

# Intro to Unity

Unity Overview

Editor Interface

Primitives

Materials

Textures

Terrain

Prefabs

First Person Controller

# What is Unity

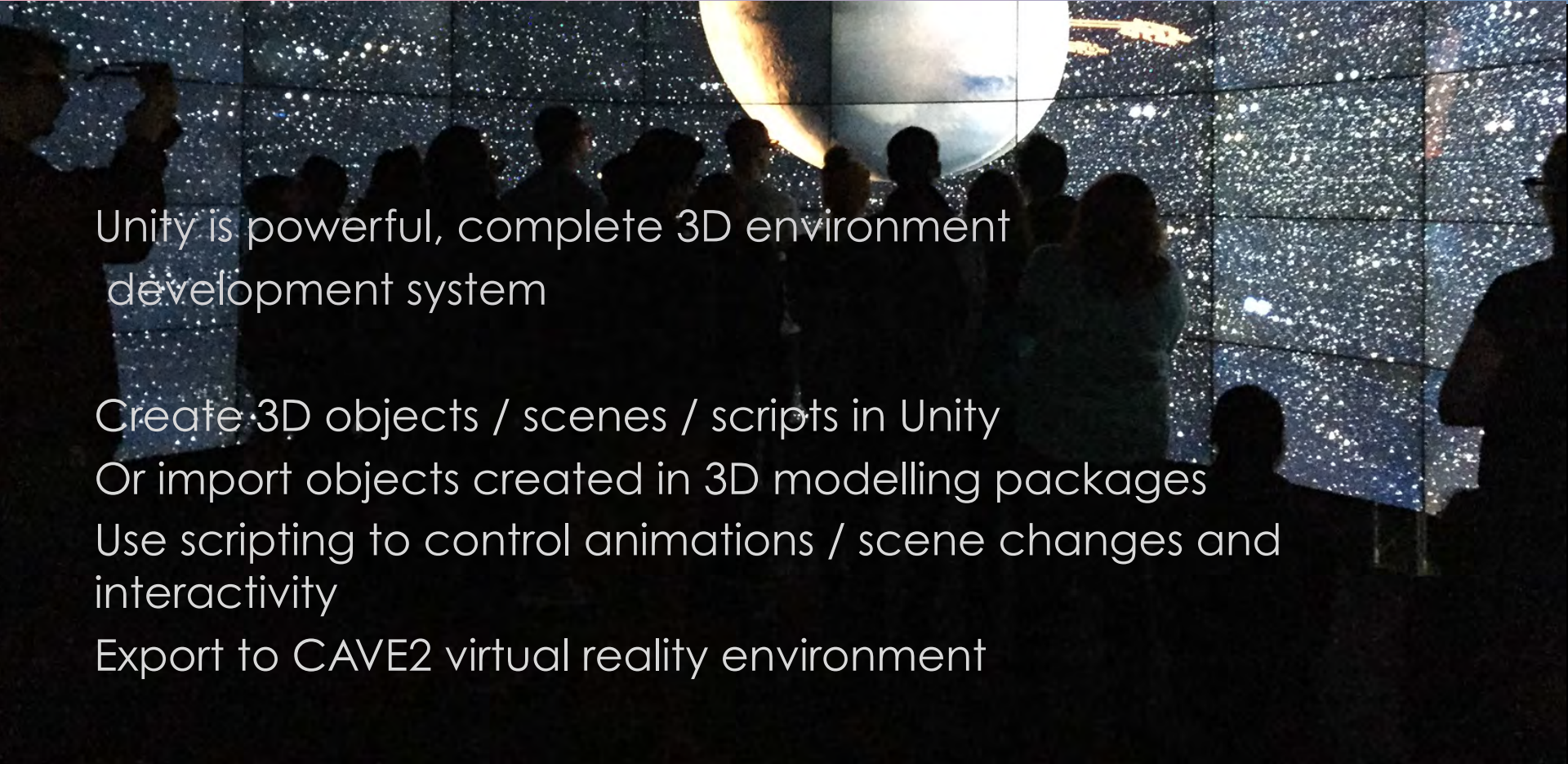
Unity is powerful, complete 3D environment development system

Create 3D objects / scenes / scripts in Unity

Or import objects created in 3D modelling packages

Use scripting to control animations / scene changes and interactivity

Export to CAVE2 virtual reality environment



# What is Unity

Integrated development environment (IDE)

Games and interactive 3D virtual environments development

Commercial game engine (Free and Pro)

Multi-platform

Popular

2 billion registered users

Large asset store (models, scripts)

Support (formal and community)

# What is Unity

- Game engine
  - 3D objects / lighting / physics / animation / scripting
- Accompanying script editor
  - MonoDevelop...
  - Visual Studio
- 3D terrain editor
- 3D object animation manager
- GUI system

# Scripting

Scripts can be written in

## JavaScript

Majority of introductory tutorials were written in Javascript

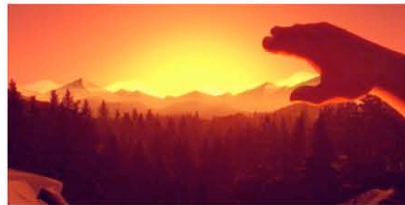
## C#

Unity can be integrated with the Microsoft Visual Studio editor, to get full benefits of code completion, source version control, intergration, serious developers work in C#

## BOO (like Python)

Smaller development in this

# Unity Games



# Unity Games

Fall Guys: Ultimate Knockout  
Among Us.

Untitled Goose Game.

Monument Valley 2.

Ori and the Will of the Wisps

Cuphead.

Pokémon Go.

Beat Saber.

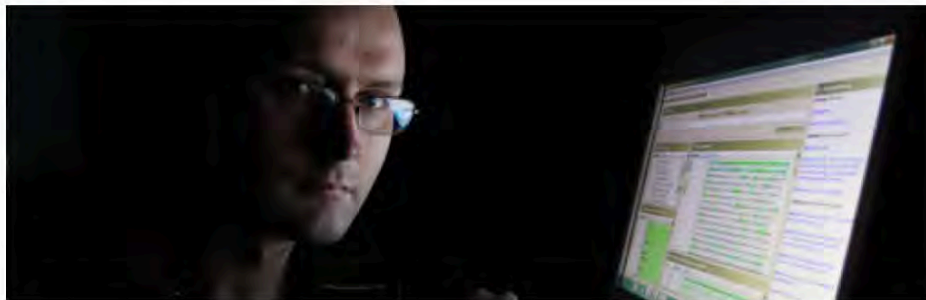
and many more [https://en.wikipedia.org/wiki/List\\_of\\_Unity\\_games](https://en.wikipedia.org/wiki/List_of_Unity_games)



### Research

[Research Overview](#)[Labs + Groups](#)[Faculty + Research](#)[Interests](#)[Publications](#)[Editorships + Editorial Boards](#)[Board + Committee Memberships](#)[Project One-Sheets](#)

### Research Overview



ICT is a multidisciplinary research institute at the University of Southern California focused on exploring and expanding how people engage with computers, through virtual characters, video games, simulated scenarios and other forms of human-computer interaction.

Leading researchers and faculty from computer science, psychology, interactive media

