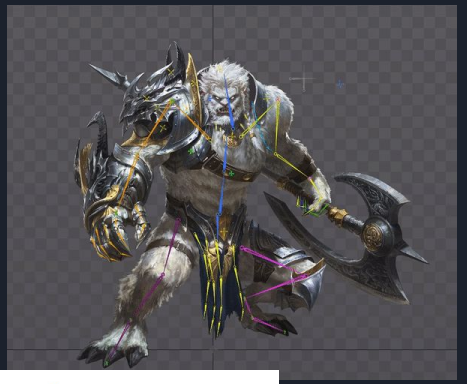


Programmatic

- Rigid-body Animation
  - Procedural Animation
- Physics-based
  - Particle System
- Bone-based Animation







Live2D Cubism

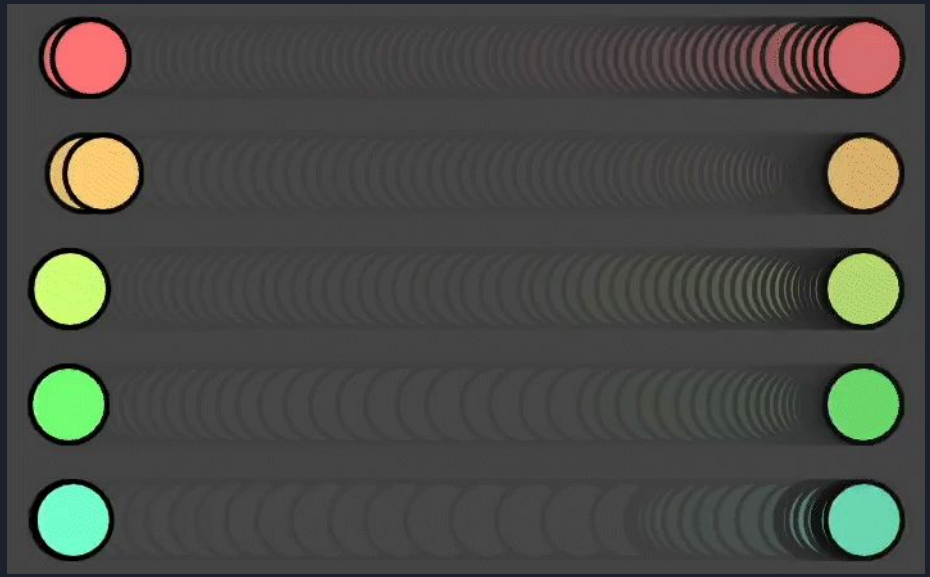
spine

Why?

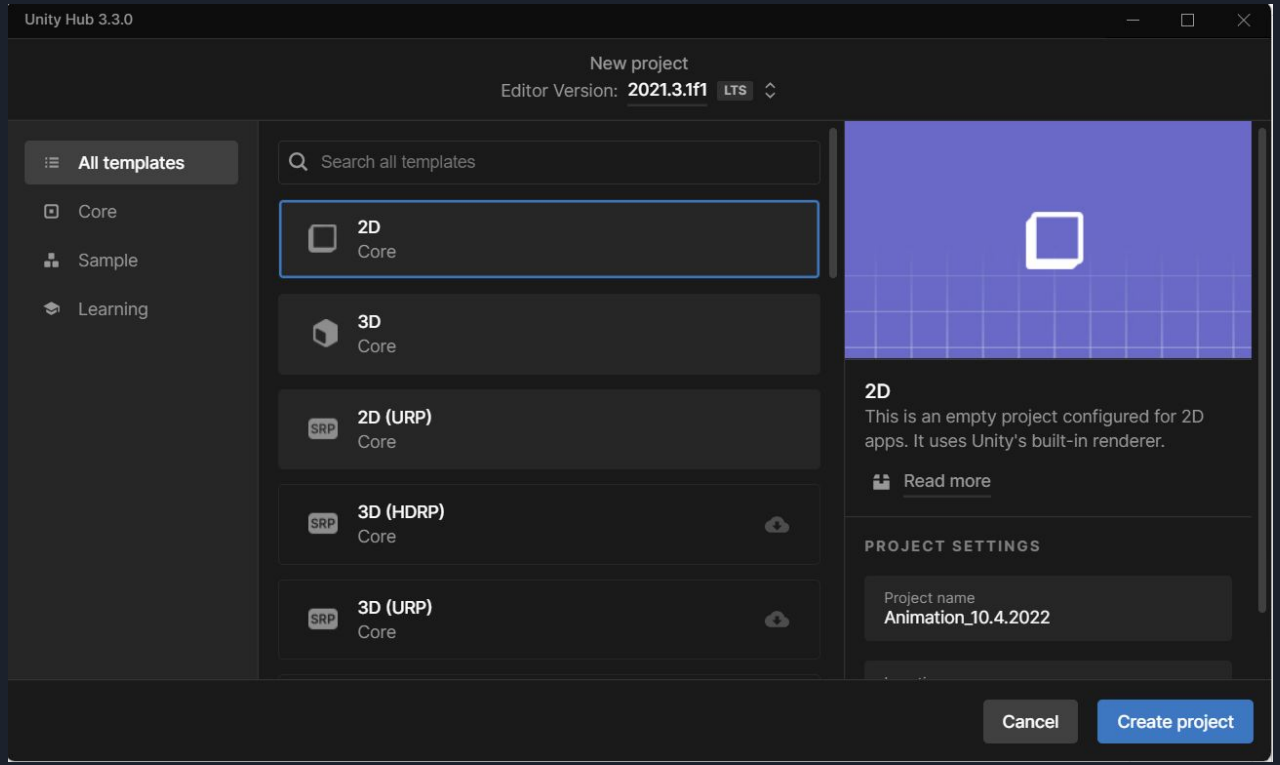
- Polished look
- Interactivity
- Game feel (hit effects, camera shake, feedback, etc)

Vocabulary

- Sprite/spritesheets
- Keyframe
- Interpolation
- Unity Animator
- Parameters



Create a new Unity 2D project or use a pre-existing one



Course website → week 4b

PART 4: ANIMATED 2D PLAYER CHARACTER (MORE ADVANCED):

IN PHOTOSHOP:

1. **Draw:** In one Photoshop file draw each character pose in its own layers.

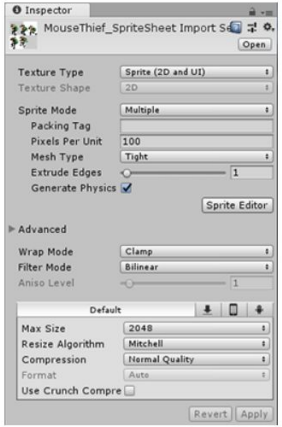
2. **Build Spritesheet:** In a new Photoshop file (power-of-two-square, like 512 x 512) paste these character poses, evenly distributed and consistently positioned (so the "ground" is the same for all).

IN UNITY:

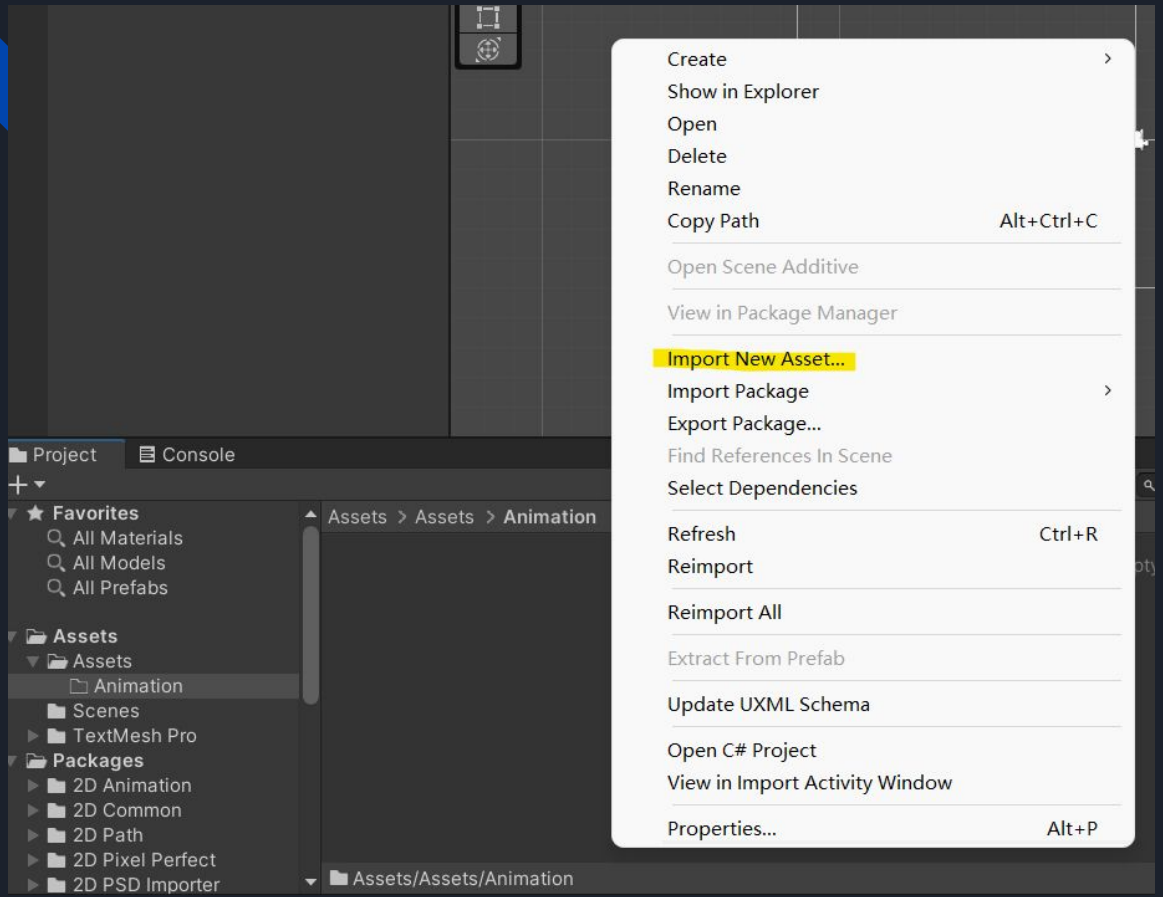
a) Add Spritesheet to Project.

b) In the Inspector, add these settings:

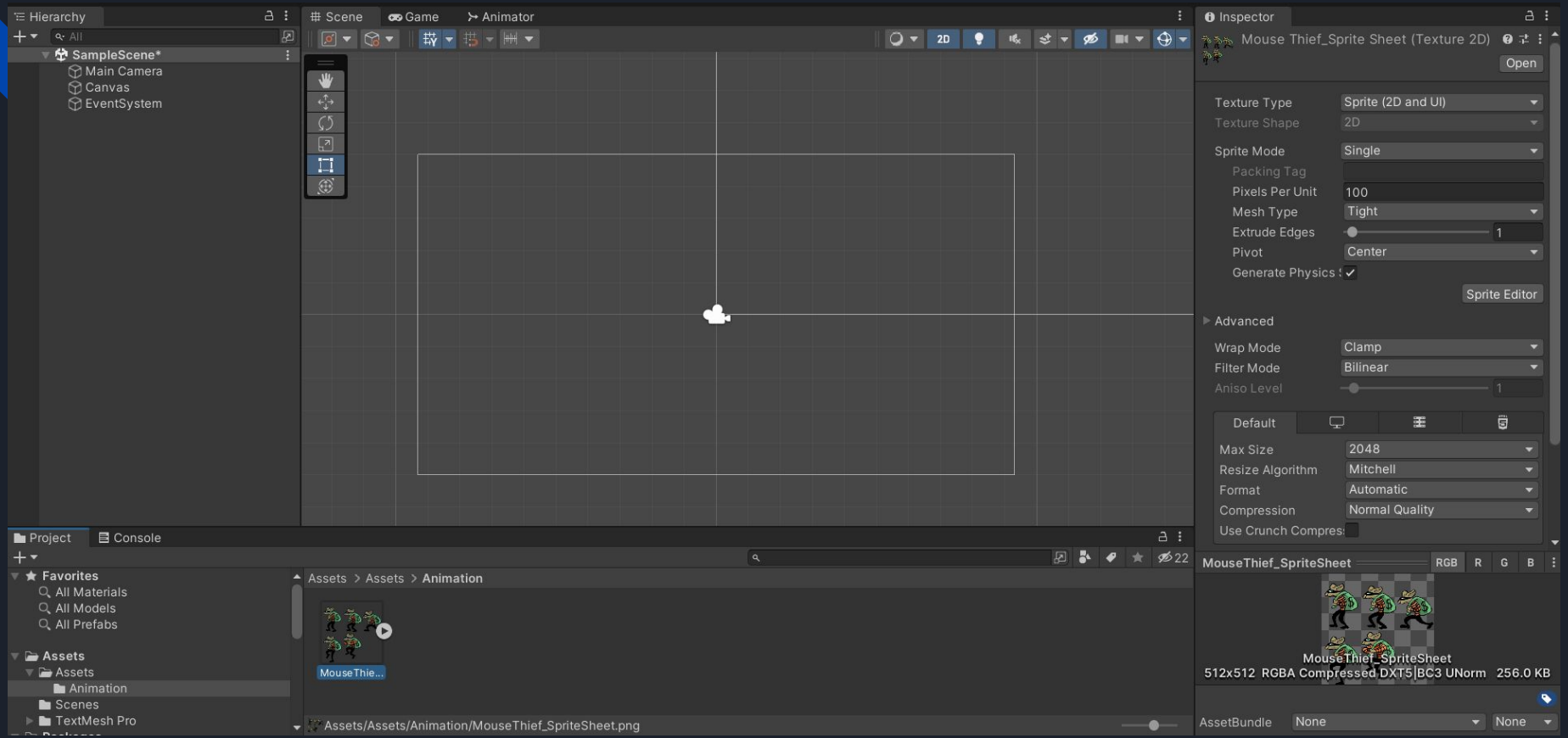
- Texture Type = **Sprite**
- Sprite Mode = **Multiple**
- **Pixels Per Unit** = 100.

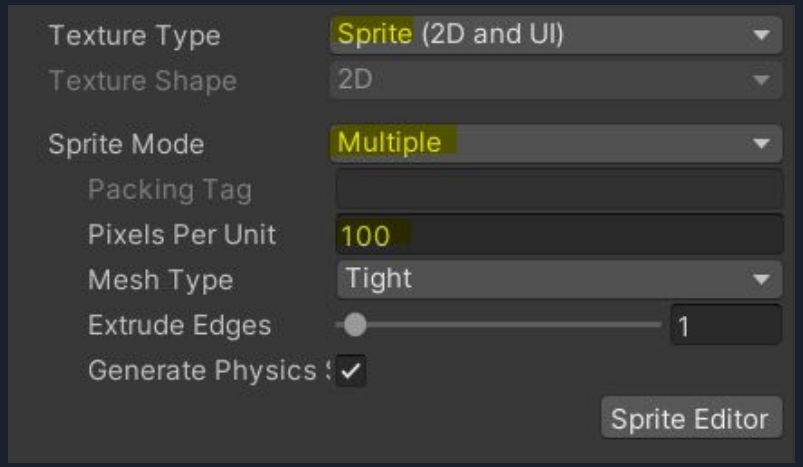


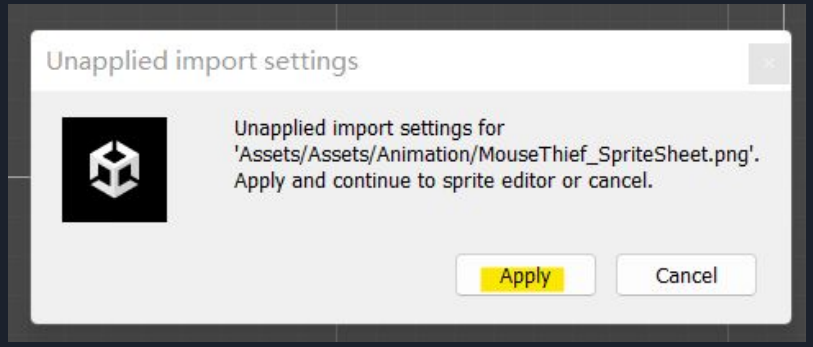
http://www.madwomb.com/tutorials/GameDesign_Unity2Dintro.html#part4


Create
Show in Explorer
Open
Delete
Rename
Copy Path Alt+Ctrl+C
Open Scene Additive
View in Package Manager
Import New Asset...
Import Package
Export Package...
Find References In Scene
Select Dependencies
Refresh Ctrl+R
Reimport
Reimport All
Extract From Prefab
Update UXML Schema
Open C# Project
View in Import Activity Window
Properties... Alt+P
Project
Console
Favorites
All Materials
All Models
All Prefabs
Assets
Assets
Animation
Scenes
TextMesh Pro
Packages
2D Animation
2D Common
2D Path
2D Pixel Perfect
2D PSD Importer
Assets > Assets > Animation
Assets/Assets/Animation

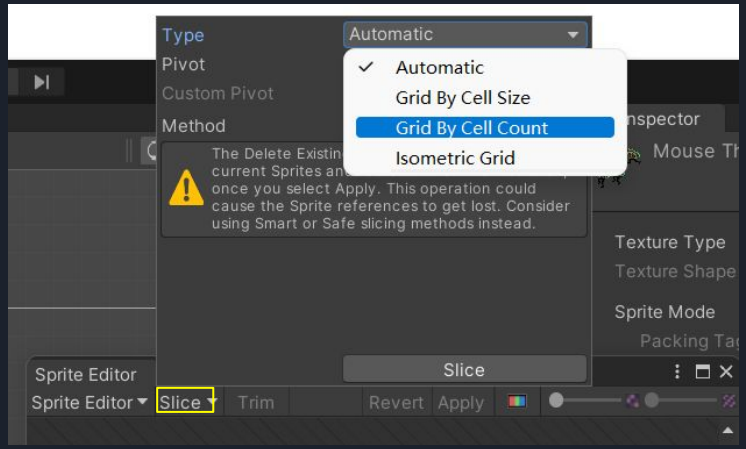
Assets > Assets > Animation
MouseThie...

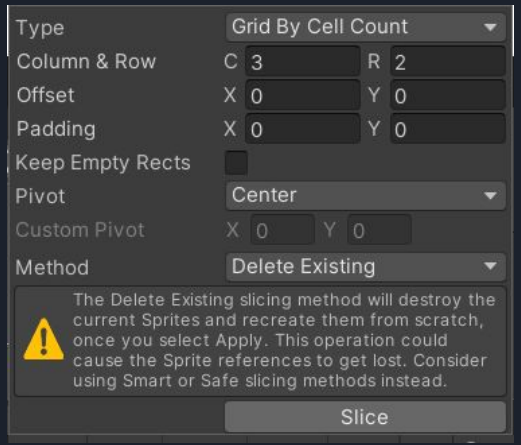

Hierarchy
SampleScene*
Main Camera
Canvas
EventSystem
Scene
Game
Animator
2D
Inspector
Mouse Thief_Sprite Sheet (Texture 2D)
Open
Texture Type
Sprite (2D and UI)
Texture Shape
2D
Sprite Mode
Single
Packing Tag
Pixels Per Unit
100
Mesh Type
Tight
Extrude Edges
1
Pivot
Center
Generate Physics
Sprite Editor
Advanced
Wrap Mode
Clamp
Filter Mode
Bilinear
Aniso Level
Default
Max Size
2048
Resize Algorithm
Mitchell
Format
Automatic
Compression
Normal Quality
Use Crunch Compres
MouseThief_SpriteSheet
RGB
R
G
B
MouseThief_SpriteSheet
512x512 RGBA Compressed DXT5|BC3 UNorm 256.0 KB
AssetBundle
None
None
Project
Console
Favorites
All Materials
All Models
All Prefabs
Assets
Assets
Animation
Scenes
TextMesh Pro
Assets > Assets > Animation
MouseThie...
Assets/Assets/Animation/MouseThief_SpriteSheet.png


Texture Type
Sprite (2D and UI)
Texture Shape
2D
Sprite Mode
Multiple
Packing Tag
Pixels Per Unit
100
Mesh Type
Tight
Extrude Edges
1
Generate Physics
Sprite Editor

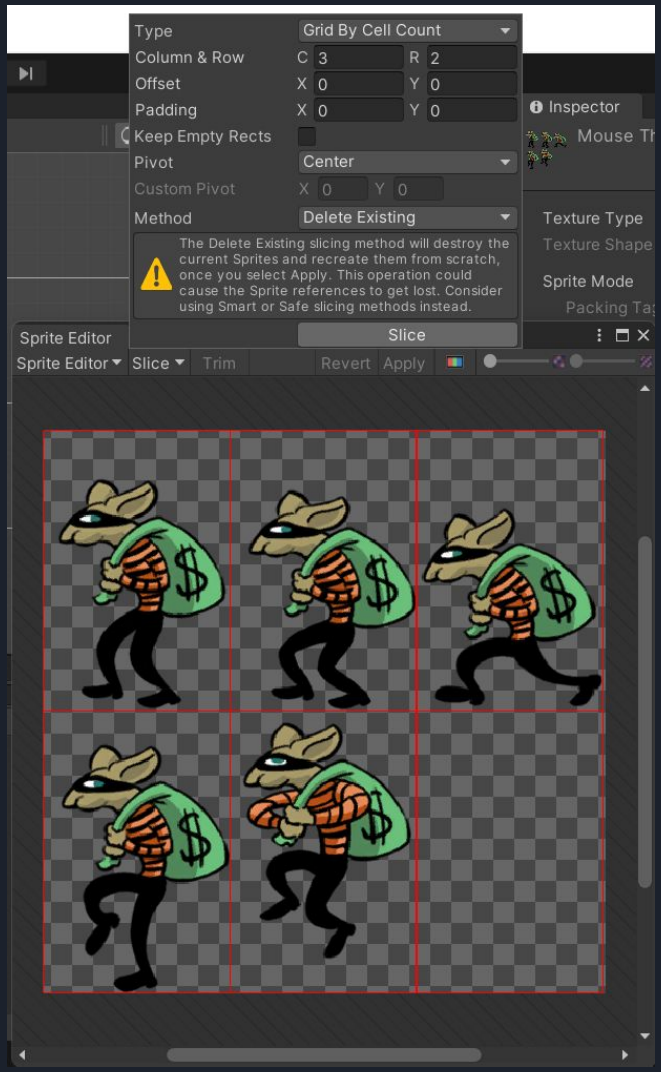

Unapplied import settings
Unapplied import settings for
'Assets/Assets/Animation/MouseThief_SpriteSheet.png'.
Apply and continue to sprite editor or cancel.
Apply
Cancel

