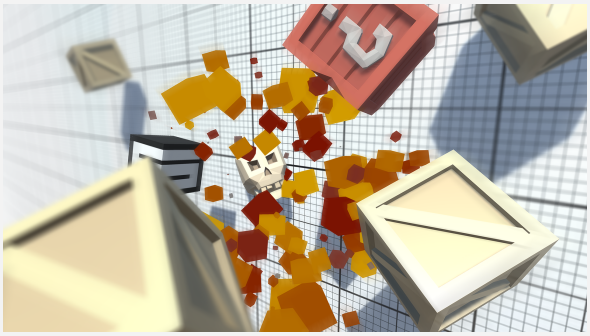
Create with Code

Unit 5 Lesson Plans



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5.1 Clicky Mouse

Steps:

Step 1: Create project and switch to 2D view

Step 2: Create good and bad targets

Step 3: Toss objects randomly in the air

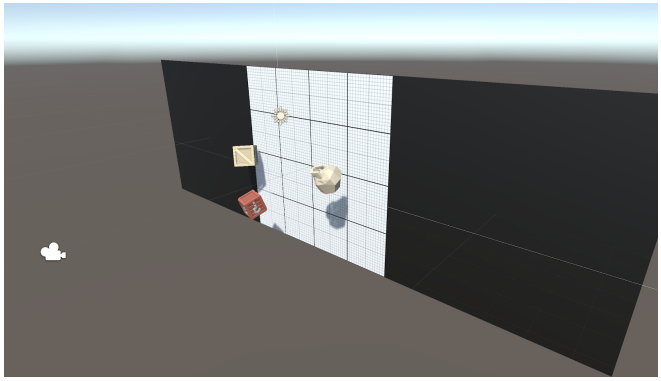
Step 4: Replace messy code with new methods

Step 5: Create object list in Game Manager

Step 6: Create a coroutine to spawn objects

Step 7: Destroy target with click and sensor

Example of project by end of lesson



Length: 60 minutes

Overview: It's time for the final unit! We will start off by creating a new project and importing the starter files, then switching the game's view to 2D. Next we will make a list of target objects for the player to click on: Three "good" objects and one "bad". The targets will launch spinning into the air after spawning at a random position at the bottom of the map. Lastly, we will allow the player to destroy them with a click!

Project Outcome: A list of three good target objects and one bad target object will spawn in a random position at the bottom of the screen, thrusting themselves into the air with random force and torque. These targets will be destroyed when the player clicks on them or they fall out of bounds.

Learning Objectives: By the end of this lesson, you will be able to:

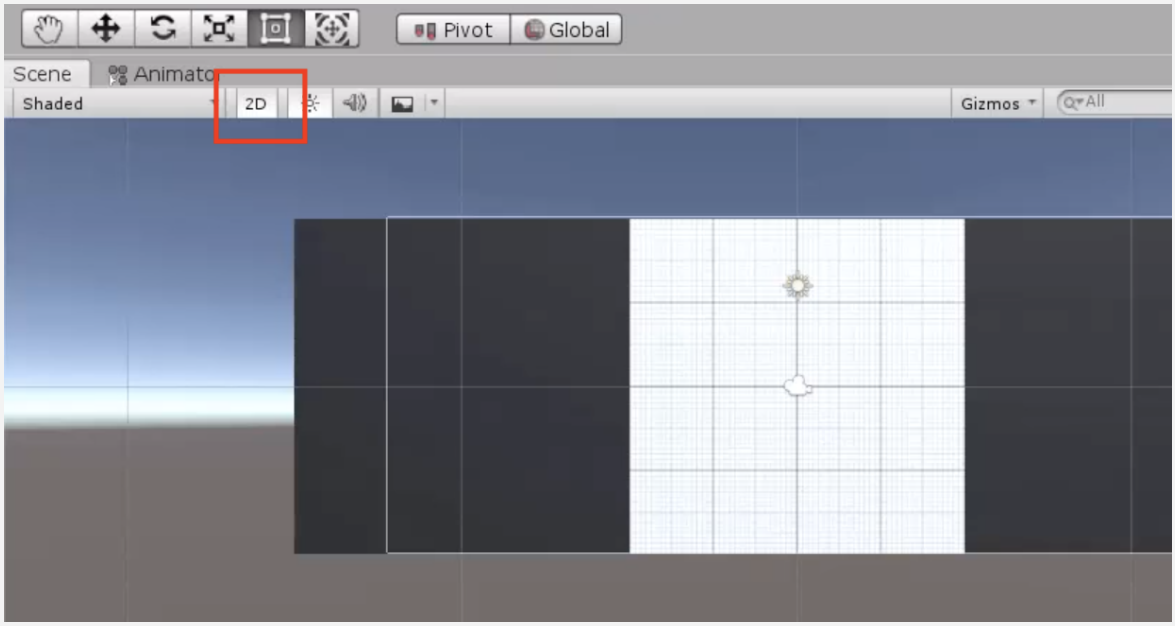
- Switch the game to 2D view for a different perspective
- Add torque to the force of an object
- Create a Game Manager object that controls game states as well as spawning
- Create a List of objects and return their length with Count
- Use While Loops to repeat code while something is true
- Use OnMouseDown to enable the player to click on things

Step 1: Create project and switch to 2D view

One last time… we need to create a new project and download the starter files to get things up and running.

1. Open **Unity Hub** and create an empty "Prototype 5" project in your course directory on the correct Unity version.
   If you forget how to do this, refer to the instructions in Lesson 1.1 - Step 1
2. Click to download the Prototype 5 Starter Files, **extract** the compressed folder, and then **import** the .unitypackage into your project.
   If you forget how to do this, refer to the instructions in Lesson 1.1 - Step 2
3. Open the **Prototype 5** scene, then delete the **sample scene** without saving
4. Click on the **2D icon** in Scene view to put Scene view in **2D**
5. (optional) Change the texture and color of the **background** and the color of the **borders**

- **New Concept:** 2D View
- **Demo:** Notice in 2D view: You can't rotate around objects or move them in the Z direction

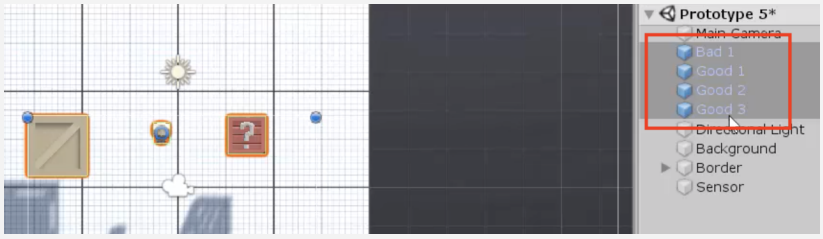


Step 2: Create good and bad targets

The first thing we need in our game are three good objects to collect, and one bad object to avoid. It'll be up to you to decide what's good and what's bad.

1. From the **Library**, drag 3 "good" objects and 1 "bad" object into the Scene, rename them "Good 1", "Good 2", "Good 3", and "Bad 1"
2. Add **Rigid Body** and **Box Collider** components, then make sure that Colliders surround objects properly
3. Create a new Scripts folder, a new "Target.cs" script inside it, attach it to the **Target objects**
4. Drag all 4 targets into the **Prefabs folder** to create "original prefabs", then **delete** them from the scene

- **Tip:** The bigger the collider boxes, the easier it will be to hit them
- **Tip:** Try selecting multiple objects and applying scripts/components - very handy



Step 3: Toss objects randomly in the air

Now that we have 4 target prefabs with the same script, we need to toss them into the air with a random force, torque, and position.

1. In **Target.cs**, declare a new ***private Rigidbody targetRb;*** and initialize it in **Start()**
2. In **Start()**, add an **upward force** multiplied by a **randomized speed**
3. Add a **torque** with randomized **xyz values**
4. Set the **position** with a randomized **X value**

- **New Function:** AddTorque
- **Tip:** Test with different values by dragging them in during runtime
- **Don't worry:** We're going to fix all these hard-coded values next

```
private Rigidbody targetRb;

void Start() {
  targetRb = GetComponent<Rigidbody>();
  targetRb.AddForce(Vector3.up * Random.Range(12, 16), ForceMode.Impulse);
  targetRb.AddTorque(Random.Range(-10, 10), Random.Range(-10, 10),
  Random.Range(-10, 10), ForceMode.Impulse);
  transform.position = new Vector3(Random.Range(-4, 4), -6); }
```

Step 4: Replace messy code with new methods

Instead of leaving the random force, torque, and position making our Start() function messy and unreadable, we're going to store each of them in brand new clearly named custom methods.