### Featured Research

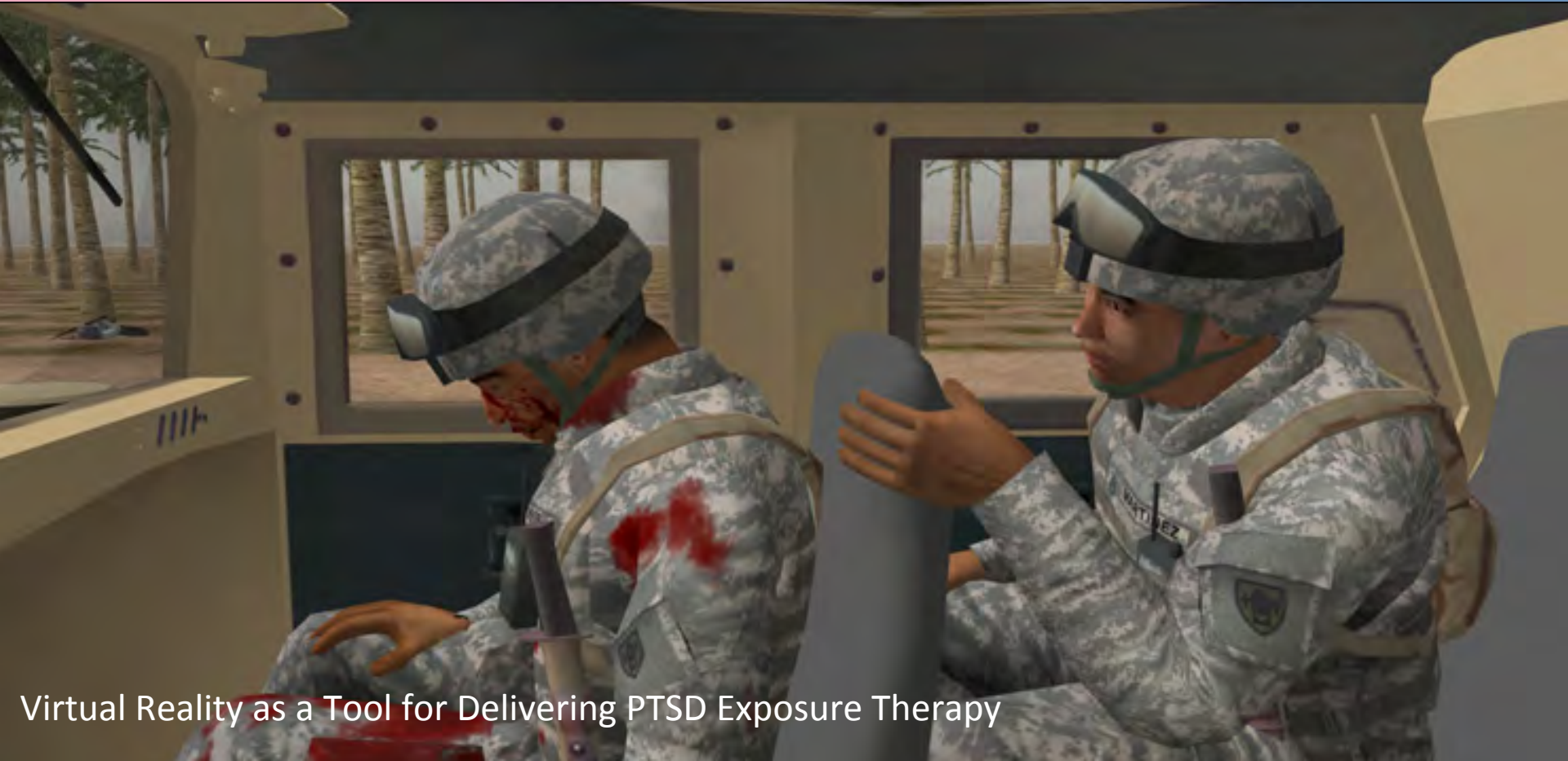


### Graphics

The ICT Graphics Laboratory develops new techniques for creating and displaying photo-real computer graphics of people, objects and environments.



# Institute for Creative Technologies /Skip Rizzo- Medical VR



Virtual Reality as a Tool for Delivering PTSD Exposure Therapy

# Free vs Pro

Pro offers:

Level of Detail

No Personal Edition splash screen

Profiler

Full screen post processing effects (Oculus)

Team License

Unity Cloud Build Pro

Unity Analytics Pro...

# What is Unity

Simplify development of games.

Game Mechanics

- physics, AI

Rendering Effects

- shadows, lighting

I/O Abstraction

- input devices
- output devices

# Multi Platform

## Multiple Build Targets

- Windows
- Linux
- iOS
- Android
- Web player
- Oculus Rift
- Wii
- ... and more!

# Version

CAVE2 supports 2019.2.11

CAVE2 Unity template and Guide

<https://github.com/uic-evl/omicron-unity/wiki/Guide-for-running-Unity-in-CAVE2>

# Other game engines



# Installation

CAVE2 supports 2019.2.11

Install Unity Hub > Archives > Unity 2019.2.11

<https://unity.com/download#how-get-started>



Products

Solutions

Learning

Support & Services

Community

Developer tools

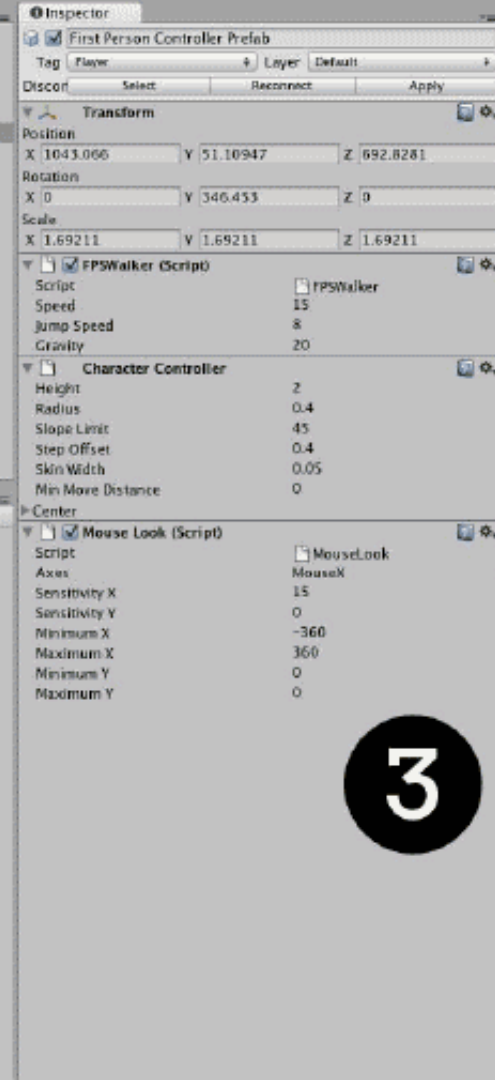
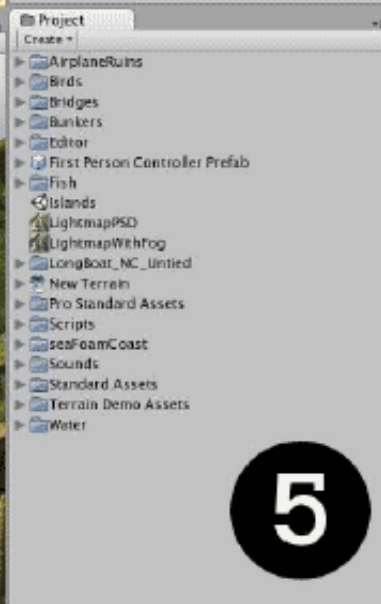
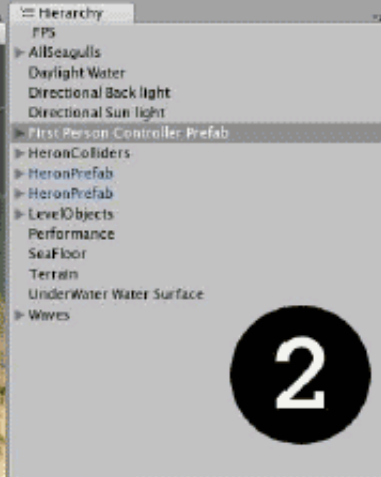
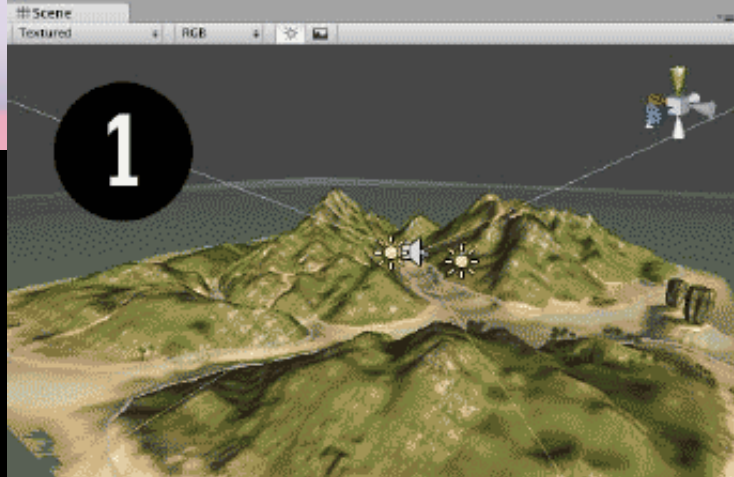
Get started



DOWNLOAD UNITY

# UNLOCK YOUR CREATIVITY

Download the world's most popular development platform for creating 2D and 3D multiplatform games and interactive experiences.





# Editor

## 1 – Scene

- Editable current scene with 3d 3D game objects where the game is constructed

## 2 – Hierarchy

Text list of game objects and sub-objects in the current scene

## 3 – Inspector

Properties for currently selected asset/object

## 4 – Game

Preview how game will look when executing

## 5 – Project

Contents of Project 'assets' folder (i.e. files in that folder)  
library of scripts, digital media files, and scenes, library

# Editor

## 1 – Scene

Editable (design-time) 3D game objects in the current scene

- place for any visual assets in your Unity environment
- updates in real-time when you are previewing the game
- the manipulator on the top right allows you to switch between a number of standard views
- perspective view allows to view current scene with a vanishing point
-

## 2 – Hierarchy

Text list of game objects and sub-objects in the current scene

- lists all the objects in the currently loaded scene
- lists object children

Children are objects that can be thought of as subordinate to the parent object; wherever the top object moves, they'll follow, keeping the current offset they have to this object.