Layers
Layout
Inspector
Texture Type
Sprite (2D and UI)
Texture Shape
2D
Sprite Mode
Multiple
Packing Tag
Pixels Per Unit
100
Mesh Type
Tight
Extrude Edges
1
Sprite Editor
Sprite Editor
Slice
Trim
Revert
Apply
Clamp
Bilinear
2048
Mitchell
Automatic
None
Revert
Apply
U2D.Animation.SpriteLibrarySourceAssetP
U2D.Animation.SpritePostProcess
RGB
R
G
B
MouseThief_SpriteSheet
x512 RGBA8 UNorm 1.0 MB


Type
Automatic
Pivot
Custom Pivot
Method
Automatic
Grid By Cell Size
Grid By Cell Count
Isometric Grid
The Delete Existin
current Sprites an
once you select Apply. This operation could
cause the Sprite references to get lost. Consider
using Smart or Safe slicing methods instead.
Texture Type
Texture Shape
Sprite Mode
Slice
Sprite Editor
Sprite Editor
Slice
Trim
Revert
Apply


Type
Grid By Cell Count
Column & Row
C 3
R 2
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

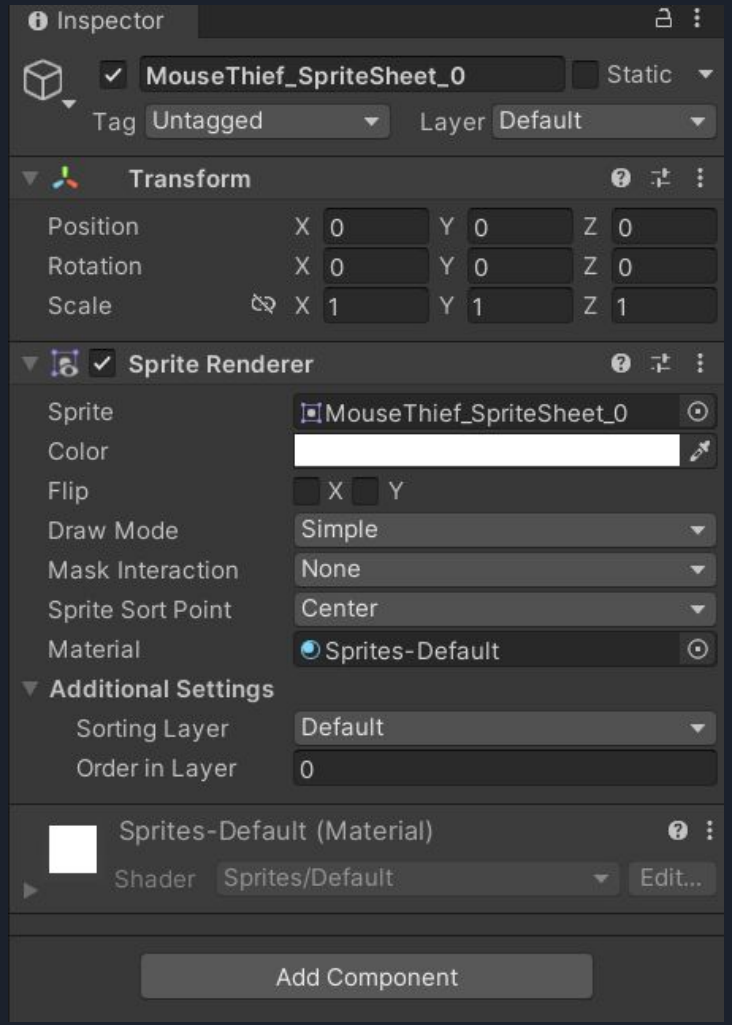
Hit “apply”

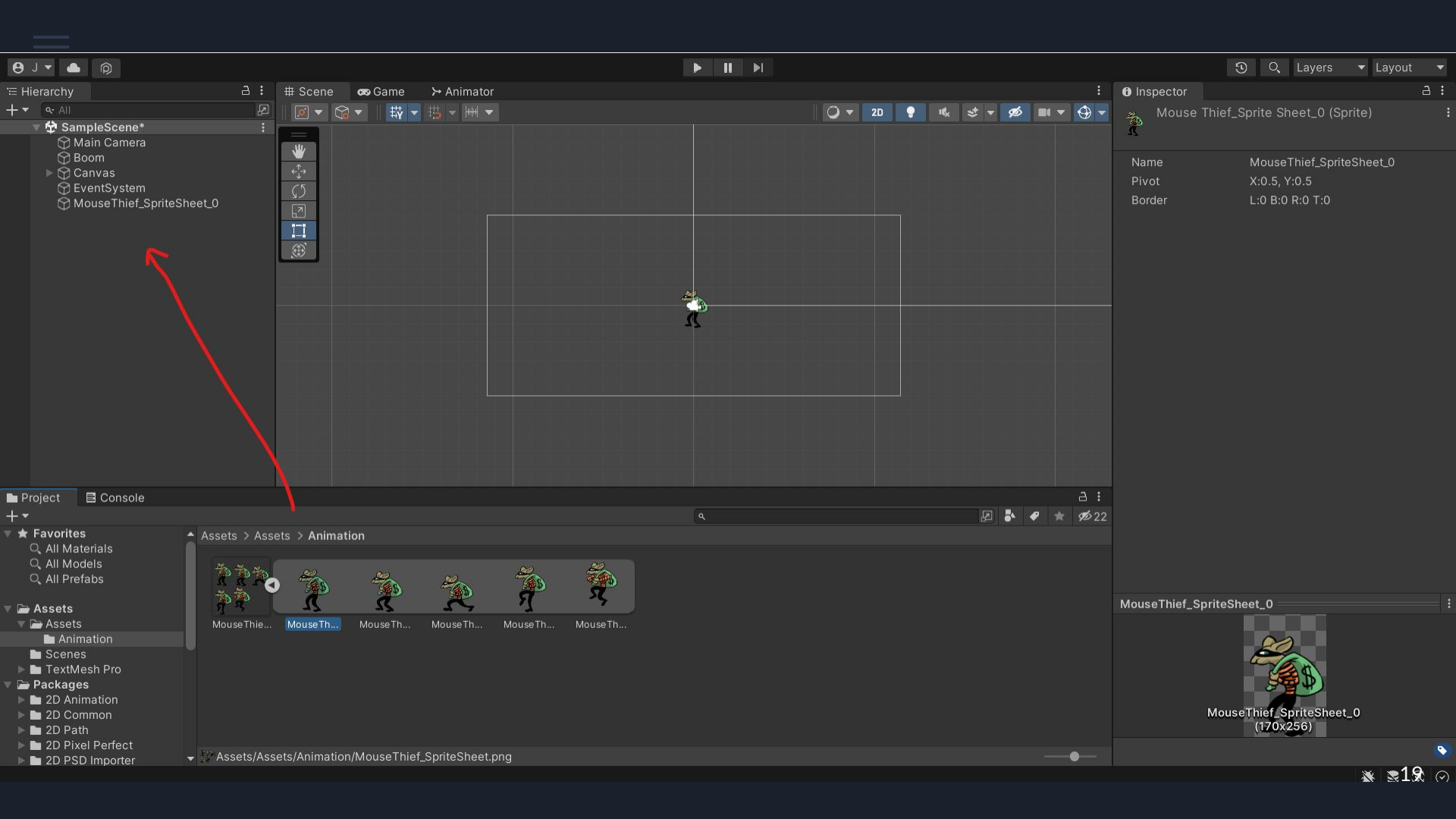

Type
Grid By Cell Count
Column & Row
C 3
R 2
Offset
X 0
Y 0
Padding
X 0
Y 0
Keep Empty Rects
Pivot
Center
Custom Pivot
X 0
Y 0
Method
Delete Existing
The Delete Existing slicing method will destroy the current Sprites and recreate them from scratch, once you select Apply. This operation could cause the Sprite references to get lost. Consider using Smart or Safe slicing methods instead.
Slice
Inspector
Texture Type
Texture Shape
Sprite Mode
Sprite Editor
Sprite Editor
Slice
Trim
Revert
Apply

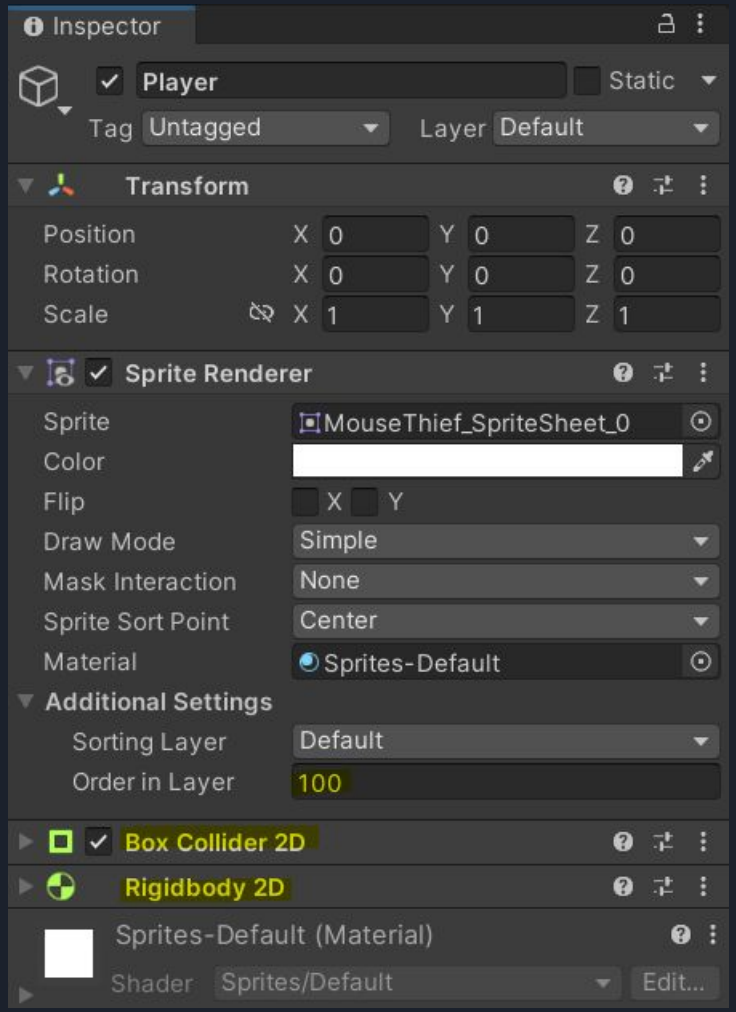
Drag the first sprite into the Hierarchy

If dragging doesn't work:

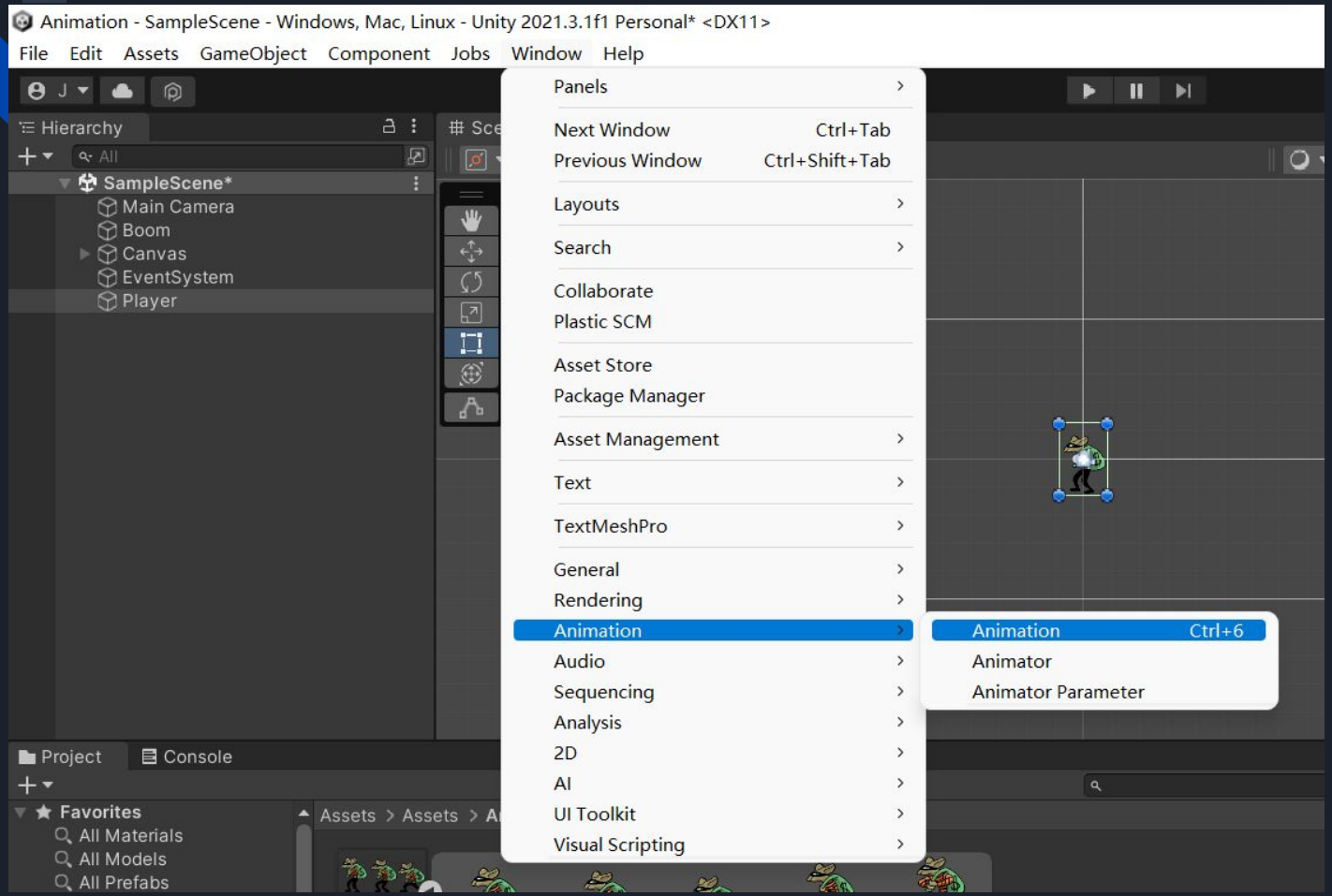
- Create new empty GameObject
- Add Component - Sprite Renderer
- Select the first Mouse sprite through"Sprite"




Hierarchy
SampleScene*
Main Camera
Boom
Canvas
EventSystem
MouseThief_SpriteSheet_0
Scene
Game
Animator
2D
Inspector
Mouse Thief_Sprite Sheet_0 (Sprite)
Name MouseThief_SpriteSheet_0
Pivot X:0.5, Y:0.5
Border L:0 B:0 R:0 T:0
Project
Console
Favorites
All Materials
All Models
All Prefabs
Assets
Assets
Animation
Scenes
TextMesh Pro
Packages
2D Animation
2D Common
2D Path
2D Pixel Perfect
2D PSD Importer
Assets > Assets > Animation
MouseThie...
MouseTh...
MouseTh...
MouseTh...
MouseTh...
MouseTh...
Assets/Assets/Animation/MouseThief_SpriteSheet.png
MouseThief_SpriteSheet_0
MouseThief_SpriteSheet_0
(170x256)


Inspector
Player
Static
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
Sprite Renderer
Sprite MouseThief_SpriteSheet_0
Color
Flip X Y
Draw Mode Simple
Mask Interaction None
Sprite Sort Point Center
Material Sprites-Default
Additional Settings
Sorting Layer Default
Order in Layer 100
Box Collider 2D
Rigidbody 2D
Sprites-Default (Material)
Shader Sprites/Default
Edit...