1. Declare and initialize new private float variables for ***minSpeed, maxSpeed, maxTorque, xRange,*** and ***ySpawnPos***;
2. Create a new function for ***Vector3 RandomForce()*** and call it in ***Start()***
3. Create a new function for ***float RandomTorque()*** and call it in ***Start()***
4. Create a new function for ***RandomSpawnPos()***, have it return a new ***Vector3*** and call it in ***Start()***

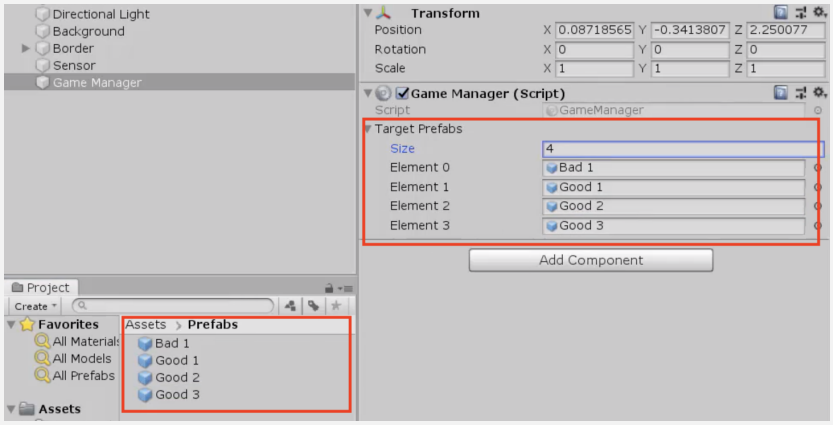
```
private float minSpeed = 12;
private float maxSpeed = 16;
private float maxTorque = 10;
private float xRange = 4;
private float ySpawnPos = -6;

void Start() {
  ...
  targetRb.AddForce(... RandomForce(), ForceMode.Impulse);
  targetRb.AddTorque(... RandomTorque(), RandomTorque(), RandomTorque(),
    ForceMode.Impulse);
  transform.position = ... RandomSpawnPos();
}

Vector3 RandomForce() {
  return Vector3.up * Random.Range(minSpeed, maxSpeed);
}
float RandomTorque() {
  return Random.Range(-maxTorque, maxTorque);
}
Vector3 RandomSpawnPos() {
  return new Vector3(Random.Range(-xRange, xRange), ySpawnPos);
}
```

Step 5: Create object list in Game Manager

The next thing we should do is create a list for these objects to spawn from. Instead of making a Spawn Manager for these spawn functions, we're going to make a Game Manager that will also control game states later on.

1. Create a new "Game Manager" **Empty object**, attach a new **GameManager.cs** script, then open it
2. Declare a new ***public List<GameObject> targets;***, then in the Game Manager inspector, change the list **Size** to 4 and assign your **prefabs**

- **New Concept:** Lists
- **New Concept:** Game Manager
- **Demo:** Feel free to reference old code: We used an array instead of a list to spawn the animals in Unit 2



Step 6: Create a coroutine to spawn objects

Now that we have a list of object prefabs, we should instantiate them in the game using coroutines and a new type of loop.

1. Declare and initialize a new ***private float spawnRate*** variable
2. Create a new ***IEnumerator SpawnTarget ()*** method
3. Inside the new method, ***while(true),*** wait **1 second**, generate a **random index**, and spawn a random **target**
4. In **Start()**, use the ***StartCoroutine*** method to begin spawning objects

- **Tip:** Feel free to reference old code: we used coroutines for the powerup cooldown in Unit 4
- **Tip:** Arrays return an integer with .Length, while Lists return an integer with .Count
- **New Concept:** While Loops

```
private float spawnRate = 1.0f;

void Start() {  StartCoroutine(SpawnTarget());  }

IEnumerator SpawnTarget() {
  while (true) {
    yield return new WaitForSeconds(spawnRate);
    int index = Random.Range(0, targets.Count);
    Instantiate(targets[index]); } }
```

Step 7: Destroy target with click and sensor

Now that our targets are spawning and getting tossed into the air, we need a way for the player to destroy them with a click. We also need to destroy any targets that fall below the screen.

1. In **Target.cs**, add a new method for ***private void OnMouseDown() { }*** , and inside that method, destroy the gameObject
2. Add a new method for ***private void OnTriggerEnter(Collider other)*** and inside that function, destroy the gameObject

- **New Function:** OnMouseDown
- **Tip:** There is also OnMouseUp, and OnMouseEnter, but Down is definitely the one we want
- **Tip:** You could use Update and check if target y position is lower than a certain value, but a sensor is better because it doesn't run all the time

```
private void OnMouseDown() {
  Destroy(gameObject); }

private void OnTriggerEnter(Collider other) {
  Destroy(gameObject); }
```

Lesson Recap

New Functionality	• Random objects are tossed into the air on intervals • Objects are given random speed, position, and torque • If you click on an object, it is destroyed
New Concepts and Skills	• 2D View • AddTorque • Game Manager • Lists • While Loops • Mouse Events
Next Lesson	• We'll add some effects and keep track of score!

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5.2 Keeping Score

Steps:

Step 1: Add Score text position it on screen

Step 2: Edit the Score Text's properties

Step 3: Initialize score text and variable

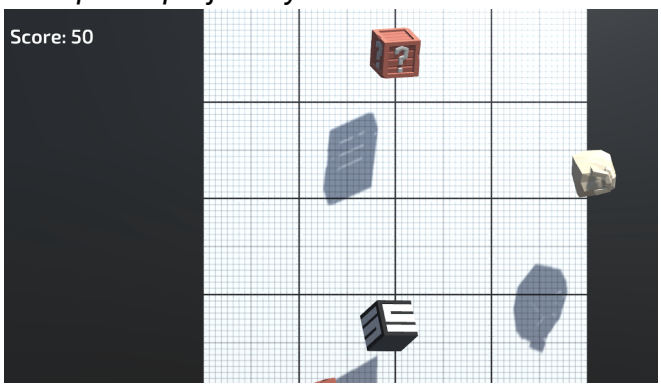
Step 4: Create a new UpdateScore method

Step 5: Add score when targets are destroyed

Step 6: Assign a point value to each target

Step 7: Add a Particle explosion

Example of project by end of lesson



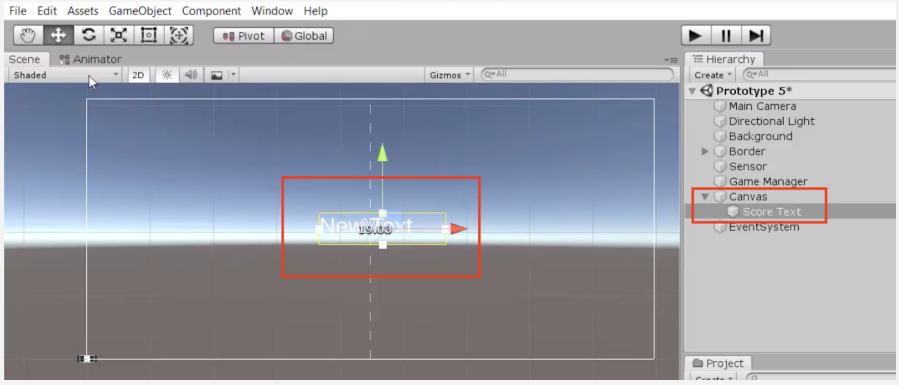
Length:	60 minutes
Overview:	Objects fly into the scene and the player can click to destroy them, but nothing happens. In this lesson, we will display a score in the user interface that tracks and displays the player's points. We will give each target object a different point value, adding or subtracting points on click. Lastly, we will add cool explosions when each target is destroyed.
Project Outcome:	A "Score: " section will display in the UI, starting at zero. When the player clicks a target, the score will update and particles will explode as the target is destroyed. Each "Good" target adds a different point value to the score, while the "Bad" target subtracts from the score.
Learning Objectives:	By the end of this lesson, you will be able to: - Create UI Elements in the Canvas - Lock elements and objects into place with Anchors - Use variables and script communication to update elements in the UI

Step 1: Add Score text position it on screen

In order to display the score on-screen, we need to add our very first UI element.