## 3 – Inspector

Properties for currently selected assets and objects

- allows to look at and tweak individual settings of various game objects and assets
- allows to adjust global settings
- is content-sensitive
- changes its parameters based on which game object/asset is selected
- a place to show project settings and preferences by choosing them from the Edit menu

## 4 – Game

Preview how game will look when executing

- previewing the game
- shows a rendering of how the game will look
- ignoring graphical effects that need to be computed at run-time, from the point of view of the main camera

# Editor

## Navigating the Scene Window



The scene view is what allows you to look around and move the visual assets you import into Unity. It's how you'll assemble your levels and place important things like lighting, trigger zones, audio, and much more. Being able to control the camera is important if you want to do anything at all with it.



Hand Tool (shortcut Q) : drag around in the scene to pan your view. Holding down alt+drag will rotate the view, Ctrl.+drag will allow you to zoom. Does not move anything in the scene, just your point of view.

Translate Tool (shortcut X) : active selection tool, enables to drag an object's axis handles in order to reposition it.

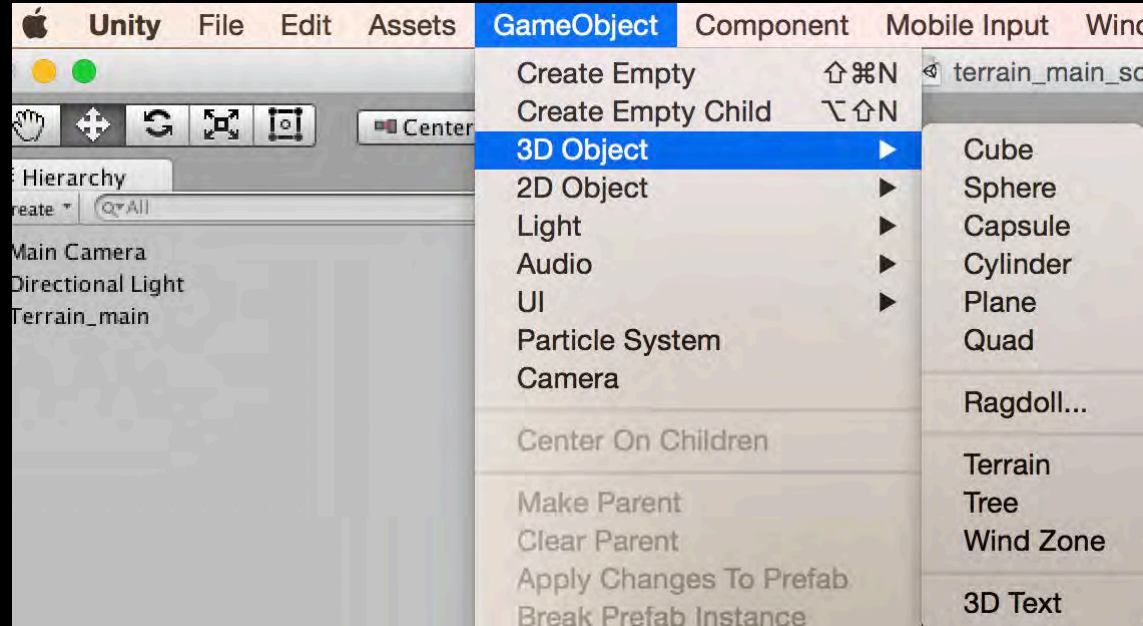
Rotate Tool (shortcut E) : using handles to allow you to rotate an object around either of its axes.

Scale Tool (shortcut R) : works the same as the previous two tools, allows scaling of an object.

# Primitives

basic game objects Unity  
can create without  
Importing external assets

- lights
- particle systems
- cameras
- 3D objects
- 2D objects
- Etc.



1. Game Object > 3D Object > Cube



# Primitives

Scale: X: 25, Y: 1, Z: 25

Move camera a little back  
and point it downward to see the box

2. Game Object > 3D Object > Sphere  
Move and place it above the cube

Position: X: 0, Y: 2, Z: 0

Scale: X: 4, Y: 4, Z: 4

IntroUnity1.unity - IntroUnity - PC, Mac & Linux Standalone (Personal)

Center Local

Hierarchy: Main Camera, Directional Light, Cube, Sphere

Scene: Shaded, 2D, Gizmos, Q=All

Game: Free Aspect, Maximize on Play, Mute audio

Inspector: ballBouncing

Dynamic Friction	0.6
Static Friction	0.6
Bounciness	0.8
Friction Combine	Average
Bounce Combine	Maximum
Friction Direction 2	X 0 Y 0 Z 0
Dynamic Friction 2	0
Static Friction 2	0

Console Project

Assets

- ballBouncing
- IntroUnity1

ballBouncing.physicMaterial

Asset Labels

AssetBundle: None



# Primitives

Scale: X: 25, Y: 1, Z: 25

Move camera a little back  
and point it downward to see the box

3. Assign the sphere a rigid body component

Select the sphere

Component > Physics > Rigid Body

4. Preview the game

# Primitives

sphere should fall, but not bounce yet

5. Create a physic material, which will provide the material properties to make the game object bouncy

Asset > Create > Physics Material

6. Drag the new physics material from the Asset window onto the Sphere game object in the Hierarchy window or directly onto the sphere in the Scene window

# Primitives

7. In inspector adjust the parameters

Bounciness to 0.8 and Bounce  
Combine to Maximum

8. Preview the game

the sphere should bounce similar to a rubber ball

9. experiment with different heights and different angles

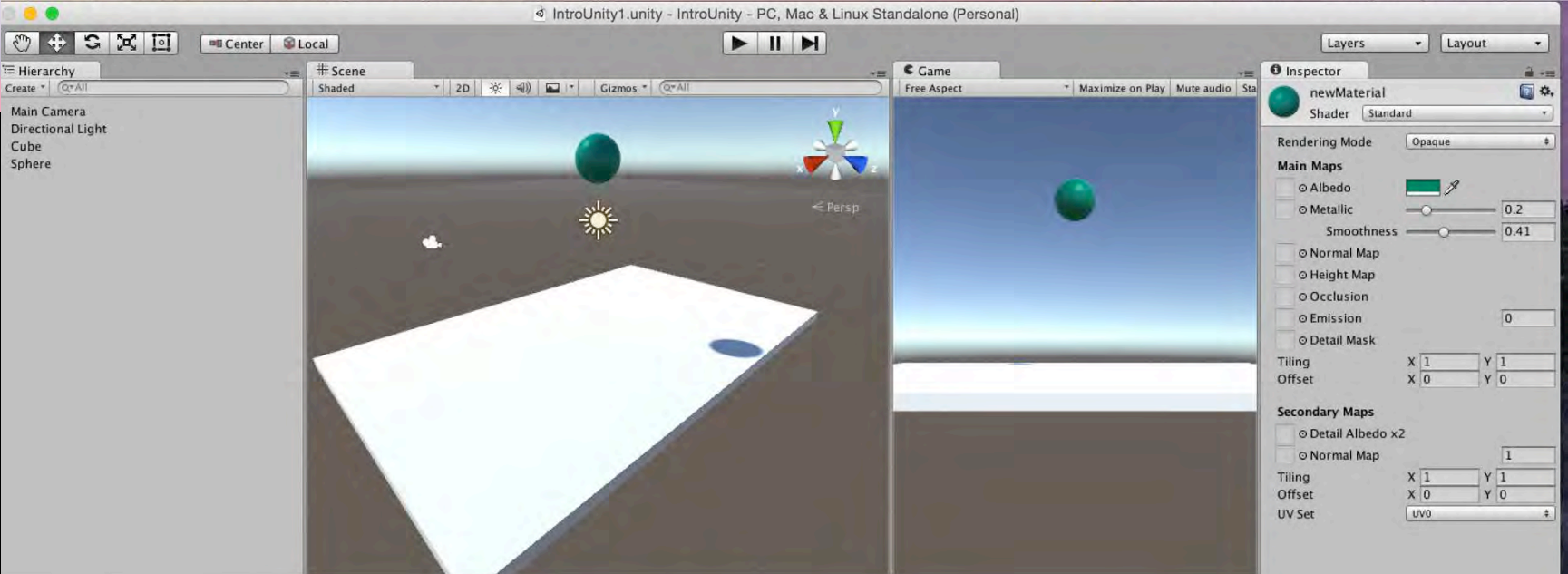
# Materials

## 10. Assets > Create > Material

double click the color swatch next to *Main color* and choose a different color

tweak the material's properties by experimenting with different shaders from the shader drop-down menu in the Inspector window

11. Drag new material from the Project window onto the game object in the Hierarchy window



# Textures

Textures should be in the following format to enable ‘tiling’

Square and the power of two

128 x 128

256 x 256

512 x 512

1024 x 1024

Shaders control the rendering characteristics of textured surface



# Terrain

Unity's Terrain editor

- islands
- topographical landscapes
- Mountains
- And more

12. Create a new Scene "terrain" and save it

13. GameObject > 3D Object > Terrain

# Terrain

14. Change to top view

- the view manipulator icon in the Scene window's top right corner (top-isometric)

Zoom into the terrain (F key)

15. Select Raise/Lower Terrain tool in the Inspector window  
(make sure the Terrain is selected in the Hierarchy window)

“draw” on the top view of the ground plane in the Scene window to create terrain topography

# Terrain

16. Fine-tune brush size and opacity

17. Maximize the scene window to see the details of your terrain

18. Assets > Import Package > Environment



Create

Reveal in Finder

Open

Delete

Import New Asset...