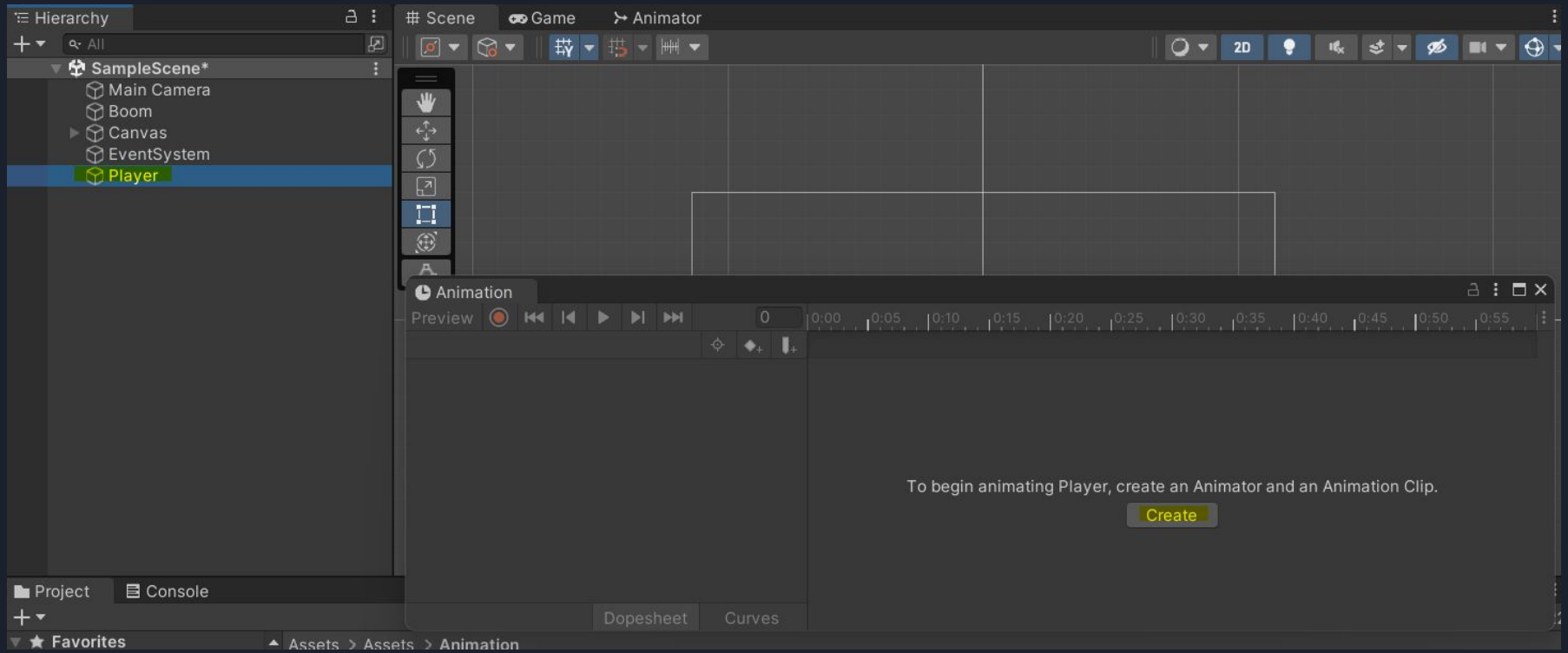
Check for understanding



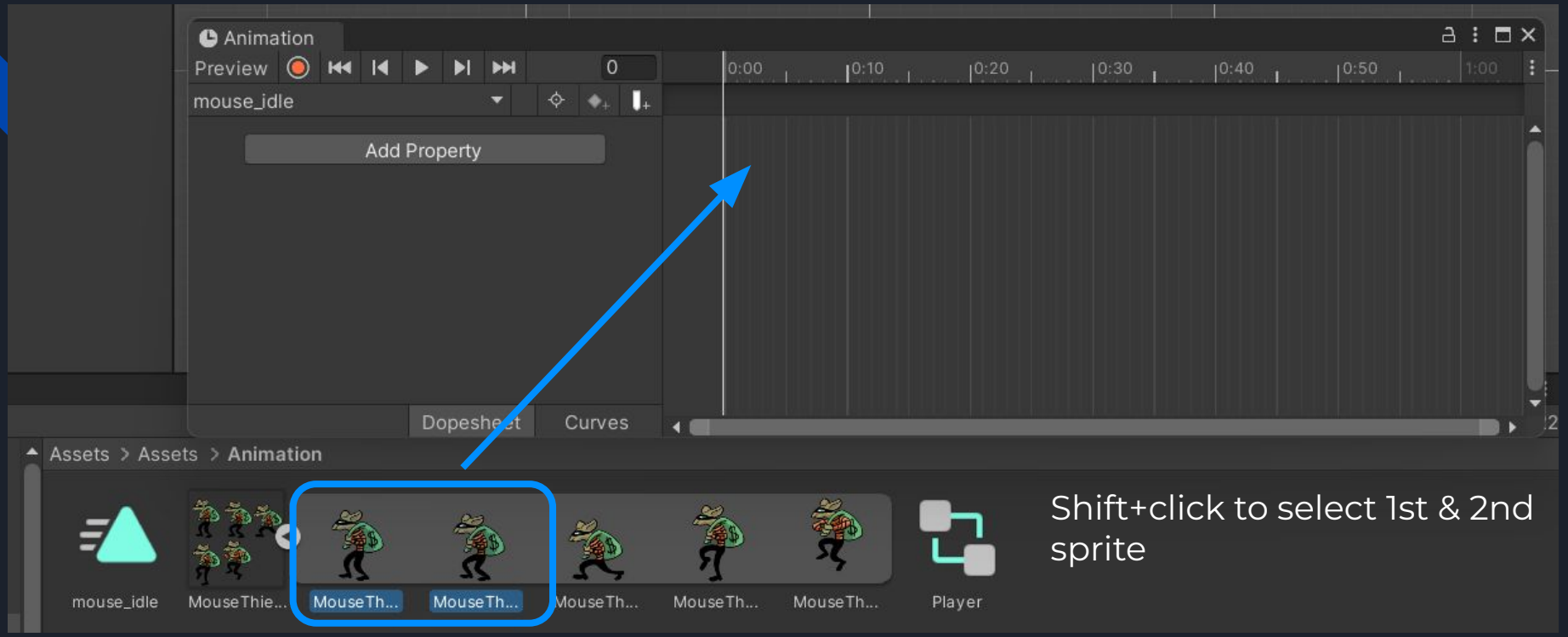
Animation panel

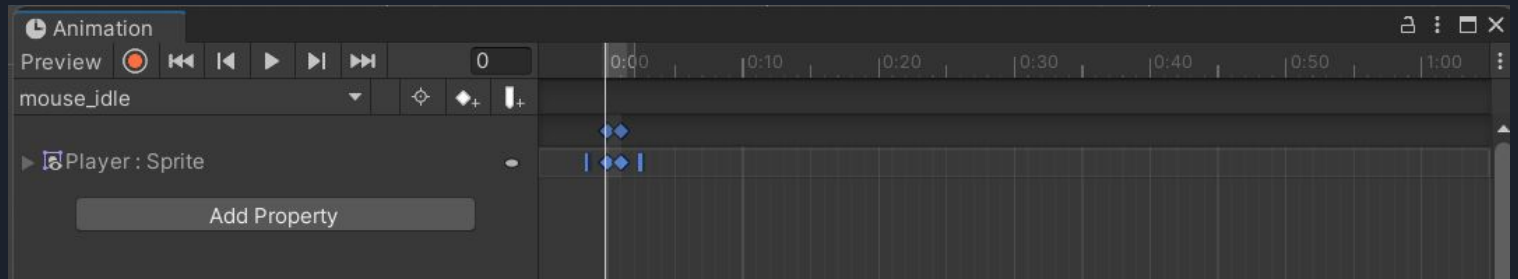
- Allows you to add animator component to gameobjects
- Allows you to create & edit animation clips attached to gameobjects

Have the player selected before creating an Animator & Animation Clip

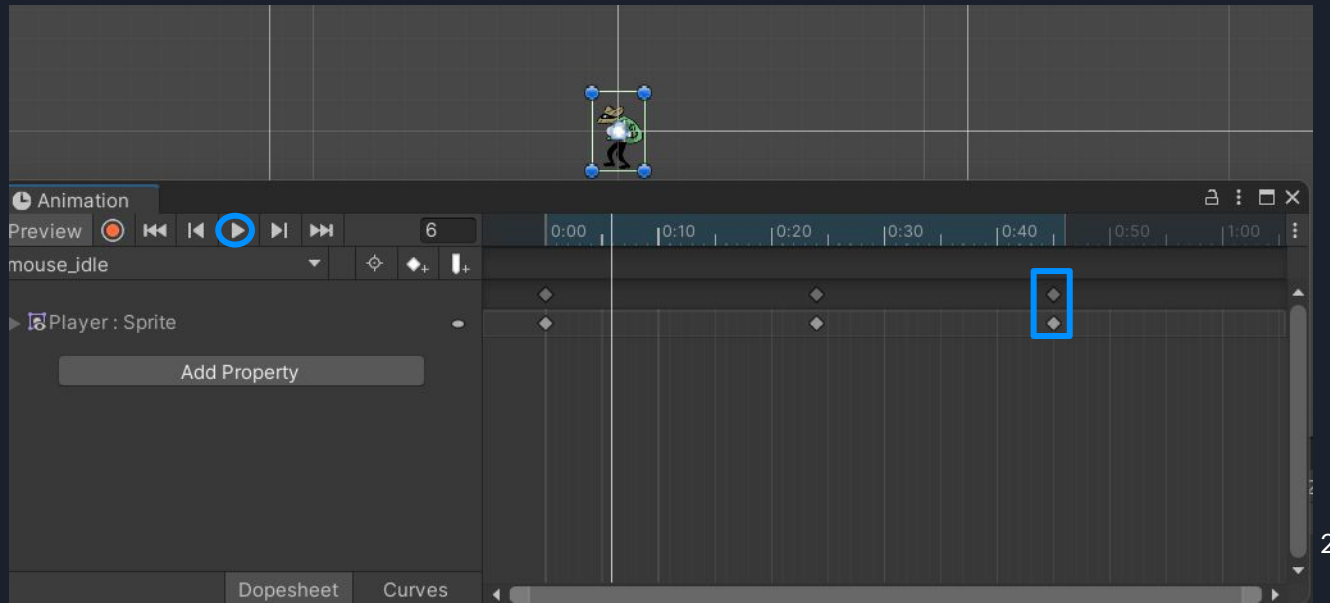


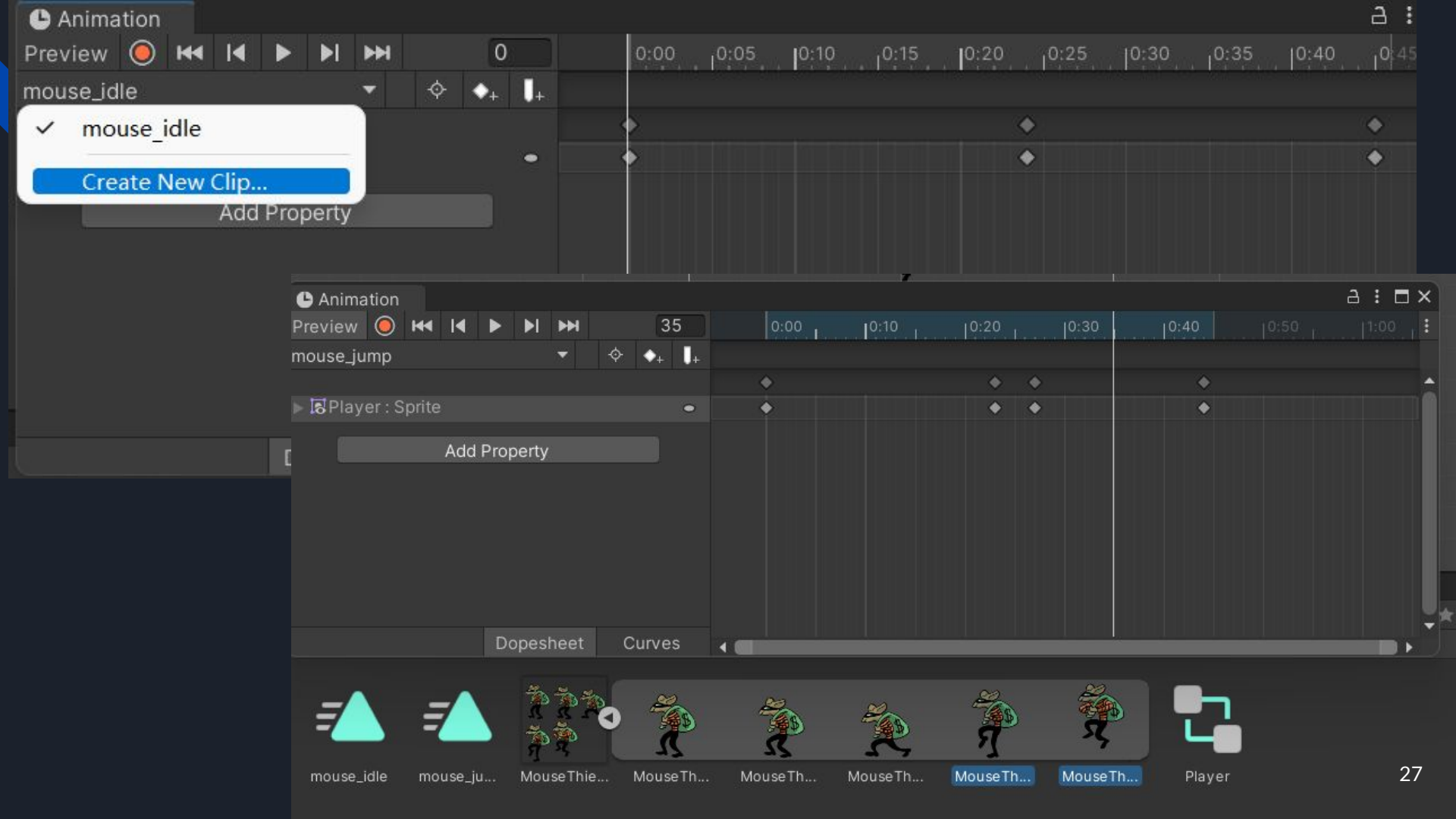
- Hit “create”
- Save the animator in an Animation folder (or create a new folder)