1. In the Hierarchy, *Create > UI > **TextMeshPro text***, then if prompted click the button to **Import TMP Essentials**
2. Rename the new object "Score Text", then **zoom out** to see the **canvas** in Scene view
3. Change the **Anchor Point** so that it is anchored from the **top-left corner**
4. In the inspector, change its **Pos X** and **Pos Y** so that it is in the top-left corner

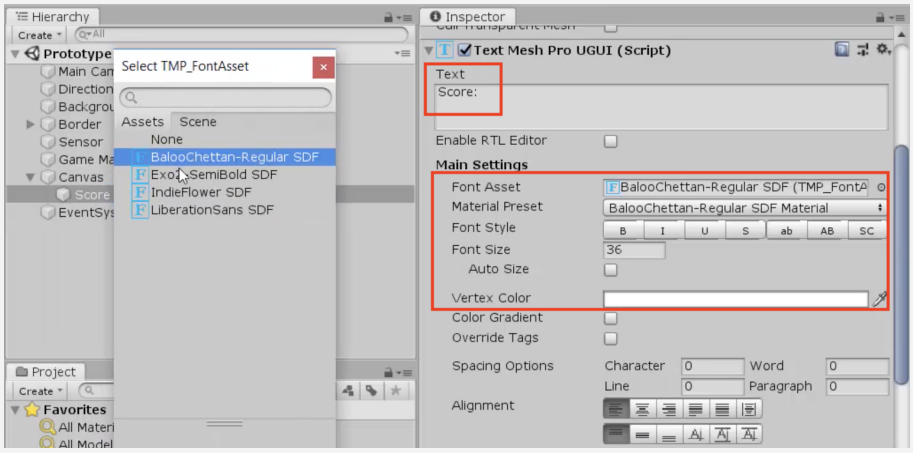
- **New Concept:** Text Mesh Pro / TMPro
- **New Concept:** Canvas
- **New Concept:** Anchor Points
- **Tip:** Look at how it displays in scene vs game view. It may be hard to see white text depending on the background



Step 2: Edit the Score Text's properties

Now that the basic text is in the scene and positioned properly, we should edit its properties so that it looks nice and has the correct text.

1. Change its text to "Score:"
2. Choose a **Font Asset**, **Style**, **Size**, and **Vertex color** to look good with your background



Step 3: Initialize score text and variable

We have a great place to display score in the UI, but nothing is displaying there! We need the UI to display a score variable, so the player can keep track of their points.

1. At the top of **GameManager.cs**, add "using TMPro;"
2. Declare a new ***public TextMeshProUGUI scoreText***, then assign that variable in the inspector
3. Create a new ***private int score*** variable and initialize it in ***Start()*** as ***score = 0;***
4. Also in **Start()**, set ***scoreText.text = "Score: " + score;***

- **New Concept:** Importing Libraries

```
using TMPro;
```

```
private int score;
public TextMeshProUGUI scoreText;

void Start() {
  StartCoroutine(SpawnTarget());
  score = 0;
  scoreText.text = "Score: " + score; }
```

Step 4: Create a new UpdateScore method

The score text displays the score variable perfectly, but it never gets updated. We need to write a new function that racks up points to display in the UI.

1. Create a new ***private void UpdateScore*** method that requires one ***int scoreToAdd*** parameter
2. Cut and paste ***scoreText.text = "Score: " + score;*** into the new method, then call ***UpdateScore(0)*** in ***Start()***
3. In ***UpdateScore()***, increment the score by adding ***score += scoreToAdd;***
4. Call ***UpdateScore(5)*** in the **spawnTarget()** function

- **New Concept:** Custom functions requiring parameters
- **Don't worry:** It doesn't make sense to add to score when spawned, this is just temporary

```
void Start() {
  ...scoreText.text = "Score: " + score;
  UpdateScore(0); }

IEnumerator SpawnTarget() {
  while (true) {  ... UpdateScore(5);  }

private void UpdateScore(int scoreToAdd) {
  score += scoreToAdd;
  scoreText.text = "Score: " + score; }
```

Step 5: Add score when targets are destroyed

Now that we have a method to update the score, we should call it in the target script whenever a target is destroyed.

1. In GameManager.cs, make the ***UpdateScore*** method ***public***
2. In Target.cs, create a reference to ***private GameManager gameManager;***
3. Initialize GameManager in ***Start()*** using the ***Find()*** method
4. When a target is **destroyed**, call ***UpdateScore(5);***, then **delete** the method call from SpawnTarget()

- **Tip:** Feel free to reference old code: We used script communication in Unit 3 to stop the game on GameOver
- **Warning:** If you try to call UpdateScore while it's private, it won't work

GameManager.cs

```
IEnumerator SpawnTarget() {
  while (true) {  ... UpdateScore(5);  }

private public void UpdateScore(int scoreToAdd) { ... }
```

Target.cs

```
private GameManager gameManager;

void Start() {
  ... gameManager = GameObject.Find("Game Manager")
        .GetComponent<GameManager>();}

private void OnMouseDown() {
  ... gameManager.UpdateScore(5); }
```

Step 6: Assign a point value to each target

The score gets updated when targets are clicked, but we want to give each of the targets a different value. The good objects should vary in point value, and the bad object should subtract points.

1. In Target.cs, create a new ***public int pointValue*** variable
2. In each of the **Target prefab's** inspectors, set the **Point Value** to whatever they're worth, including the bad target's **negative value**
3. Add the new variable to ***UpdateScore(pointValue);***

- **Tip:** Here's the beauty of variables at work. Each target $ can have their own unique pointValue!

```
public int pointValue;

private void OnMouseDown() {
  Destroy(gameObject);
  gameManager.UpdateScore(5 pointValue); }
```

Step 7: Add a Particle explosion

The score is totally functional, but clicking targets is sort of… unsatisfying. To spice things up, let's add some explosive particles whenever a target gets clicked!

1. In Target.cs, add a new ***public ParticleSystem explosionParticle*** variable
2. For each of your target prefabs, assign a **particle prefab** from *Course Library > Particles* to the **Explosion Particle** variable
3. In the ***OnMouseDown()*** function, **instantiate** a new explosion prefab

```
public ParticleSystem explosionParticle;

private void OnMouseDown() {
  Destroy(gameObject);
  Instantiate(explosionParticle, transform.position,
  explosionParticle.transform.rotation);
  gameManager.UpdateScore(pointValue); }
```

Lesson Recap

New Functionality	• There is a UI element for score on the screen • The player's score is tracked and displayed by the score text when hit a target • There are particle explosions when the player gets an object
New Concepts and Skills	• TextMeshPro • Canvas • Anchor Points • Import Libraries • Custom methods with parameters • Calling methods from other scripts
Next Lesson	• We'll use some UI elements again - this time to tell the player the game is over and reset our game!

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5.3 Game Over

Steps:

Step 1: Create a Game Over text object

Step 2: Make GameOver text appear

Step 3: Create GameOver function

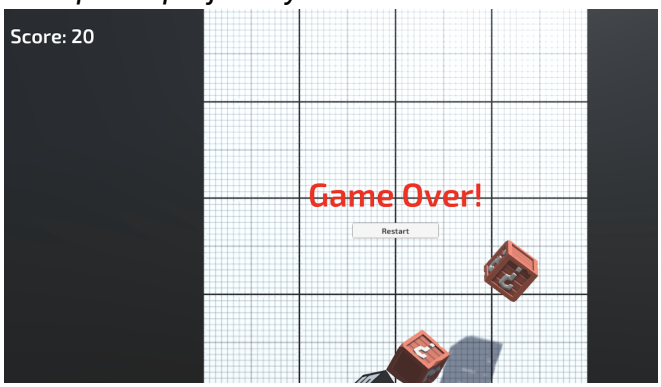
Step 4: Stop spawning and score on GameOver

Step 5: Add a Restart button

Step 6: Make the restart button work

Step 7: Show restart button on game over

Example of project by end of lesson



Length: 60 minutes

Overview: We added a great score counter to the game, but there are plenty of other game-changing UI elements that we could add. In this lesson, we will create some “Game Over” text that displays when a “good” target object drops below the sensor. During game over, targets will cease to spawn and the score will be reset. Lastly, we will add a “Restart Game” button that allows the player to restart the game after they have lost.