Import Package

Export Package...

Find References in Scene

Select Dependencies

Refresh

⌘R

Reimport

Reimport All

Run API Updater...

Sync MonoDevelop Project

Custom Package...

2D

Cameras

Characters

CrossPlatformInput

Effects

Environment

ParticleSystems

Prototyping

Utility

Vehicles

terrain\_main\_scene.unity - IntroUnity - PC, Mac & Linux Standalone (Personal)



Layers Layout

Hierarchy

Main Camera  
Directional Light  
Terrain\_main

Console Project

Create

All Models  
All Prefabs  
All Scripts  
Assets  
Editor  
Standard Assets  
Characters  
FirstPersonChar  
Audio  
Prefabs  
Scripts  
PhysicsMaterials  
RollerBall

Assets > Standard Assets > Characters > FirstPersonCharacter > Prefabs  
FPSController  
RigidBodyFPSController

# Terrain

Create terrain by selecting brush type, brush size and opacity

Sculpt topology

Set maximum height and smooth corners

Textures loaded to paint texture onto terrain

First texture acts as background, paint textures

Paint on trees and grass.

# Terrain

19. Paint the terrain

Select the Brush tool using Inspector window > Terrain

20. Add Texture

Add terrain texture

Search for “sand”



Center Local

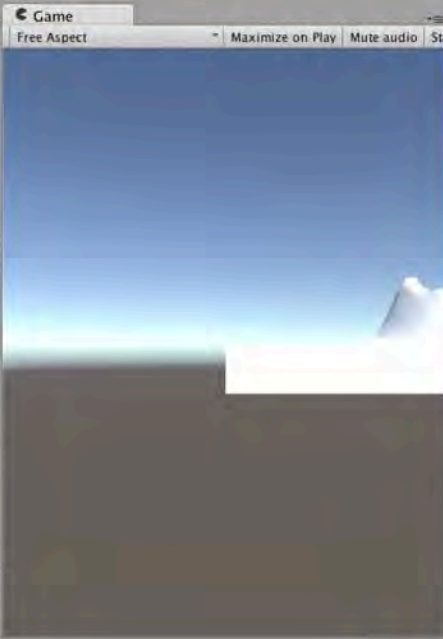
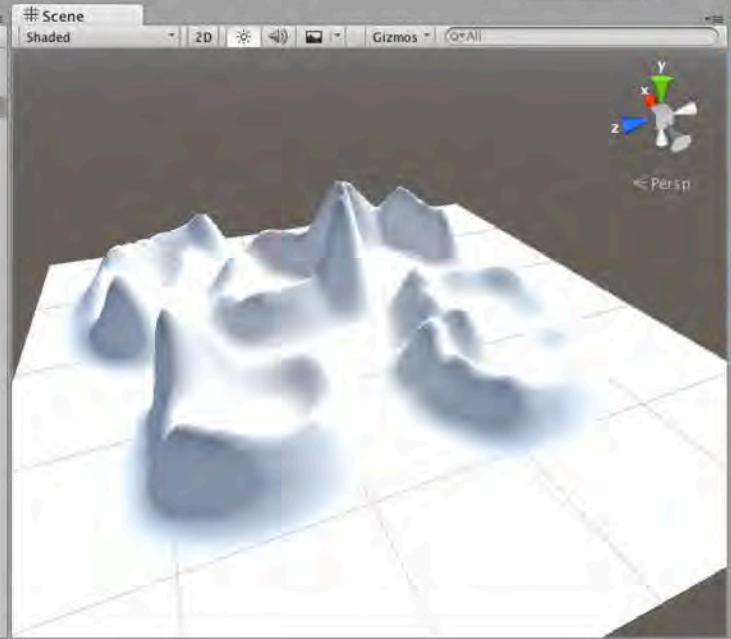


Layers Layout

Hierarchy

Create + (Q+A)

- Main Camera
- Directional Light
- Terrain\_main



Inspector

Terrain\_main 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

**Terrain**

Paint Texture

Select a texture below, then click to paint

**Brushes**

**Textures**

No terrain textures defined.

Edit Textures...

**Settings**

Brush Size 100

Opacity 97

Target Strength 1

Console Project

Create +

- All Models
- All Prefabs
- All Scripts

**Assets**

- Editor
- Standard Assets
  - Characters
    - FirstPersonChar
      - Audio
      - Prefabs
      - Scripts
    - PhysicsMaterials
    - RollerBall

Library

This folder is empty.

Terrain Collider

Material None (Physic Material)

Terrain Data New Terrain 1

Enable Tree Colliders

Add Component



Center Local

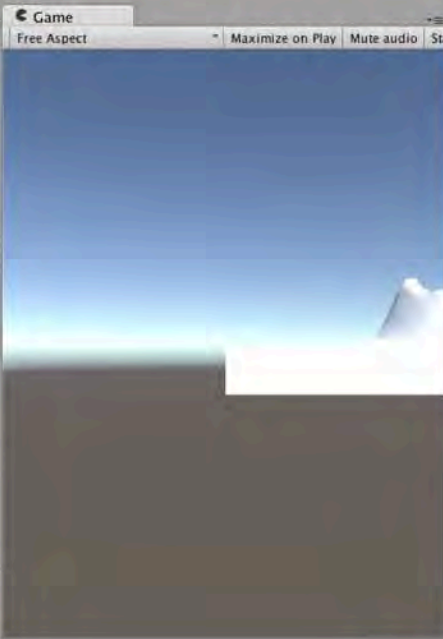
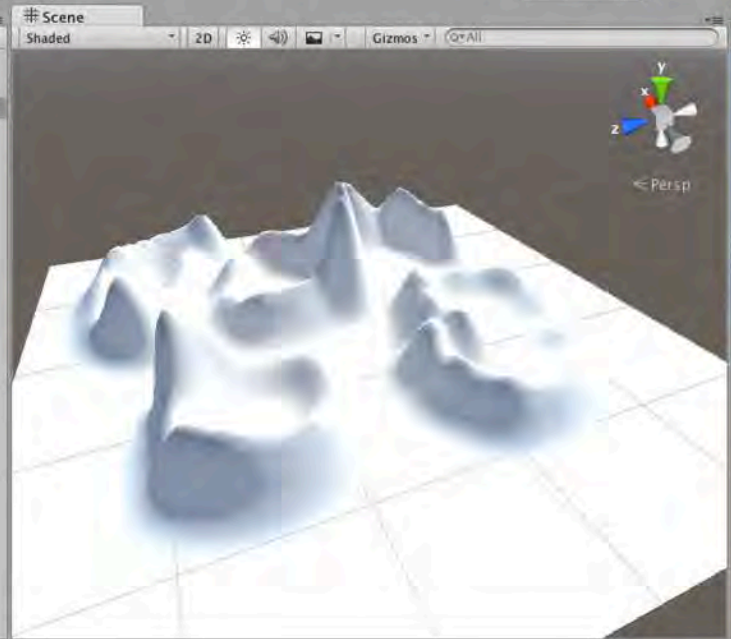


Layers Layout

Hierarchy

Create [Q+A]

- Main Camera
- Directional Light
- Terrain\_main



Inspector

Terrain\_main [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

**Terrain**

Paint Texture

Select a texture below, then click to paint.

**Brushes**

**Textures**

No terrain textures defined.

**Settings**

Brush Size

Opacity 97

Target Strength 1

**Terrain Collider**

Material None (Physic Material)

Terrain Data New Terrain 1

Enable Tree Colliders [checked]

Add Component

Console Project

Create [Q+A]

- All Models
- All Prefabs
- All Scripts

**Assets**

- Editor
- Standard Assets
  - Characters
    - FirstPersonChar
      - Audio
      - Prefabs
      - Scripts
    - PhysicsMaterials
    - RollerBall

Library

This folder is empty.