- Rename Animator to **mouse_idle.anim**


Animation
Preview
0
mouse_idle
Add Property
0:00
0:10
0:20
0:30
0:40
0:50
1:00
Dopesheet
Curves
Assets > Assets > Animation
mouse_idle
MouseThie...
MouseTh...
MouseTh...
MouseTh...
MouseTh...
MouseTh...
Player
Shift+click to select 1st & 2nd sprite


Animation
Preview
0
mouse_idle
Player : Sprite
Add Property
0:00
0:10
0:20
0:30
0:40
0:50
1:00

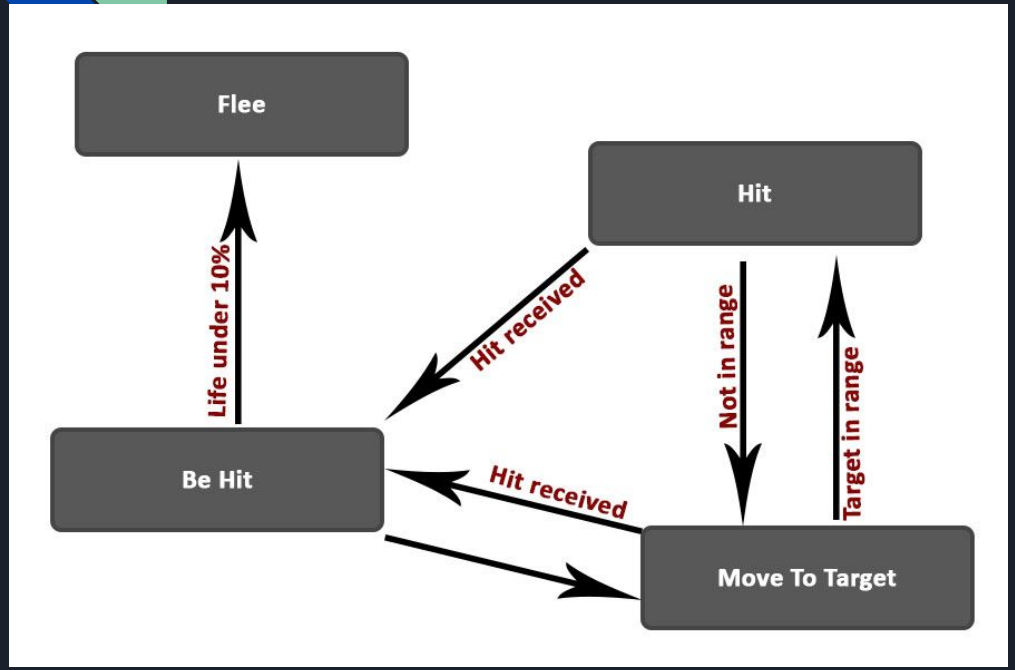
Animation
Preview
11
mouse_idle
Player : Sprite
Add Property
0:00
0:10
0:20
0:30
0:40
0:50
1:00
Dopesheet
Curves