Project Outcome: When a “good” target drops below the sensor at the bottom of the screen, the targets will stop spawning and a “Game Over” message will display across the screen. Just underneath the “Game Over” message will be a “Reset Game” button that reboots the game and resets the score, so the player can enjoy it all over again.

Learning Objectives: By the end of this lesson, you will be able to:
- Make UI elements appear and disappear with .SetActive
- Use Script Communication and Game states to have a working “Game Over” screen
- Restart the game using a UI button and Scene Management

Step 1: Create a Game Over text object

If we want some "Game Over" text to appear when the game ends, the first thing we'll do is create and customize a new UI text element that says "Game Over".

1. Right-click on the **Canvas**, create a new *UI* > ***TextMeshPro - Text*** object, and rename it "Game Over Text"
2. In the inspector, edit its **Text**, **Pos X**, **Pos Y**, **Font Asset**, **Size**, **Style**, **Color**, and **Alignment**
3. Set the "Wrapping" setting to "Disabled"

- **Tip:** The center of the screen is the best place for this Game Over message - it grabs the player's attention

Step 2: Make GameOver text appear

We've got some beautiful Game Over text on the screen, but it's just sitting and blocking our view right now. We should deactivate it, so it can reappear when the game ends.

1. In GameManager.cs, create a new ***public TextMeshProUGUI gameOverText;*** and assign the **Game Over** object to it in the inspector
2. **Uncheck** the Active checkbox to **deactivate** the Game Over text by default
3. In ***Start()***, activate the Game Over text

- **Don't worry:** We're just doing this temporarily to make sure it works

```
public TextMeshProUGUI gameOverText;

void Start() {
  ...
  gameOverText.gameObject.SetActive(true); }
```

Step 3: Create GameOver function

We've temporarily made the "Game Over" text appear at the start of the game, but we actually want to trigger it when one of the "Good" objects is missed and falls.

1. Create a new ***public void GameOver()*** function, and **move** the code that activates the game over text inside it
2. In Target.cs, call ***gameManager.GameOver()*** if a target collides with the **sensor**
3. Add a new "Bad" tag to the **Bad object**, add a condition that will only trigger game over if it's *not* a bad object

```
void Start() {
  ... gameOverText.gameObject.SetActive(true); }

public void GameOver() {
  gameOverText.gameObject.SetActive(true); }

<------>
private void OnTriggerEnter(Collider other) {
  Destroy(gameObject);
  if (!gameObject.CompareTag("Bad")) { gameManager.GameOver(); } }
```

Step 4: Stop spawning and score on GameOver

The "Game Over" message appears exactly when we want it to, but the game itself continues to play. In order to truly halt the game and call this a "Game Over', we need to stop spawning targets and stop generating score for the player.

1. Create a new ***public bool isGameActive;***
2. As the **first line** In ***Start()***, set ***isGameActive = true;*** and in ***GameOver()***, set ***isGameActive = false;***
3. To prevent spawning, in the ***SpawnTarget()*** coroutine, change ***while (true)*** to ***while (isGameActive)***
4. To prevent scoring, in Target.cs, in the ***OnMouseDown()*** function, add the condition ***if (gameManager.isGameActive) {***

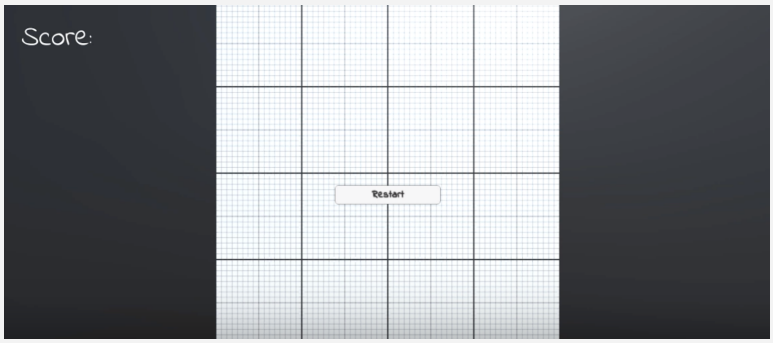
```
public bool isGameActive;

void Start() {  ... isGameActive = true;  }

public void GameOver() {  ... isGameActive = false; }

IEnumerator SpawnTarget() {  while (true isGameActive) {  ...  }
<------>
private void OnMouseDown() {
  if (gameManager.isGameActive) { ... [all function code moved inside]  }}
```

Step 5: Add a Restart button

Our Game Over mechanics are working like a charm, but there's no way to replay the game. In order to let the player restart the game, we will create our first UI button

1. Right-click on the **Canvas** and *Create > UI > Button*
   Note: You could also use **Button - TextMeshPro** for more control over the button's text.
2. Rename the button "Restart Button"
3. Temporarily **reactivate** the Game Over text in order to reposition the Restart Button nicely with the text, then **deactivate** it again
4. Select the Text child object, then edit its **Text** to say "Restart", its **Font, Style,** and **Size**

- **New Concept:** Buttons



Step 6: Make the restart button work

We've added the Restart button to the scene and it LOOKS good, but now we need to make it actually work and restart the game.

1. In GameManager.cs, add ***using UnityEngine.SceneManagement;***
2. Create a new ***public void RestartGame()*** function that reloads the current scene
3. In the **Button's** inspector, click **+** to add a new **On Click event**, drag it in the **Game Manager** object and select the ***GameManager.RestartGame*** function

- **New Concept:** Scene Management
- **New Concept:** On Click Event
- **Don't worry:** The restart button is just sitting there for now, but we will fix it later

```
using UnityEngine.SceneManagement;

public void RestartGame() {
  SceneManager.LoadScene(SceneManager.GetActiveScene().name); }
```

Step 7: Show restart button on game over

The Restart Button looks great, but we don't want it in our faces throughout the entire game. Similar to the "Game Over" message, we will turn off the Restart Button while the game is active.

1. At the top of GameManager.cs add ***using UnityEngine.UI;***
2. Declare a new ***public Button restartButton;*** and assign the **Restart Button** to it in the inspector
3. **Uncheck** the "Active" checkbox for the **Restart Button** in the inspector
4. In the ***GameOver*** function, activate the **Restart Button**

- **Tip:** Adding "using UnityEngine.UI" allows you to access the Button class

```
using UnityEngine.UI;

public Button restartButton;

public void GameOver() {  ...
restartButton.gameObject.SetActive(true);  }
```

Lesson Recap

New Functionality	• A functional Game Over screen with a Restart button • When the Restart button is clicked, the game resets
New Concepts and Skills	• Game states • Buttons • On Click events • Scene management Library • UI Library • Booleans to control game states
Next Lesson	• In our next lesson, we'll use buttons to really add some difficulty to our game

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5.4 What's the Difficulty?