Context menu for Terrain Collider:

- Add Texture...
- Edit Texture...
- Remove Texture



**Add Terrain Texture**

Albedo (RGB) Smoothness (A) Normal

None (Texture2D) None (Texture2D)

Select Select

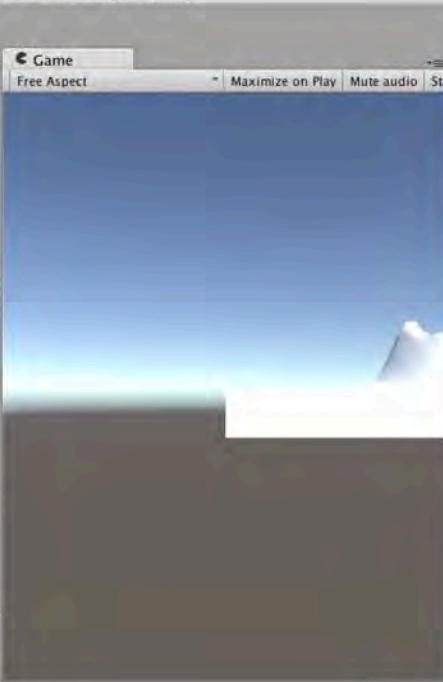
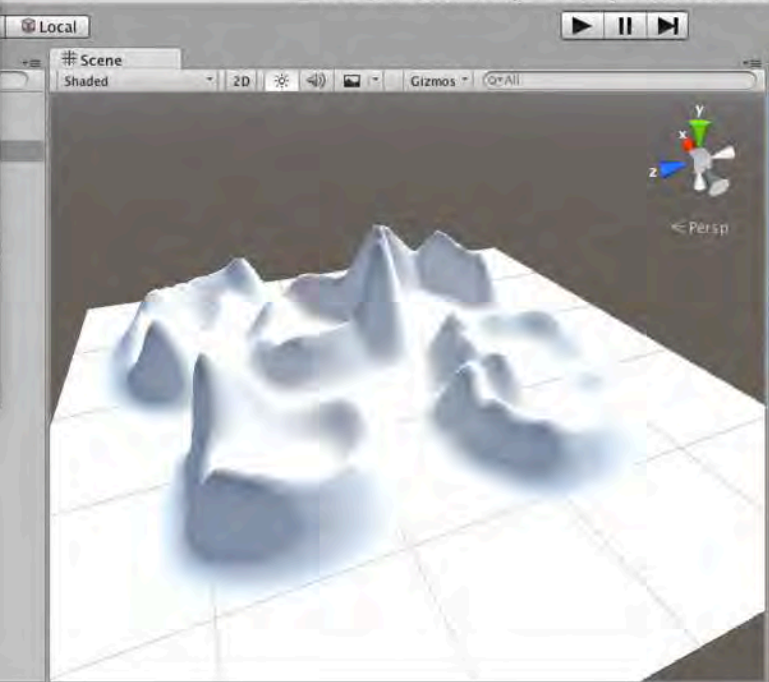
Assign a tiling texture

Size Offset

x 15 0

y 15 0

Add



**Inspector**

Terrain\_main

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

**Terrain**

Paint Texture

Select a texture below, then click to paint.

**Brushes**

**Textures**

No terrain textures defined.

Edit Textures...

**Settings**

Brush Size 100

Opacity 97

Target Strength 1

**Terrain Collider**

Material None (Physic Material)

Terrain Data New Terrain 1

Enable Tree Colliders

Add Component

**Console**

Project

Create

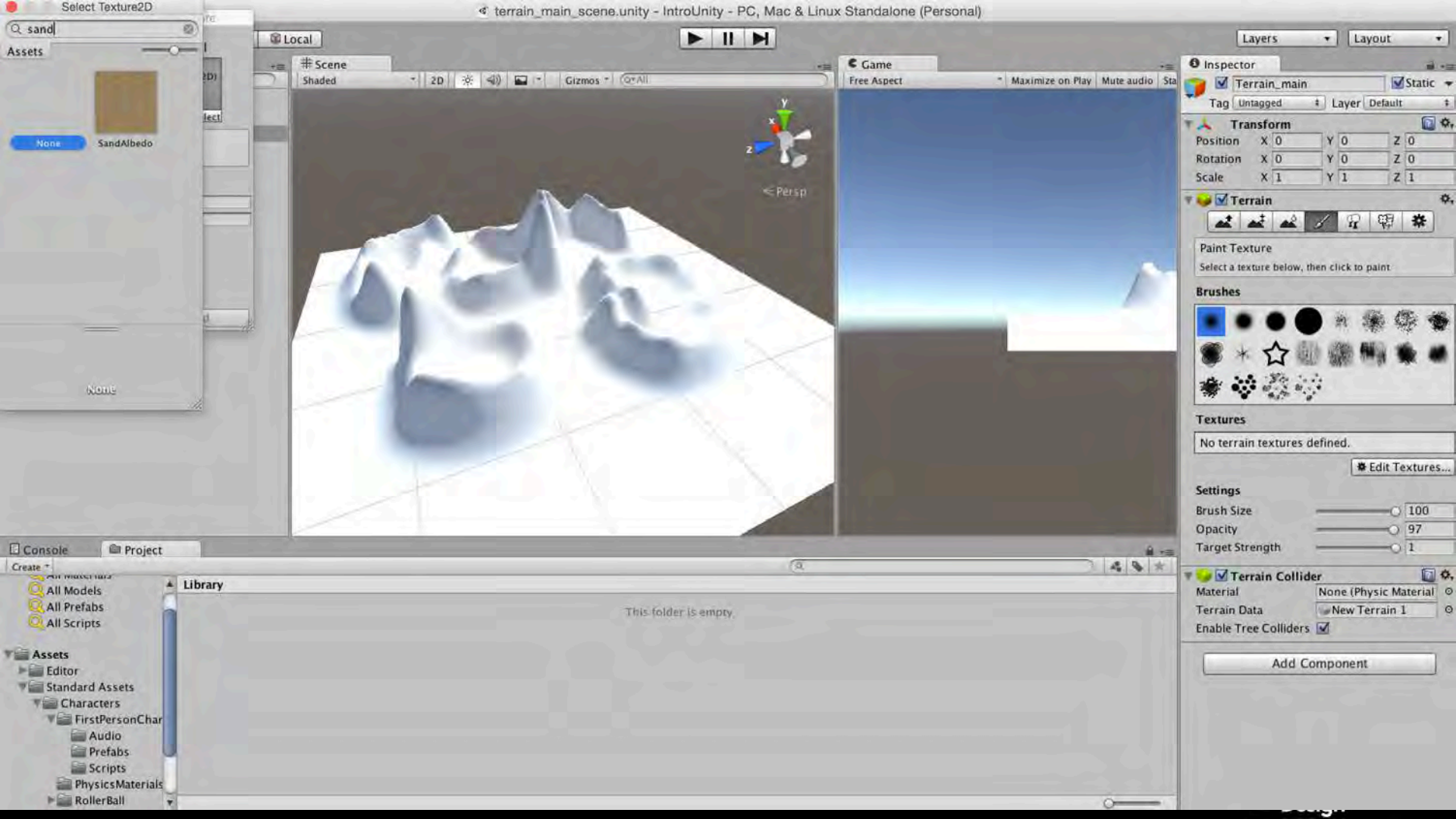
- All Models
- All Prefabs
- All Scripts

**Assets**

- Editor
- Standard Assets
- Characters
  - FirstPersonChar
    - Audio
    - Prefabs
    - Scripts
  - PhysicsMaterials
  - RollerBall

**Library**

This folder is empty.



**Add Terrain Texture**

Albedo (RGB) Smoothness (A) Normal

None (Texture2D)