Animation
Preview
6
mouse_idle
Player : Sprite
Add Property
0:00
0:10
0:20
0:30
0:40
0:50
1:00
Dopesheet
Curves


Animation
Preview
0
mouse_idle
0:00
0:05
0:10
0:15
0:20
0:25
0:30
0:35
0:40
mouse_idle
Create New Clip...
Add Property
Animation
Preview
35
mouse_jump
0:00
0:10
0:20
0:30
0:40
0:50
1:00
Player : Sprite
Add Property
Dopesheet
Curves
mouse_idle
mouse_ju...
MouseThie...
MouseTh...
MouseTh...
MouseTh...
MouseTh...
MouseTh...
Player

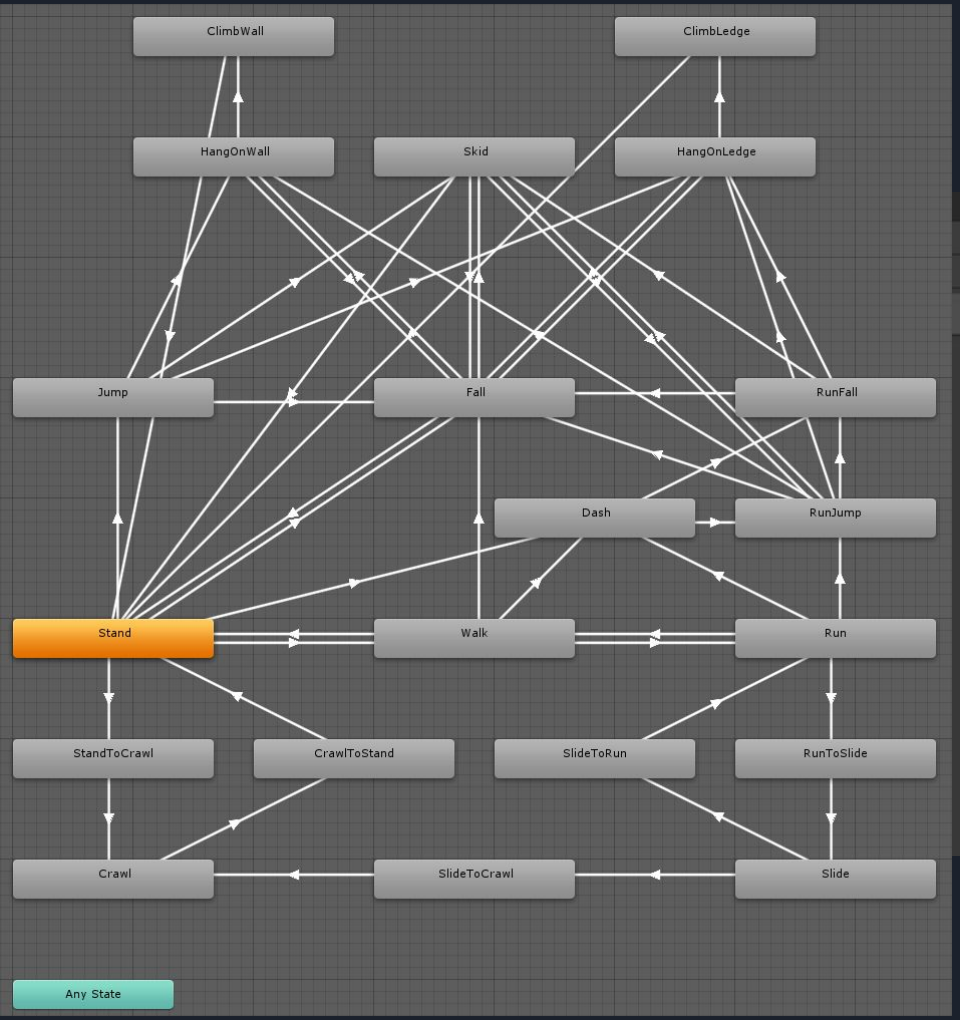
Mecanim State Machine

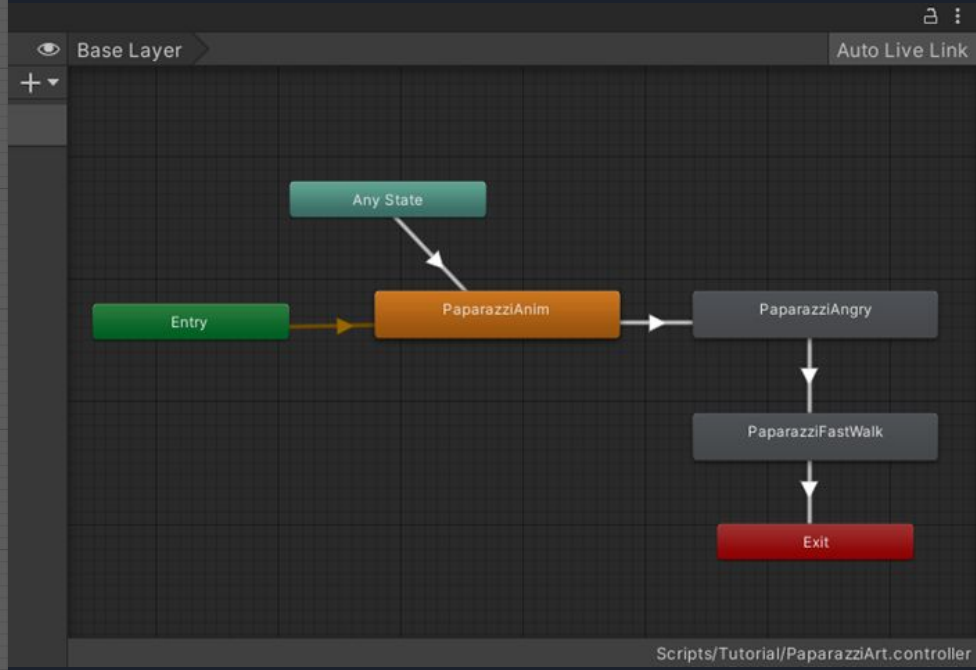
Mecanim State Machine

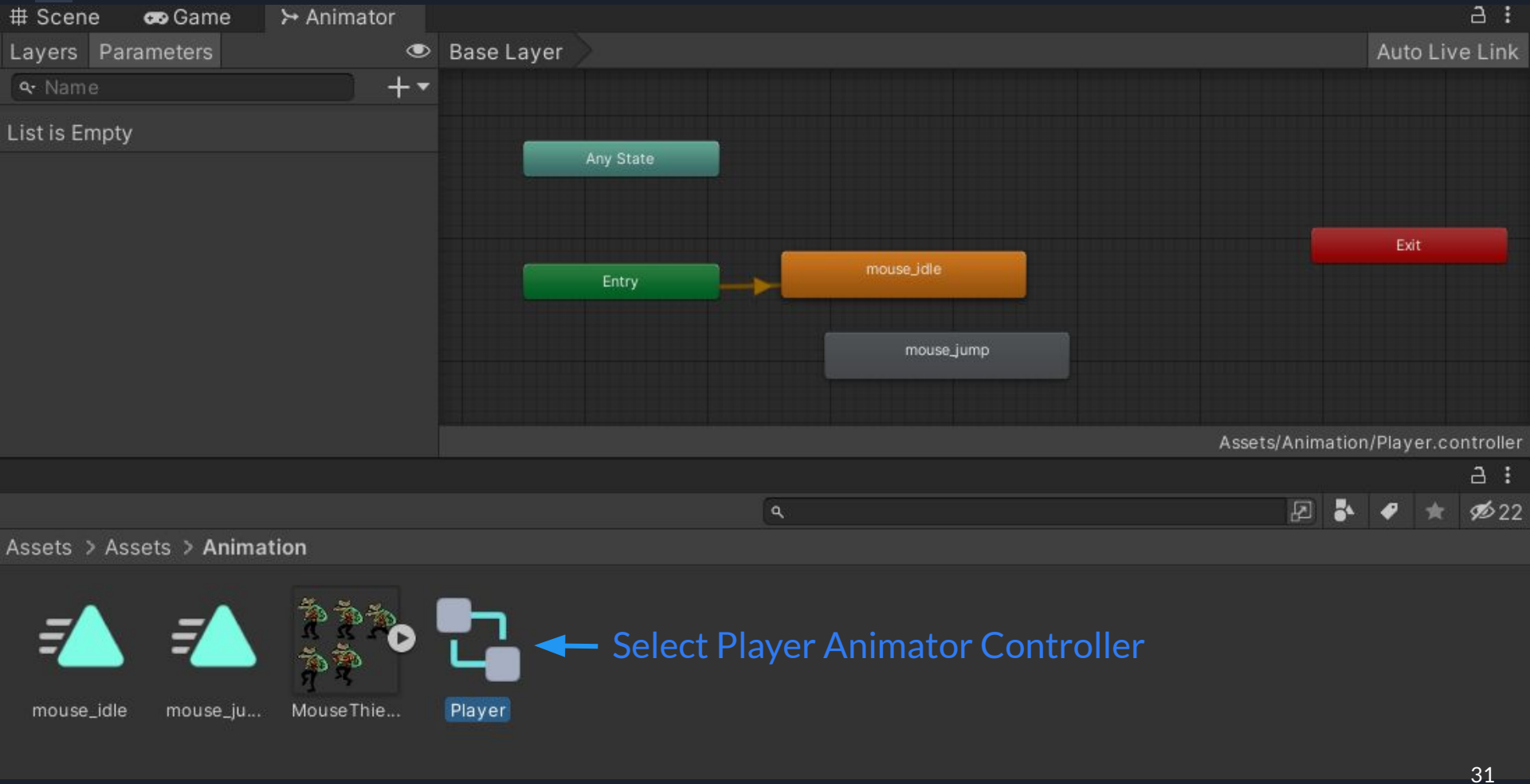


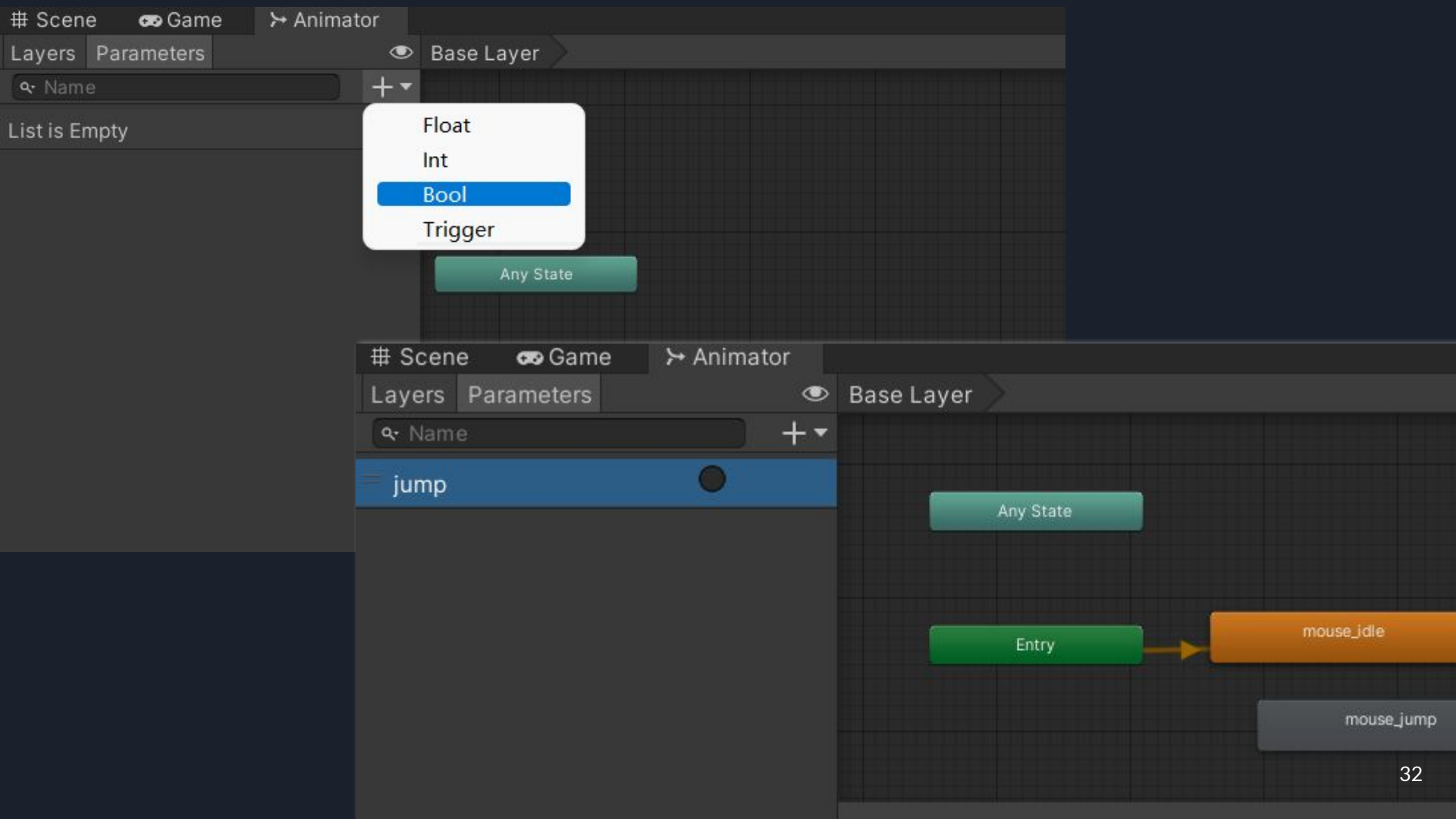
- Type of finite State Machine
- One animation clip will play
- Uses:
  - Character animation & transitions
  - UI
  - AI
    - NPC/enemy
    - Objects

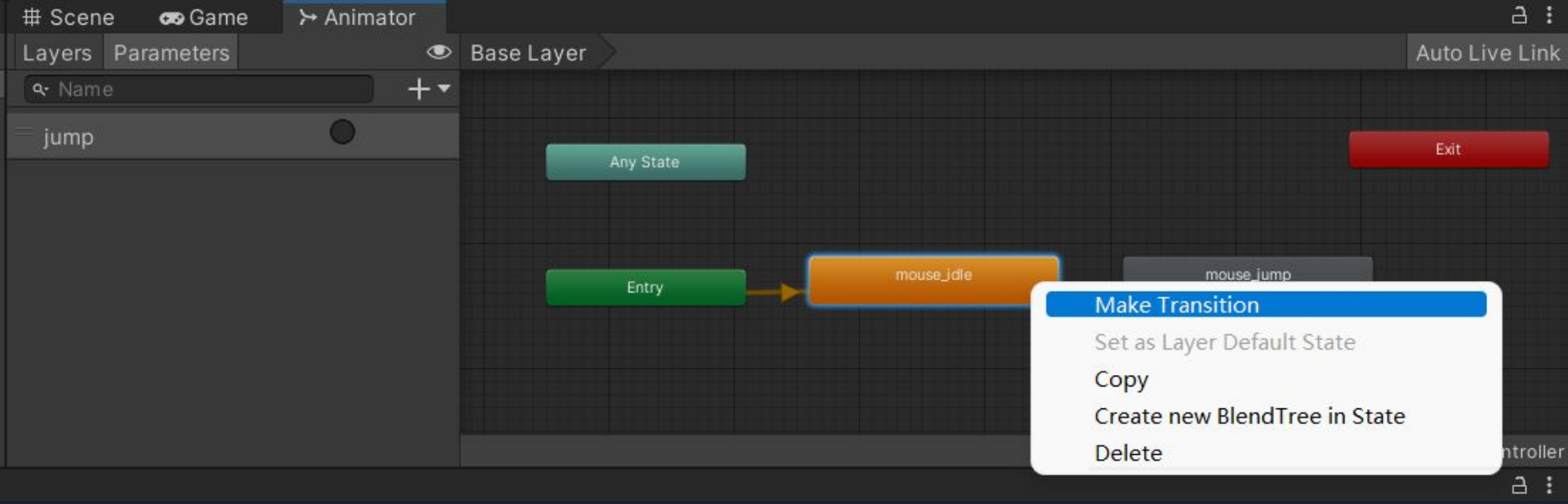
Just an example of state machines in action