Steps:

Step 1: Create Title text and menu buttons

Step 2: Add a DifficultyButton script

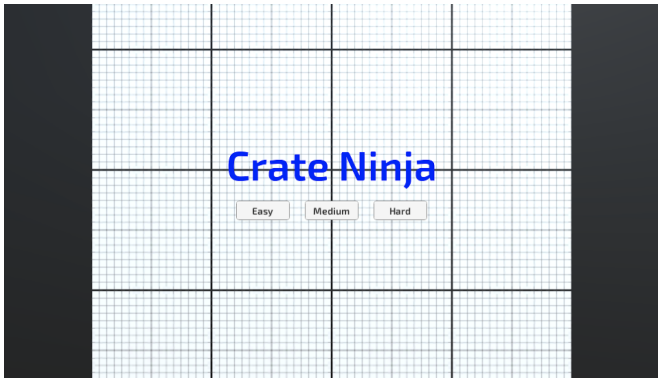
Step 3: Call SetDifficulty on button click

Step 4: Make your buttons start the game

Step 5: Deactivate Title Screen on StartGame

Step 6: Use a parameter to change difficulty

Example of project by end of lesson



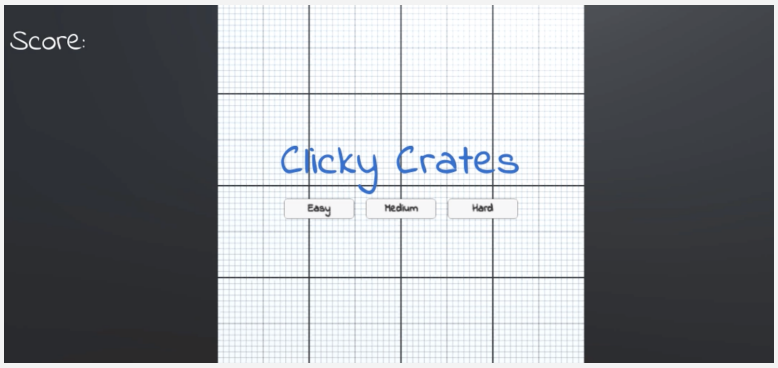
Length:	60 minutes
Overview:	It's time for the final lesson! To finish our game, we will add a Menu and Title Screen of sorts. You will create your own title, and style the text to make it look nice. You will create three new buttons that set the difficulty of the game. The higher the difficulty, the faster the targets spawn!
Project Outcome:	Starting the game will open to a beautiful menu, with the title displayed prominently and three difficulty buttons resting at the bottom of the screen. Each difficulty will affect the spawn rate of the targets, increasing the skill required to stop "good" targets from falling.
Learning Objectives:	By the end of this lesson, you will be able to: - Store UI elements in a parent object to create Menus, UI, or HUD - Add listeners to detect when a UI Button has been clicked - Set difficulty by passing parameters into game functions like SpawnRate

Step 1: Create Title text and menu buttons

The first thing we should do is create all of the UI elements we're going to need. This includes a big title, as well as three difficulty buttons.

1. Duplicate your **Game Over text** to create your **Title Text,** editing its name, text and all of its attributes
2. Duplicate your **Restart Button** and edit its attributes to create an "Easy Button" button
3. Edit and duplicate the new Easy **button** to create a"Medium Button" and a "Hard Button"

- **Tip:** You can position the title and buttons however you want, but you should try to keep them central and visible to the player



Step 2: Add a DifficultyButton script

Our difficulty buttons look great, but they don't actually do anything. If they're going to have custom functionality, we first need to give them a new script.

1. For all 3 new buttons, in the Button component, in the **On Click ()** section, click the **minus** (-) button to remove the RestartGame functionality
2. Create a new **DifficultyButton.cs** script and attach it to **all 3 buttons**
3. Add ***using UnityEngine.UI*** to your imports
4. Create a new ***private Button button;*** variable and initialize it in ***Start()***

```
using UnityEngine.UI;

private Button button;

void Start() {
  button = GetComponent<Button>(); }
```

Step 3: Call SetDifficulty on button click

Now that we have a script for our buttons, we can create a SetDifficulty method and tie that method to the click of those buttons

1. Create a new ***void SetDifficulty*** function, and inside it, ***Debug.Log(gameObject.name + " was clicked");***
2. Add the **button listener** to call the ***SetDifficulty*** function

- **New Function:** AddListener
- **Don't worry:** onClick.AddListener is similar what we did in the inspector with the Restart button
- **Don't worry:** We're just using Debug for testing, to make sure the buttons are working

```
void Start() {
  button = GetComponent<Button>();
  button.onClick.AddListener(SetDifficulty);
}

void SetDifficulty() {
  Debug.Log(gameObject.name + " was clicked");
}
```

Step 4: Make your buttons start the game

The Title Screen looks great if you ignore the target objects bouncing around, but we have no way of actually starting the game. We need a StartGame function that can communicate with SetDifficulty.

1. In GameManager.cs, create a new ***public void StartGame()*** function and move everything from ***Start()*** into it
2. In DifficultyButton.cs, create a new ***private GameManager gameManager;*** and initialize it in ***Start()***
3. In the ***SetDifficulty()*** function, call ***gameManager.startGame();***

- **Don't worry:** Title objects don't disappear yet - we'll do that next

GameManager.cs

```
void Start() { ... }

public void StartGame() {
  isGameActive = true;
  score = 0;
  StartCoroutine(SpawnTarget());
  UpdateScore(0);
}
```

DifficultyButton.cs

```
private GameManager gameManager;

void Start () {
 ...
 gameManager = GameObject.Find("Game Manager").GetComponent<GameManager>();
}

void SetDifficulty() {
 ...
 gameManager.StartGame();
}
```

Step 5: Deactivate Title Screen on StartGame

If we want the title screen to disappear when the game starts, we should store them in an empty object rather than turning them off individually. Simply deactivating the single empty parent object makes for a lot less work.

1. Right-click on the Canvas and *Create > Empty Object*, rename it "Title Screen", and drag the **3 buttons** and **title** onto it
2. In GameManager.cs, create a new ***public GameObject titleScreen;*** and assign it in the inspector
3. In ***StartGame()***, deactivate the title screen object

```
public GameObject titleScreen;

StartGame() {
  ... titleScreen.gameObject.SetActive(false); }
```

Step 6: Use a parameter to change difficulty

The difficulty buttons start the game, but they still don't change the game's difficulty. The last thing we have to do is actually make the difficulty buttons affect the rate that target objects spawn.

1. In DifficultyButton.cs, create a new ***public int difficulty*** variable, then in the Inspector, assign the **Easy** difficulty as 1, **Medium** as 2, and **Hard** as 3
2. Add an ***int difficulty*** parameter to the ***StartGame()*** function
3. In ***StartGame()***, set ***spawnRate /= difficulty;***
4. Fix the error in DifficultyButton.cs by passing the difficulty parameter to ***StartGame(difficulty)***

- **New Concept:** /= operator

```
public int difficulty;

void SetDifficulty() {
  ... gameManager.startGame(difficulty); }

<------>
public void StartGame(int difficulty) {
  spawnRate /= difficulty; }
```

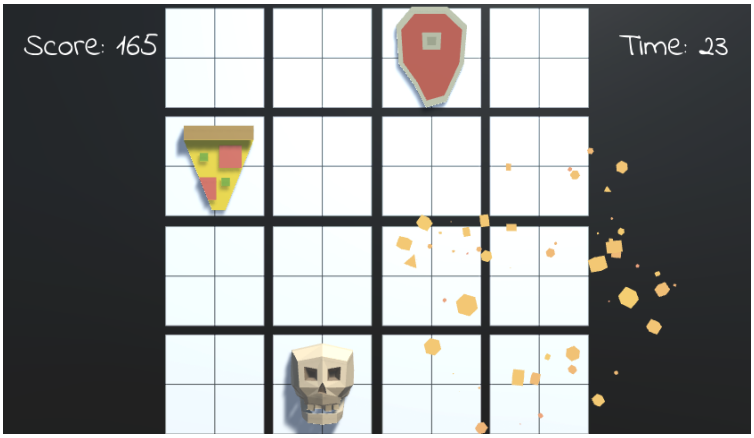
Lesson Recap

New Functionality	• Title screen that lets the user start the game • Difficulty selection that affects spawn rate
New Concepts and Skills	• AddListener() • Passing parameters between scripts • Divide/Assign (/=) operator • Grouping child objects

unity

Challenge 5

Whack-a-Food



Challenge Overview: Put your User Interface skills to the test with this whack-a-mole-like challenge in which you have to get all the food that pops up on a grid while avoiding the skulls. You will have to debug buttons, mouse clicks, score tracking, restart sequences, and difficulty setting to get to the bottom of this one.