Metallic  0

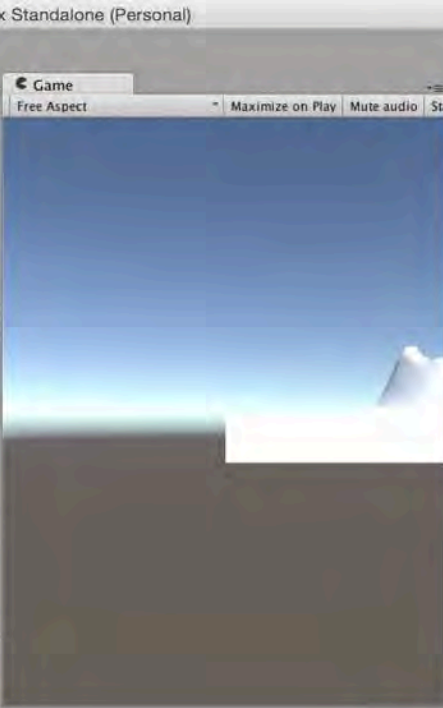
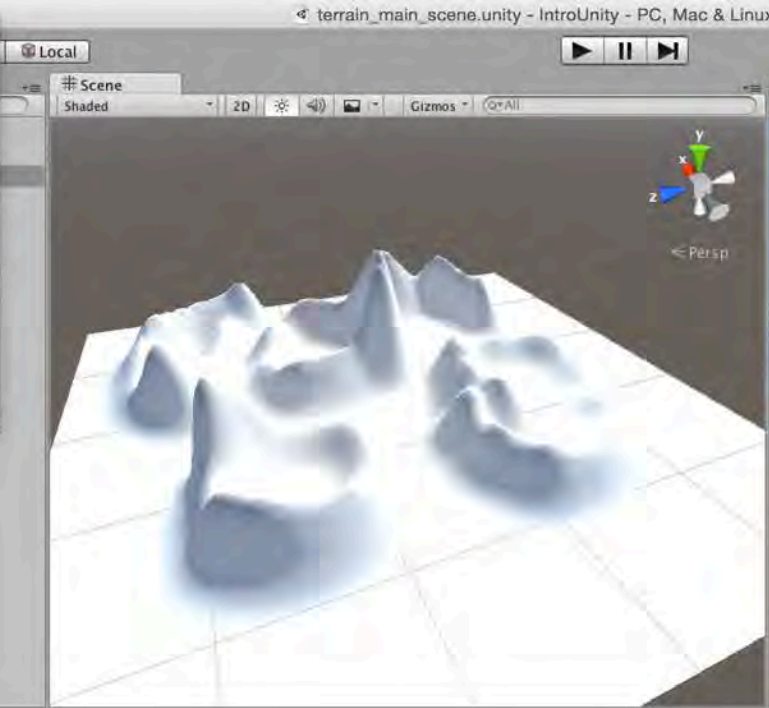
Smoothness  0

Size Offset

x 15 0

y 15 0

Add



Layers Layout

Inspector

Terrain\_main 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

**Terrain**

Paint Texture

Select a texture below, then click to paint.

**Brushes**

**Textures**

No terrain textures defined.

Edit Textures...

**Settings**

Brush Size 100

Opacity 97

Target Strength 1

**Terrain Collider**

Material None (Physic Material)

Terrain Data New Terrain 1

Enable Tree Colliders

Add Component

Console Project

Create

All Models

All Prefabs

All Scripts

**Assets**

Editor

Standard Assets

Characters

FirstPersonChar

Audio

Prefabs

Scripts

PhysicsMaterials

RollerBall

**Library**

This folder is empty.



Center Local

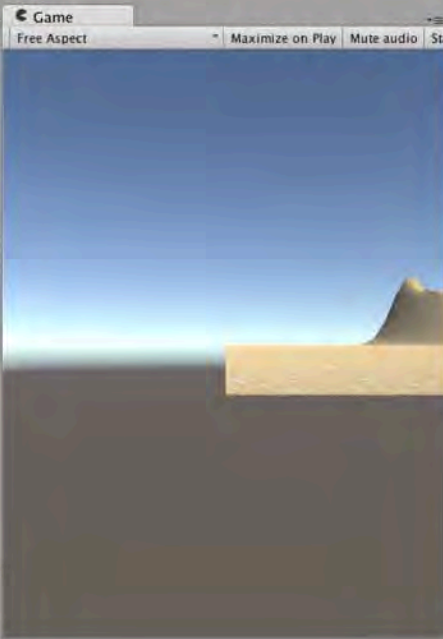
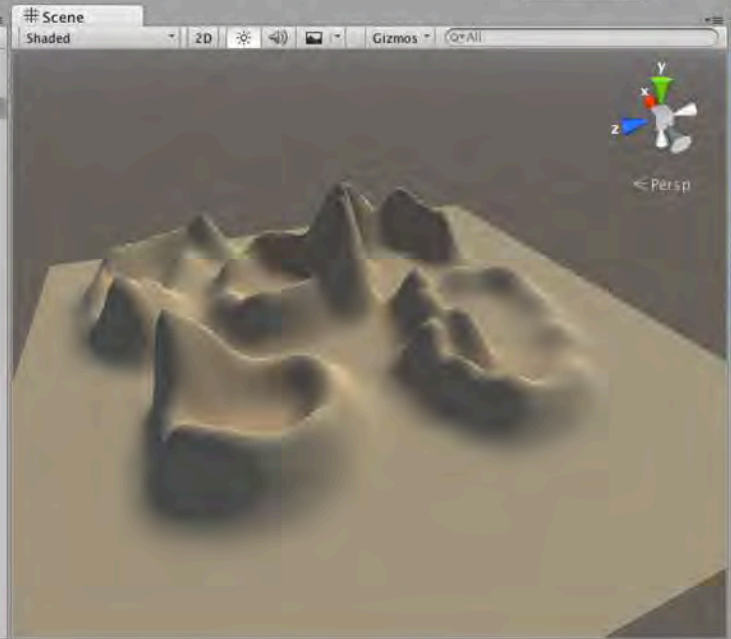


Layers Layout

Hierarchy

Create

- Main Camera
- Directional Light
- Terrain\_main



Inspector

Terrain\_main  Static

Tag  Layer

**Transform**

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

**Terrain**

Paint Texture  
 Select a texture below, then click to paint.

**Brushes**

**Textures**

**Settings**

Brush Size   
 Opacity   
 Target Strength

**Terrain Collider**

Material   
 Terrain Data   
 Enable Tree Colliders

Console Project

Create

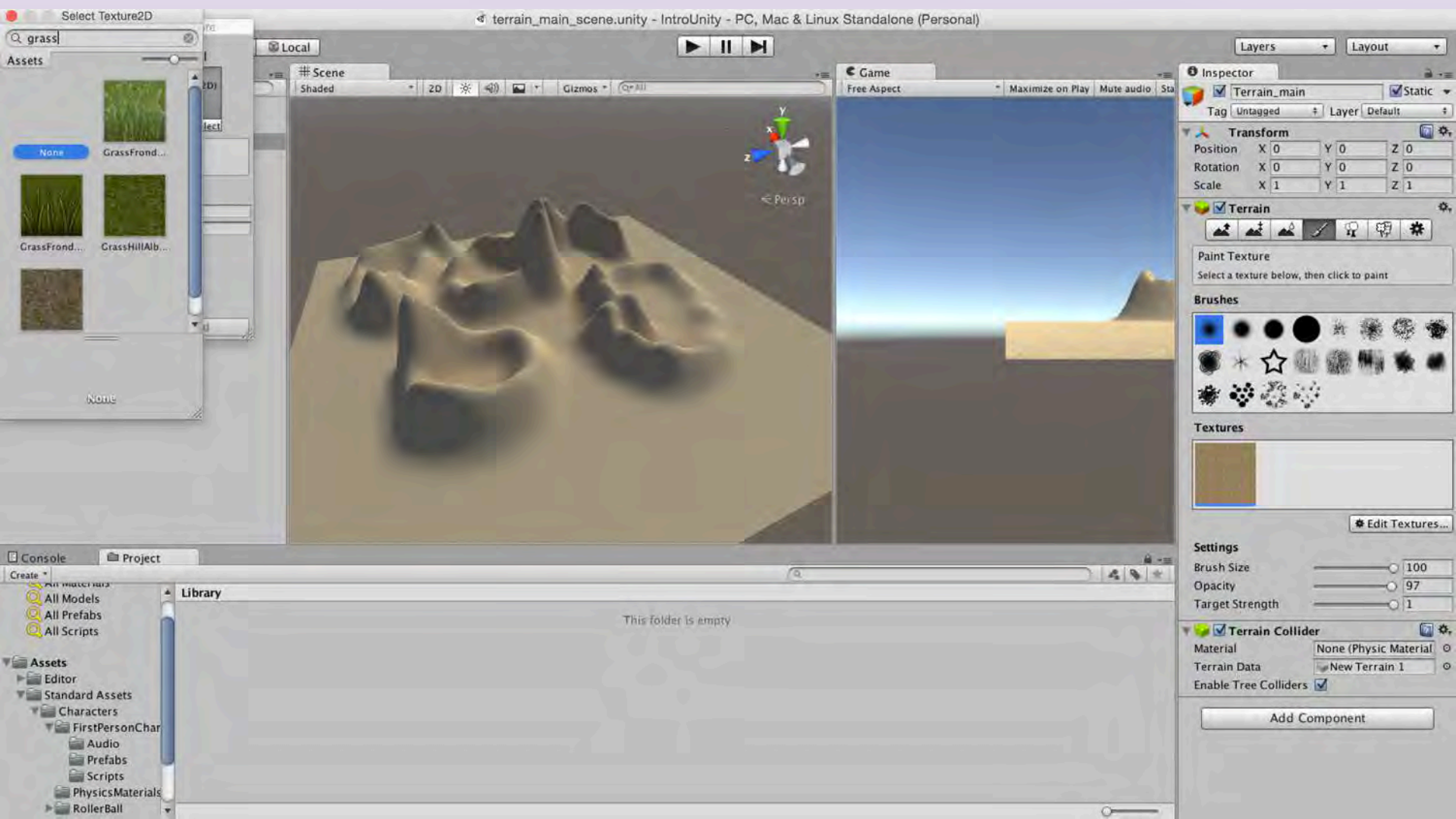
- All Models
- All Prefabs
- All Scripts

**Assets**

- Editor
- Standard Assets
- Characters
  - FirstPersonChar
    - Audio
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    - Scripts
  - PhysicsMaterials
  - RollerBall

Library

This folder is empty.