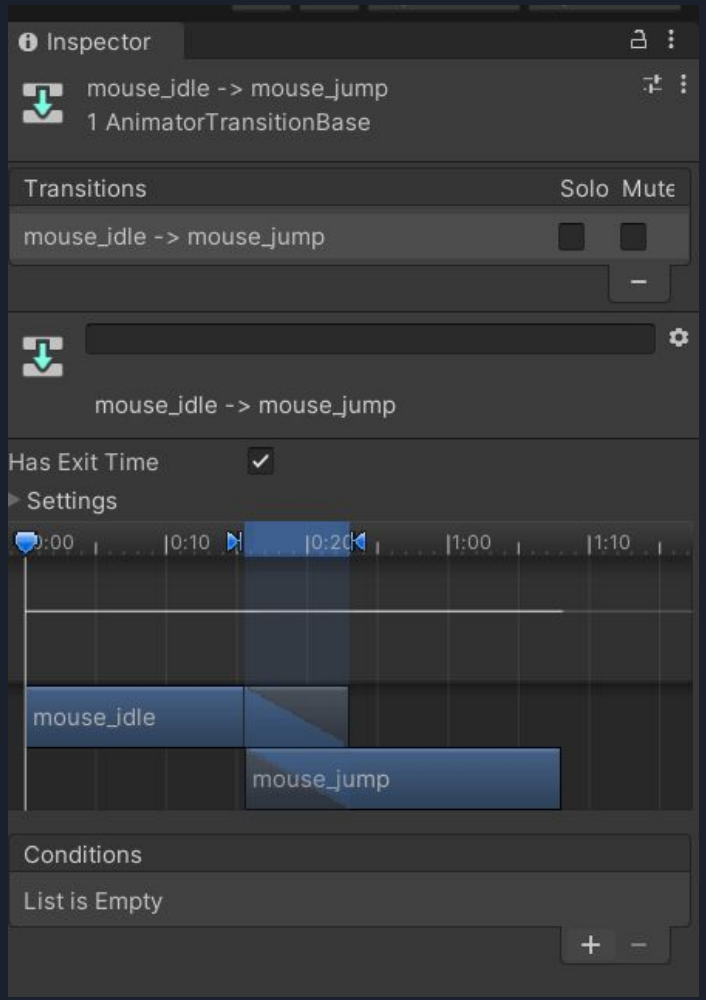


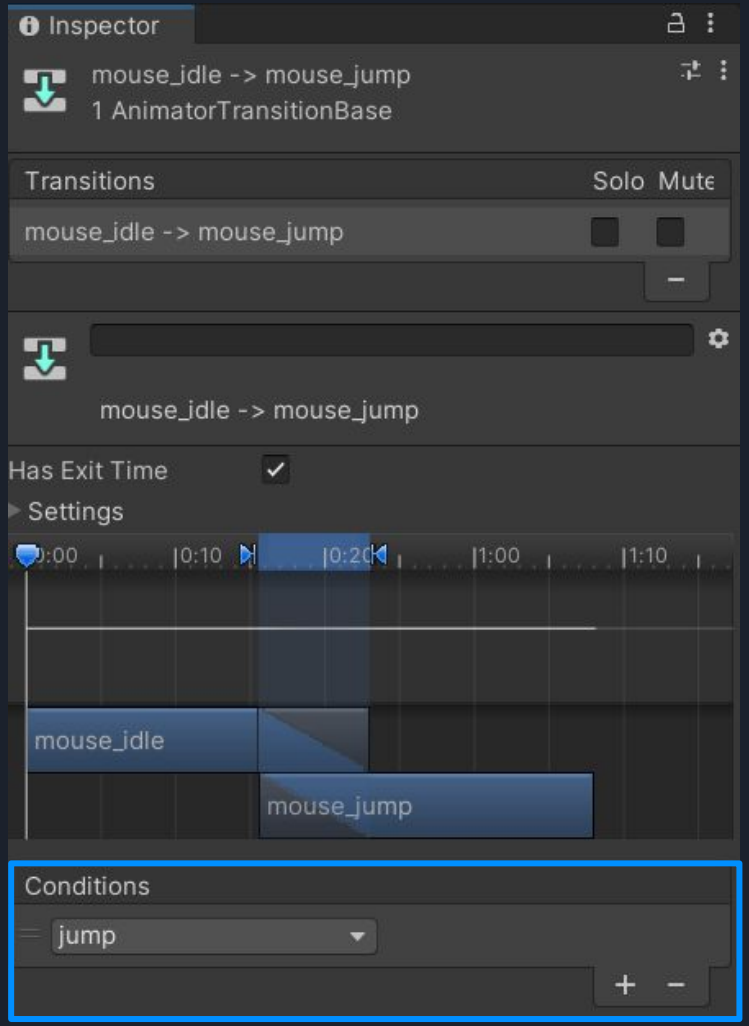


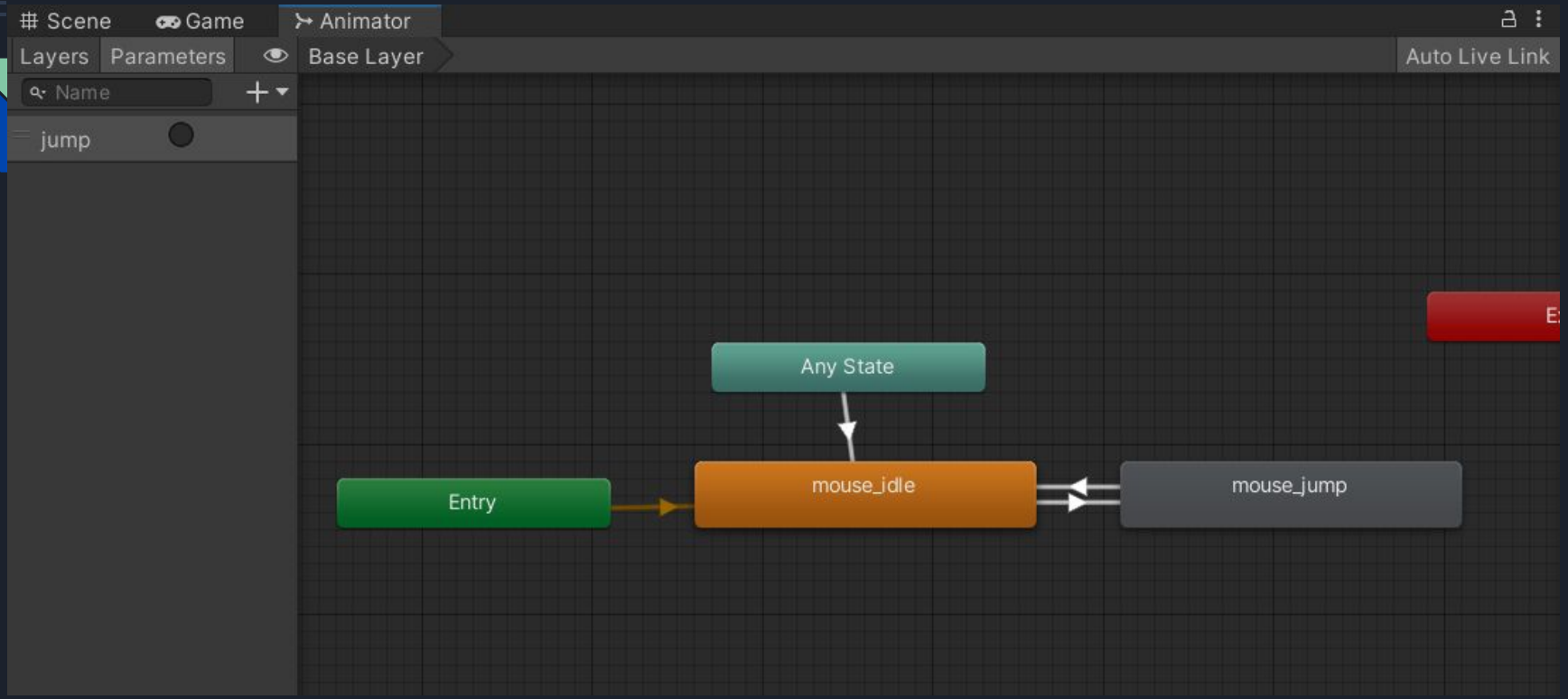

Scene
Game
Animator
Layers
Parameters
Name
List is Empty
Base Layer
Auto Live Link
Any State
Entry
mouse_idle
mouse_jump
Exit
Assets/Animation/Player.controller
22
Assets > Assets > Animation
mouse_idle
mouse_ju...
MouseThie...
Player
Select Player Animator Controller


Scene
Game
Animator
Layers
Parameters
Base Layer
Name
List is Empty
Float
Int
Bool
Trigger
Any State
Scene
Game
Animator
Layers
Parameters
Base Layer
Name
jump
Any State
Entry
mouse_idle
mouse_jump


Scene
Game
Animator
Layers
Parameters
Base Layer
Auto Live Link
Name
jump
Any State
Exit
Entry
mouse_idle
mouse_jump
Make Transition
Set as Layer Default State
Copy
Create new BlendTree in State
Delete


Inspector
mouse_idle -> mouse_jump
1 AnimatorTransitionBase
Transitions
Solo
Mute
mouse_idle -> mouse_jump
mouse_idle -> mouse_jump
Has Exit Time
Settings
0:00
0:10
0:20
1:00
1:10
mouse_idle
mouse_jump
Conditions
List is Empty


Inspector
mouse_idle -> mouse_jump
1 AnimatorTransitionBase
Transitions
Solo
Mute
mouse_idle -> mouse_jump
mouse_idle -> mouse_jump
Has Exit Time
Settings
0:00
0:10
0:20
1:00
1:10
mouse_idle
mouse_jump
Conditions
jump



- For booleans, set to true
- For Float/Int, set to > or < a certain value

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
public class PlayerControlAnimated : MonoBehaviour
{
    public Animator anim;
    public float jump_height = 1;

    // Start is called before the first frame update
    void Start()
    {
        anim = gameObject.GetComponent<Animator>();
    }

    // Update is called once per frame
    void Update()
    {
        //jump code
        if (Input.GetKey(KeyCode.UpArrow))
        {
            Vector3 position = this.transform.position;
            position.y += jump_height / 4;
            this.transform.position = position;
            anim.SetTrigger("jump");
        }
    }
}
```

Summary - State Machine

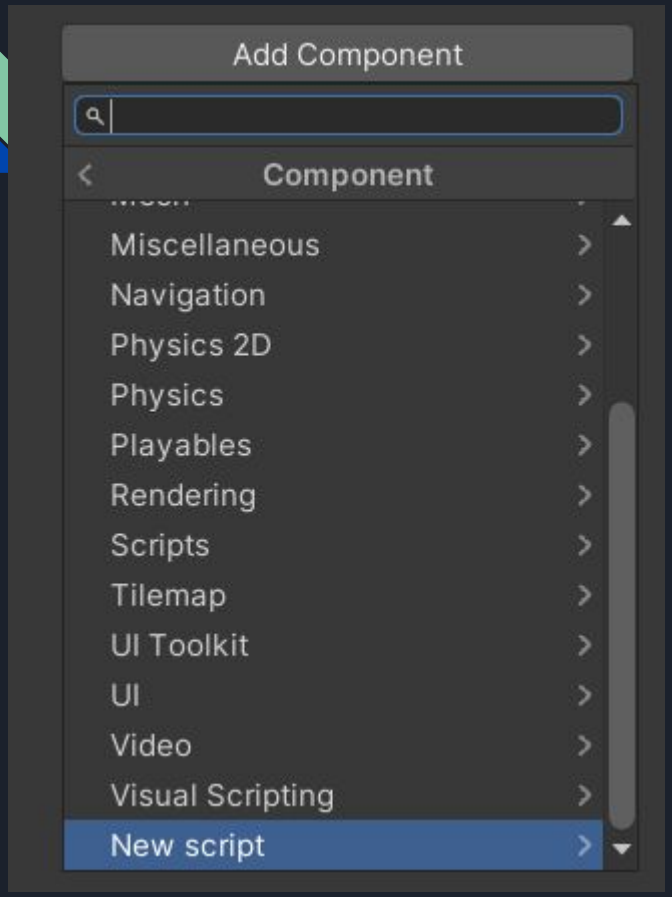
Adding animation to script

- Declare animator: public Animator animator_name;
- Edit Parameter:
  - animator_name.SetBool("name_of_condition", true);
  - animator_name.SetFloat("name_of_condition", 1.5);
  - animator_name.SetTrigger("name_of_condition");

Creating transitions in the animator

- Right click and “create transition”
- Add a condition based on your parameters
- Turn off “has exit time” if you want your animation to continue

Controlling States through Scripts



```
public class PlayerControlAnimated : MonoBehaviour
{
    public Animator anim;

    void Update()
    {
        if (Input.GetKey(KeyCode.UpArrow))
        {
            Vector3 position = this.transform.position;
            position.y += 1 / 4;
            this.transform.position = position;
            anim.SetTrigger("jump");
        }

    }
}
```

Using State Machines to Create AI Behavior

- Create a script, inherit from class “State Machine Behaviours”
- Script -> change Animator state -> call other scripts
- OnStateEnter and OnStateExit
-

```
void OnStateUpdate() {

    this.Animator.SetBool("BoolName", False);

}
```

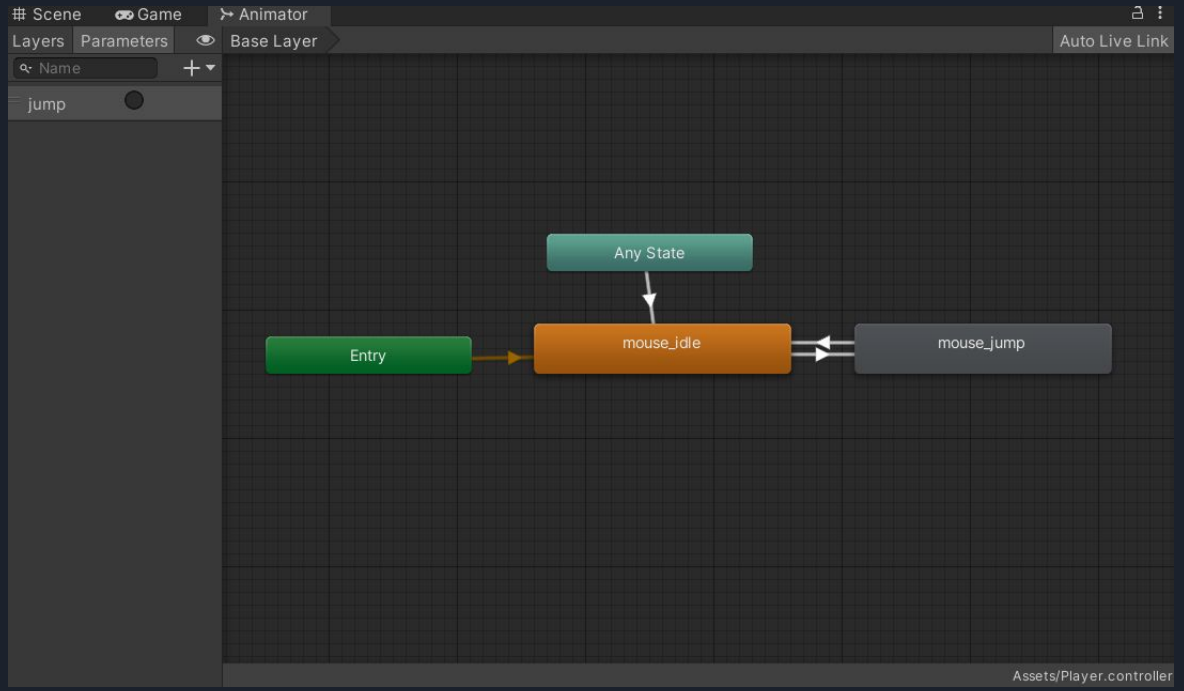
```
class TriggerContinueAfterDelay : StateMachineBehaviour {
  private float delay = 1.0f;

  void OnStateEntered() {
    this.DoAfterDelay(this._delay, () => {
      this.Animator.SetTrigger("Continue");
    }
  }
}
```

https://medium.com/the-unity-developers-handbook/dont-re-invent-finite-state-machines-how-to-repurpose-unity-s-animator-7c6c42145785

Post to Piazza:

A screenshot of your state machine with one or more parameters



Additional Resources

Using Mecanim State Machine for AI:
https://medium.com/the-unity-developers-handbook/dont-re-invent-finite-state-machines-how-to-repurpose-unity-s-animator-7c6c421e5785

Animating visual effects in Unity:
http://www.madwomb.com/tutorials/GameDesign_UnityScripting.html#2e

Animating background/menu:
http://madwomb.com/tutorials/GameDesign_UnityVisualNovel.html#animation

Tweening: http://www.madwomb.com/tutorials/gamedesign/GameDesign_Tweening.pptx