Challenge Outcome:
- All of the buttons look nice with their text properly aligned
- When you select a difficulty, the spawn rate changes accordingly
- When you click a food, it is destroyed and the score is updated in the top-left
- When you lose the game, a restart button appears that lets you play again

Challenge Objectives: In this challenge, you will reinforce the following skills/concepts:
- Working with text and button objects to get them looking the way you want
- Using Unity's various mouse-related methods appropriately
- Displaying variables on text objects properly using concatenation
- Activating and deactivating objects based on game states
- Passing information between scripts using custom methods and parameters

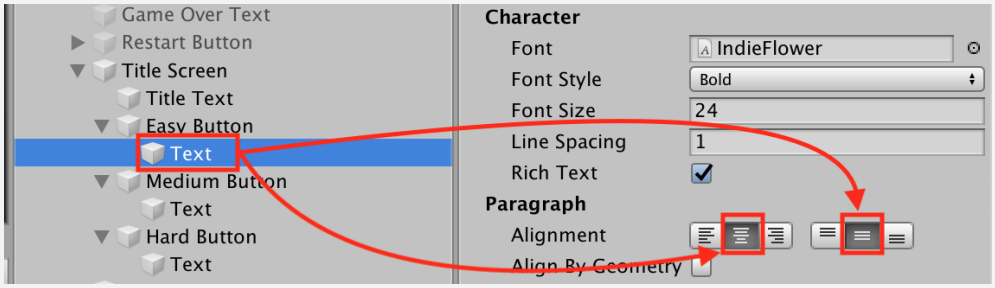
Challenge Instructions:
- Open your **Prototype 5** project
- **Download** the "Challenge 5 Starter Files" from the Tutorial Materials section, then double-click on it to **Import**
- In the *Project Window > Assets > Challenge 5 >* ***Instructions*** folder, use the "Challenge 5 - Outcome" video as a guide to complete the challenge

Challenge		Task	Hint
1	The difficulty buttons look messy	Center the text on the buttons horizontally and vertically	If you expand one of the button objects in the hierarchy, you'll see a "Text" object inside - you have to edit the properties of that "Text" object
2	The food is being destroyed too soon	The food should only be destroyed when the player clicks on it, not when the mouse touches it	OnMouseEnter() detects when the mouse *enters* an object's collider - OnMouseDown() detects when the mouse *clicks* on an object's collider
3	The Score is being replaced by the word "score"	It should always say, "Score: __" with the value displayed after "Score:"	When you set the score text, you have to add (concatenate) the word "Score: " *and* the actual score value
4	When you lose, there's no way to Restart	Make the Restart button appear on the game over screen	In the GameOver() method, make sure the restart button is being reactivated
5	The difficulty buttons don't change the difficulty	The spawnRate is always way too fast. When you click Easy, the spawnRate should be slower - if you click Hard, the spawnRate should be faster.	There is no information (or parameter) being passed from the buttons' script to the Game Manager's script - you need to implement a difficulty parameter

Bonus Challenge		Task	Hint
X	The game can go on forever	Add a "Time: __" display that counts down from 60 in whole numbers (i.e. 59, 58, 57, etc) and triggers the game over sequence when it reaches 0.	Google, "Unity Count down timer C#". It will involve subtracting "Time.deltaTime" and using the Mathf.Round() method to display only whole numbers.

Challenge Solution

1 Expand each of the “Easy”, “Medium”, and “Hard” buttons to access their “Text” object properties, then select the horizontal and vertical alignment buttons in the “Paragraph” properties



2 In TargetX.cs, change OnMouseEnter() to OnMouseDown()

```
private void OnMouseEnter Down() {
```

3 In GameManagerX.cs, in UpdateScore(), concatenate the word “Score: “ with the score value:

```
public void UpdateScore(int scoreToAdd) {
  score += scoreToAdd;
  scoreText.text = "score" "Score: " + score;
}
```

4 In GameManagerX.cs, in GameOver(), change SetActive(false) to “true”

```
public void GameOver() {
  gameOverText.gameObject.SetActive(true);
  restartButton.gameObject.SetActive(false true);
  ...
}
```

5 In GameManagerX.cs, in StartGame(), add an “int difficulty” parameter and divide the spawnRate by it. Then in DifficultyButtonX.cs, in SetDifficulty(), pass in the “difficulty” value from the buttons.

GameManagerX.cs

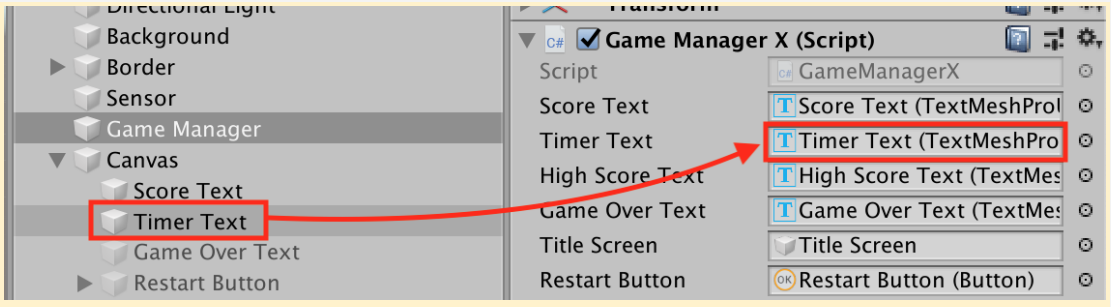
```
public void StartGame(int difficulty){
  spawnRate /= 5 difficulty;
  ...
}
```

DifficultyButtonX.cs

```
void SetDifficulty() {
  ...
  gameManagerX.StartGame(difficulty);
}
```

Bonus Challenge Solution

X1 Duplicate the “Score Text” object in the hierarchy to create a new “Timer text” object, then in GameManagerX.cs declare a new ***TextMeshProUGUI timerText*** variable and assign it in the inspector



X2 In GameManagerX.cs, in StartGame(), set your new timerText variable to your starting time

```
public void StartGame(int difficulty) {
  ...
  timeLeft = 60;
}
```

X3 In GameManagerX.cs, add an Update() function that, if the game is active, subtracts from the timeLeft and sets the timerText to a rounded version of that timeLeft. Then, if timeLeft is less than zero, calls the game over method.

```
private void Update() {
  if (isGameActive) {
    timeLeft -= Time.deltaTime;
    timerText.SetText("Time: " + Mathf.Round(timeLeft));
    if (timeLeft < 0) {
      GameOver();
    }
  }
}
```

Unit 5 Lab

Swap out your Assets

Steps:

Step 1: Import and browse the asset library

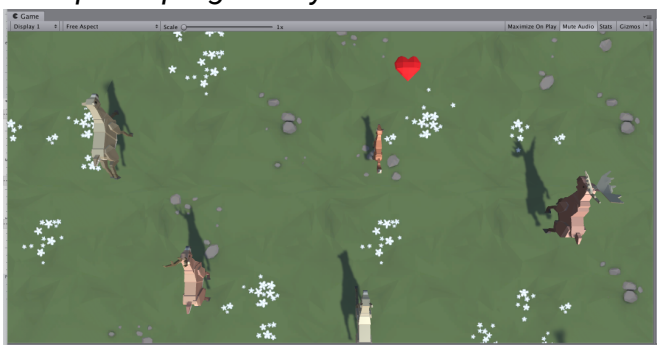
Step 2: Replace player with new asset

Step 3: Browse the Asset store

Step 4: Replace all non-player primitives

Step 5: Replace the background texture

Example of progress by end of lab



Length: 90 minutes

Overview: In this lab, you will finally replace those boring primitive objects with beautiful dynamic ones. You will either use assets from the provided course library or browse the asset store for completely new ones to give your game exactly the look and feel that you want. Then, you will go through the process of actually swapping in those new assets in the place of your placeholder primitives. By the end of this lab, your project will be looking a *lot* better.

Project Outcome: All primitive objects are replaced by actual 3D models, retaining the same basic gameplay functionality.

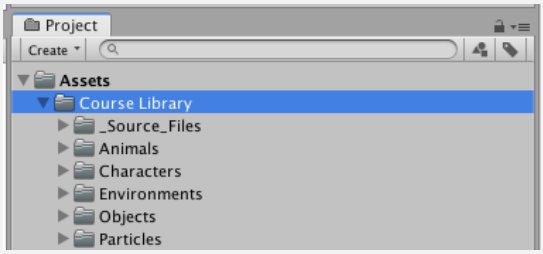
Learning Objectives: By the end of this lesson, you will be able to:
- Browse the asset store to find the perfect assets for your project
- Use Nested Prefabs to swap out placeholder objects with real assets
- Adjust material settings to get the resolution and look you want

Step 1: Import and browse the asset library

If we are going to swap out our primitive shapes with cool new assets, we need to import those assets first.