Center Local

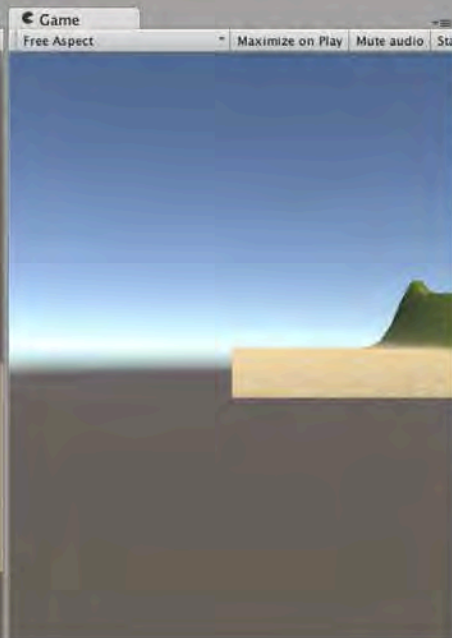
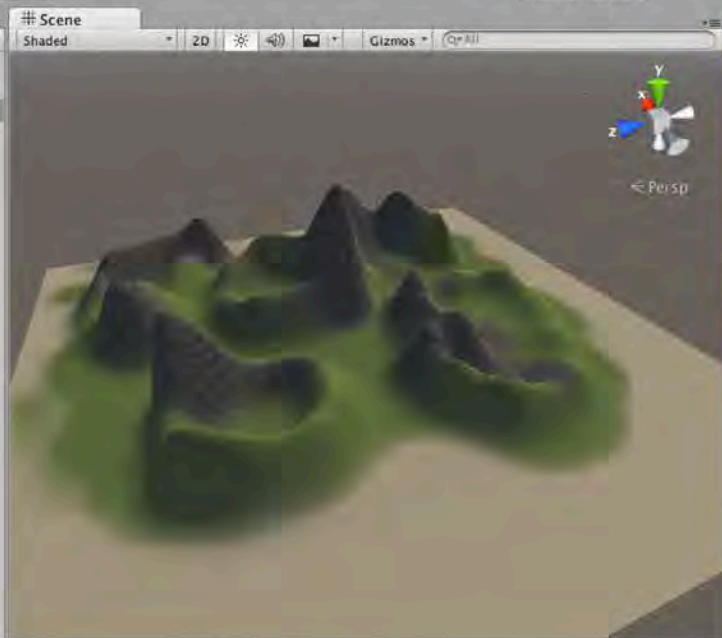


Layers Layout

Hierarchy

Create [Ctrl+Alt]

- Main Camera
- Directional Light
- Terrain\_main



Inspector

Terrain\_main [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

**Terrain**

Paint Texture  
Select a texture below, then click to paint

**Brushes**

**Textures**

Edit Textures...

**Settings**

Brush Size [Slider] 75

Opacity [Slider] 10

Target Strength [Slider] 1

**Terrain Collider**

Material None (Physic Material)

Terrain Data New Terrain 1

Enable Tree Colliders [checked]

Add Component

Console Project

Create [Ctrl+Alt]

- All Models
- All Prefabs
- All Scripts

**Assets**

- Editor
- Standard Assets
  - Characters
    - FirstPersonChar
      - Audio
      - Prefabs
      - Scripts
    - PhysicsMaterials
    - RollerBall

Library

This folder is empty



Center Local

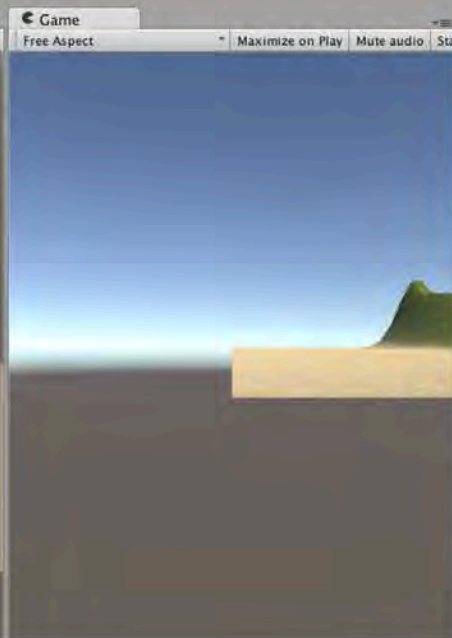
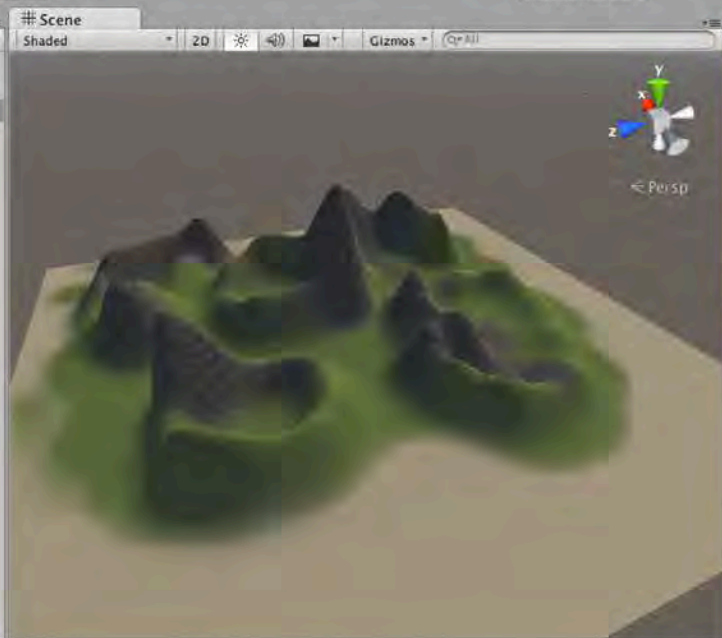


Layers Layout

Hierarchy

Create + Ctrl+Alt

- Main Camera
- Directional Light
- Terrain\_main



Inspector

Terrain\_main 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

**Terrain**

Place Trees

Hold down shift to erase trees.  
Hold down ctrl to erase the selected tree type.

Trees

No trees defined

Mass Place Trees Add Tree Edit Tree Remove Tree Refresh

**Settings**

Brush Size

Tree Density 83

Tree Height Random? [Slider]

Lock Width to Height [Checked]

Tree Width Random? [Slider]

Color Variation 0.4

Random Tree Rotation [Checked]

Console Project

Create +

- All Models
- All Prefabs
- All Scripts

**Assets**

- Editor
- Standard Assets
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      - Scripts
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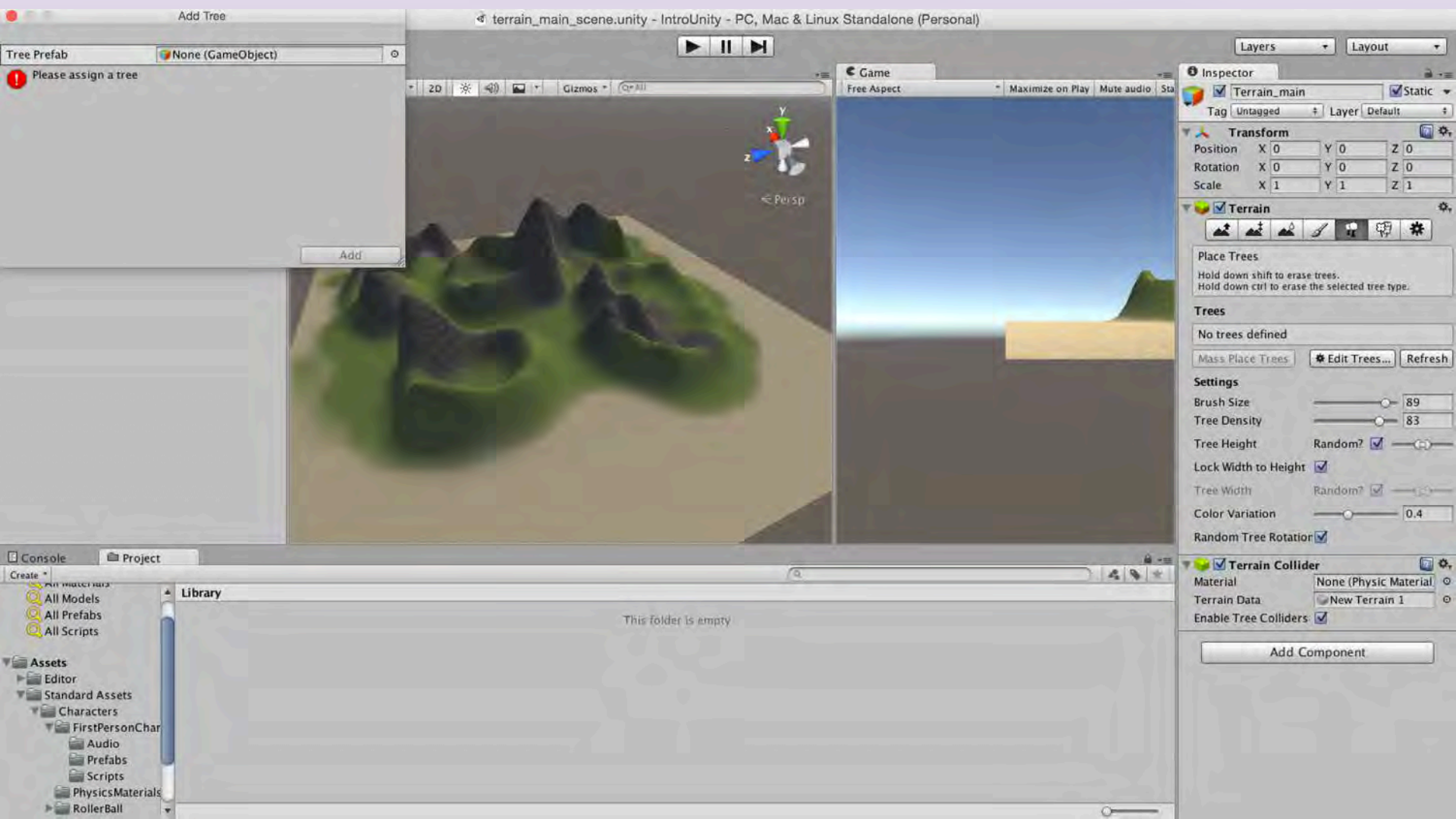
**Terrain Collider**

Material None (Physic Material)

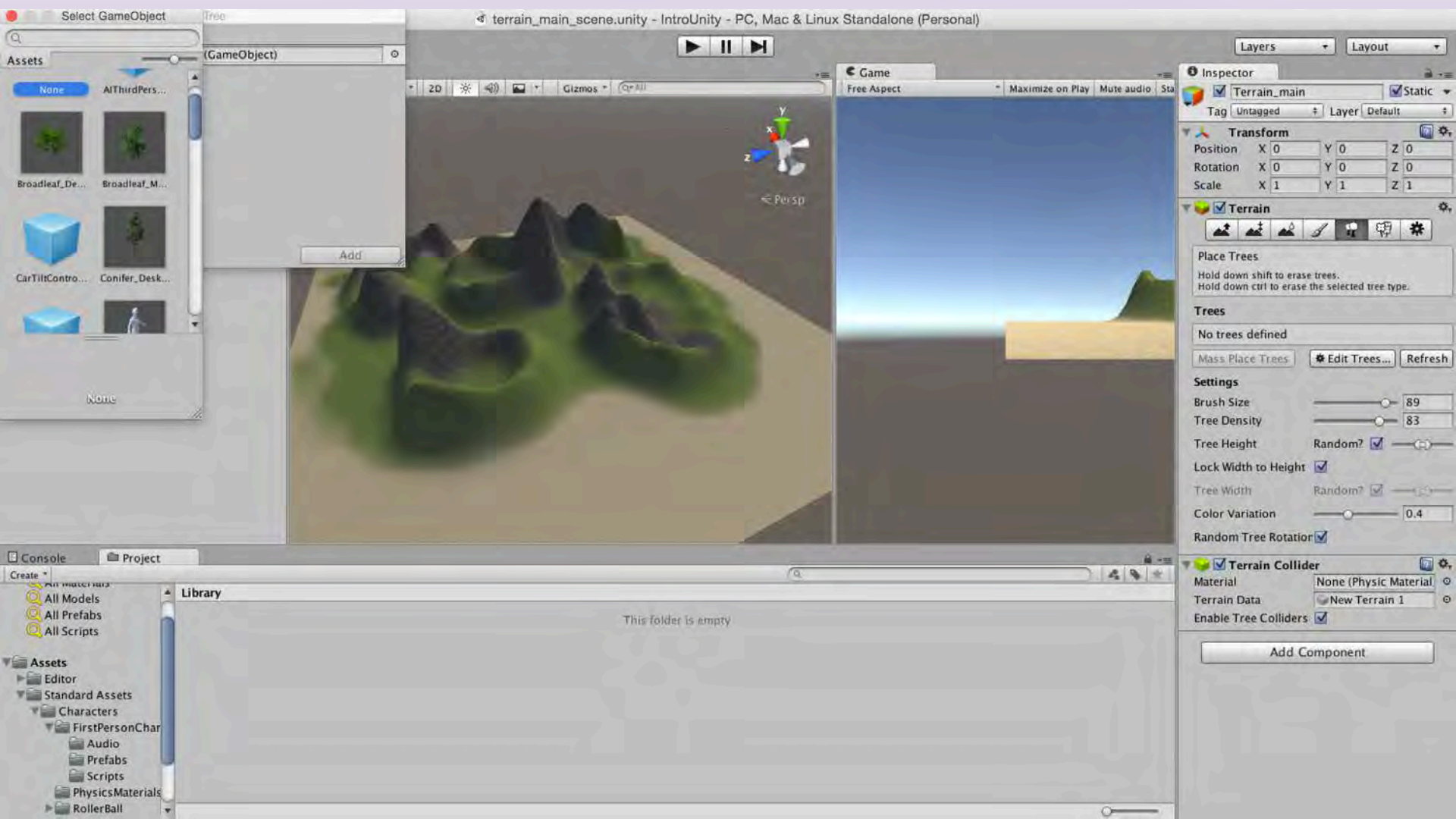
Terrain Data New Terrain 1

Enable Tree Colliders [Checked]

Add Component









Center Local



Layers

Layout

Hierarchy

Create

Main Camera  
Directional Light  
Terrain\_main

# Scene

Shaded

2D



Gizmos



Game

Free Aspect

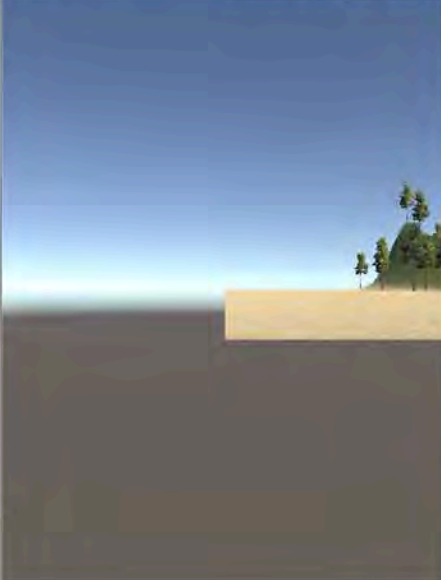
Maximize on Play



Mute audio



Sta



Inspector



Terrain\_main



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

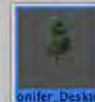
## Terrain



## Place Trees

Hold down shift to erase trees.  
Hold down ctrl to erase the selected tree type.

## Trees



Pinfer\_Desk

Mass Place Trees

\* Edit Trees...

Refresh

## Settings

Brush Size Tree Density Tree Height  Lock Width to Height Tree Width  Color Variation Random Tree Rotation 

## Terrain Collider

Material Terrain Data Enable Tree Colliders 

Add Component

Console

Project

Create

All Models  
All Prefabs  
All Scripts

Assets

- Editor
- Standard Assets
  - Characters
    - FirstPersonChar
      - Audio
      - Prefabs
      - Scripts
    - PhysicsMaterials
    - RollerBall

Library

This folder is empty

# Prefabs

pre-fabricated objects

Prefabs store a game object together with its components (transforms, appearances, scripts, etc.) and configurations for easy duplication/reuse.

Unity makes it easy to move around a world interactively (either in a first person or third person perspective) using prefabs.

# Prefabs

Object-oriented instances can be INSTANTIATED at run time

At RUN TIME a script can cause a new object instance to be created (instantiated) at a given location / with a given transform set of properties

Prefabs allow functional game objects to be reused in scenes (spawned) or imported into other projects as external assets. ‘The First Person Controller’ is an example of a Prefab

# First Person Controller

20. Assets > Import Package > Characters

Project Window > Standard Assets folder

FPS Character > Prefabs > FPSController

drag the FPS Controller onto your scene

delete the main camera

Preview the game

explore the terrain / look around with your mouse

move with WASD or the arrow keys / jump with the space bar



Create

Reveal in Finder

Open

Delete

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