1. Click to download the Course Library assets, **extract** the compressed folder, and then **import** the .unitypackage into your project.
   If you forget how to do this, refer to Lesson 1.1, step 2.
2. Browse through the library to find the assets you would like to replace your Player and non-player objects with

- **Don't worry:** It will take longer than normal to import these files because it's a lot more files
- **Don't worry:** Even if you don't think you're going to use one of these assets for your player, just choose something for now to get used to the process

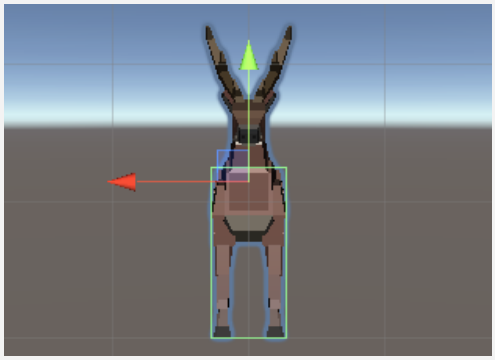


Step 2: Replace player with new asset

Now that we have the assets ready to go, the first thing we'll do is replace the Player object

1. **Drag** the Player object into the "Prefabs" folder to make it a prefab, then **double-click** on it to open the prefab editor
2. **Drag** the asset you want into the **hierarchy** to make it a nested prefab of the Player, then **scale** and **position** it so that it is around the same size and location
3. On the parent **Player** object itself, either **Edit** the collider to be the size of the new asset or **replace** it with a different type of collider (e.g. Box)
4. **Test** testing to make sure it works, then **uncheck** the **Mesh Renderer** component of the primitive

- **New:** Nested Prefabs
- **Tip:** Notice how the asset updates automatically in game view
- **Tip:** Isometric view is useful when resizing and repositioning child objects

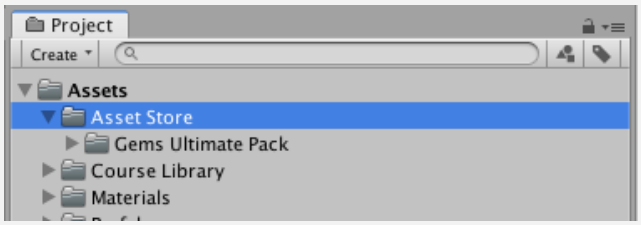


Step 3: Browse the Asset store

Even though we have a really great asset library, there may be certain assets you want that aren't in there. In that case, it might be good to try and find assets in the Unity Asset Store.

1. Click to open the Unity Asset Store
2. In the **search** bar, search for "Synty Studios" or "Low Poly", then browse some of the assets
3. In the **Pricing** filter, check "Free Assets" to only view free options, or use the **Ratings** filter to only see highly reviewed assets.
4. If you find an asset you want to include in your project, select **Add to My Assets**, then **Open in Unity.** This should automatically open the **Package Manager** window in Unity.
5. In the top-left corner of the Package Manager, use the drop-down to view Packages: My Assets, then locate your new asset in the list and click **Download,** then **Import.**
6. **Drag** the imported assets into a new folder called "Asset Store", then browse through the imported assets.

- **Warning:** This will only be possible if you can sign into a Unity account
- **Explain:** The assets for this course were made by Synty Studios, which are really good - as you can see, you normally have to pay for them
- **New:** Unity Asset Store
- **New:** "Low Poly" assets
- **Warning:** Only download "Low Poly" assets or your project will become *huge*, then not web- or mobile-friendly
- **Don't worry:** Even if you think you have all the assets you need, it's still good to take a look

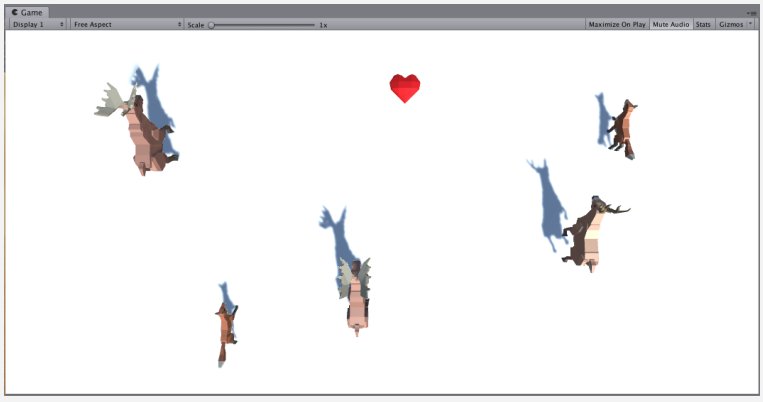


Step 4: Replace all non-player primitives

Now that we know the basic concept of our project, let's figure out how we'll get it done.

1. Repeat the process you used to replace the player prefab with your other non-player objects
2. Test to make sure everything is working as expected

- **Warning:** Make sure that, if you are editing prefabs in the scene, to Override any changes you make

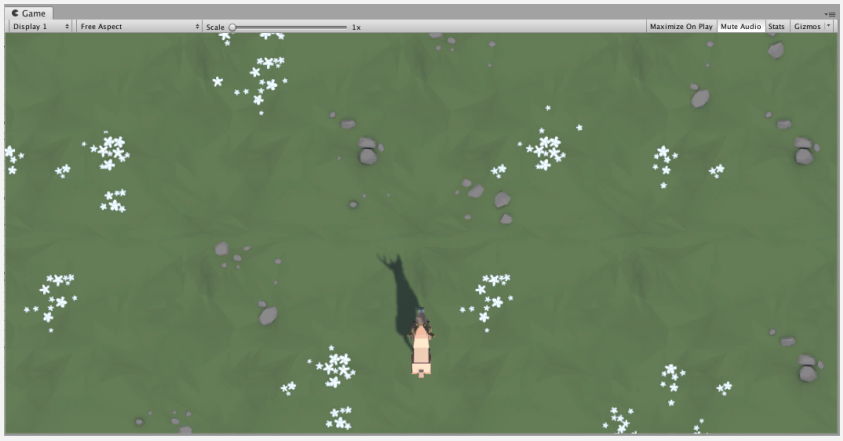


Step 5: Replace the background texture

Now that our dynamic objects have a new look, we should update the ground / background too.

1. From the *Course Library* ***> Textures***, (or from a Unity Asset Store package), drag a new material onto the Ground / Background object
2. To adjust the material's **resolution**, in the Material properties (with the sphere next to it), change the Main Map **Tiling** X and Y values
3. To make the material less shiny, in the Material properties, **uncheck** the "Specular highlights" and "Reflections" settings

- **Tip:** You might want to adjust the resolution/tiling of the material, depending on the scale of the objects
- **Tip:** Natural ground materials like grass or dirt do not tend to show highlights or reflections



Lesson Recap

New Progress	• Primitive objects replaced with new assets that function the same way
New Concepts and Skills	• Art workflow • High vs. Low Poly • Asset Store • Nested Prefabs • Material properties

unity

Quiz Unit 5

QUESTION	CHOICES
1 Which of the following follows Unity naming conventions (especially as they relate to capitalization)? 1. `public void MultiplyScore(int currentScore) { }` 2. `public void multiplyScore(int CurrentScore) { }` 3. `public Void MultiplyScore(Int currentScore) { }` 4. `public Void MultiplyScore(int CurrentScore) { }`	a. Line 1 b. Line 2 c. Line 3 d. Line 4
2 If there is a boolean in script A that you want to access in script B, which of the following are true: 1. You need a reference to script A in script B 2. The boolean needs to be public instead of private 3. The boolean must be true 4. The boolean must be included in the Update method	a. 1 only b. 1 and 2 only c. 2 and 3 only d. 3 and 4 only e. 1, 2, and 3 only f. All are true

3 Which code to fill in the blank will result in the object being destroyed?
`string name = "player"`
`bool isDead;`
`float health = 3;`
 	
`if (_____) {`
`  Destroy(gameObject);`
`}`
	a. name = "player" && isDead && health < 5
	b. name != "player" && isDead != true && health > 5
	c. name == "player" && !isDead && health < 5
	d. name == "player" && isDead != true && health > 5

4 You run your game and get the following error message in the console, “NullReferenceException: Object reference not set to an instance of an object”. Given the image and code below, what would resolve the problem?

a. In the hierarchy, rename “Game Manager” to “gameManager”
b. In the hierarchy, rename “Game Manager” as “GameManager”
c. On Line 1, rename “GameManager” as “Game Manager”
d. On Line 3, remove the GetComponent code


```
1. private GameManager gameManager;
2. void Start() {
3.   gameManager = GameObject.Find("GameManager").GetComponent<GameManager>();
4. }
```

5 Read the Unity documentation below about the OnMouseDrag event and the code beneath it. What will the value of the “counter” variable be if the user clicked and held down the mouse over an object with a collider for 10 seconds?

a. 0
b. 1
c. 99
d. 100
e. A value over 100

MonoBehaviour.OnMouseDrag()

Leave feedback Other Versions

Description

OnMouseDrag is called when the user has clicked on a GUIElement or Collider and is still holding down the mouse.

OnMouseDrag is called every frame while the mouse is down.

```
int counter = 0;
void OnMouseDrag() {
  if (counter < 100) {
    counter++;
  }
}
```

6 Based on the code below, what will be displayed in the console when the button is clicked?

a. “Welcome, Robert Smith”
b. “Welcome, firstName Smith”
c. “Button is ready”
d. “Welcome + Robert + Smith”

```
private Button button;
private string firstName = "Robert";

void Start() {
  button = GetComponent<Button>();
  button.onClick.AddListener(DisplayWelcomeMessage);
  Debug.Log("Button is ready");
}

void DisplayWelcomeMessage() {
  Debug.Log("Welcome, " + "firstName" + " Smith");
}
```

7 You have declared a new Button variable as “private Button start;”, but there’s an error under the word “Button” that says “error CS0246: The type or namespace name 'Button' could not be found (are you missing a using directive or an assembly reference?)” What is likely causing that error?

a. You can’t name a button “start” because that’s the name of a Unity Event Function
b. “Button” should be lowercase “button”
c. You are missing “using UnityEngine.UI;” from the top of your class
d. New Button variables must be made public

8 Look at the documentation and code below. Which of the following lines would *NOT* produce an error?

a. Line 5
b. Line 6
c. Line 7
d. Line 8

public void **AddForceAtPosition**(Vector3 **force**, Vector3 **position**, ForceMode **mode** = ForceMode.Force);

Parameters

force	Force vector in world coordinates.
position	Position in world coordinates.

Description

Applies `force` at `position`. As a result this will apply a torque and force on the object.

```
1. public Vector3 explosion;
2. Vector3 startPos;
3. float startSpeed;
4. void Start {
5.   AddForceAtPosition(50, 0, ForceMode.Impulse)
6.   AddForceAtPosition(100, startPos, ForceMode.Impulse)
7.   AddForceAtPosition(startSpeed, startPos, ForceMode.Impulse)
8.   AddForceAtPosition(explosion, new Vector3(0, 0, 0), ForceMode.Impulse)
9. }
```

9 If you wanted a button to display the message, “Hello!” when a button was clicked, what code would you use to fill in the blank?

a. (SendMessage);
b. (SendMessage(“Hello”));
c. (SendMessage(string Hello));
d. (SendMessage(Hello));

```
private Button button;
void Start {
  button = GetComponent<Button>();
  button.onClick.AddListener_________________;
}
void SendMessage() {
  Debug.Log(”Hello!”);
}
```

10 Which of the following is the correct way to declare a new List of game objects named “enemies”?

```
1. public List[GameObjects] enemies;
2. public List(GameObject) "enemies";
3. public List<GameObjects> "enemies";
4. public List<GameObject> enemies;
```

a. Line 1
b. Line 2
c. Line 3
d. Line 4

Quiz Answer Key

#	ANSWER	EXPLANATION
1	A	public void MultiplyScore(int currentScore) The “public”, “void”, and “int” keywords should be lowercase. Method names (like “MultiplyScore”) should be Title Case. variable names (like “currentScore”) should be camelCase.
2	B	You always need a variable reference to the script you’re trying to access and that variable must be public.
3	C	To compare a string, two ==’s are needed. By default, booleans are false unless declared as true and adding an exclamation mark before !isDead checks that it’s false. Since health = 3, checking “health < 5” is true.
4	B	GameObject.Find("GameManager") is returning a NullReferenceException error because there’s no object in the scene named that. If you renamed the “Game Manager” in the hierarchy to have no spaces, it would be fixed.
5	D	Since the function is called “every frame” the mouse is held, it will be called hundreds of times in 10 seconds. However, the condition will only be true if the counter is less than 99, meaning it will no longer increase after 100.
6	B	If you wanted it to say “Robert Smith”, you would have needed to use the variable name, firstName, *without* quotation marks.
7	C	In order to use some of the UI classes like “Button,” you need to include the “UnityEngine.UI” library
8	D	The first two required parameters are Vector3 variables. Only option D uses Vector3 variables for those parameters.
9	A	SendMessage does not require any parameters - it prints “Hello” no matter what when it is called. Also, when adding a listener, you just need to include the method’s name - no parentheses are required.
10	D	public List<GameObject> enemies is correct. <GameObject> should be in angle brackets. You don’t need “GameObject” to be plural because it’s the *type* of object it is. Variable names are never declared with quotation marks around them.

unity

Bonus Features 5 - Share your Work

Steps:

Length: 60 minutes

Overview: In this tutorial, you can go way above and beyond what you learned in this Unit and share what you've made with your fellow creators.

There are four bonus features presented in this tutorial marked as Easy, Medium, Hard, and Expert. You can attempt any number of these, put your own spin on them, and then share your work!

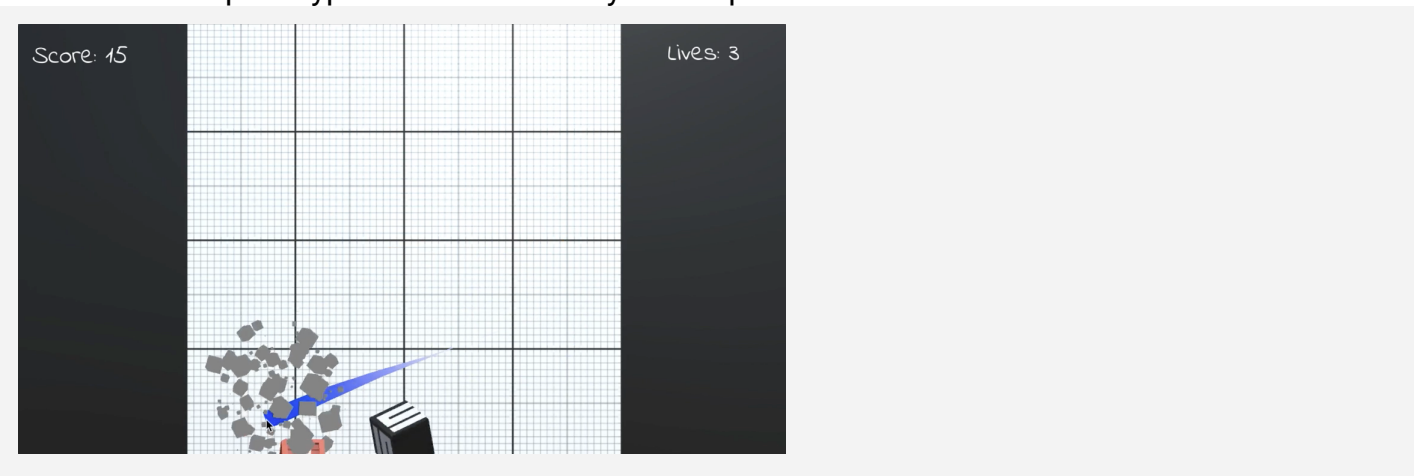
This tutorial is entirely optional, but highly recommended for anyone wishing to take their skills to a new level.

Step 1: Overview

This tutorial outlines four potential bonus features for the Quick Click Prototype at varying levels of difficulty:

- **Easy**: Lives UI
- **Medium**: Music volume
- **Hard**: Pause menu
- **Expert**: Click-and-swipe

Here's what the prototype could look like if you complete all four features:



The Easy and Medium features can probably be completed entirely with skills from this course, but the Hard and Expert features will require some additional research.

Since this is optional, you can attempt none of them, all of them, or any combination in between. You can come up with your own original bonus features as well!

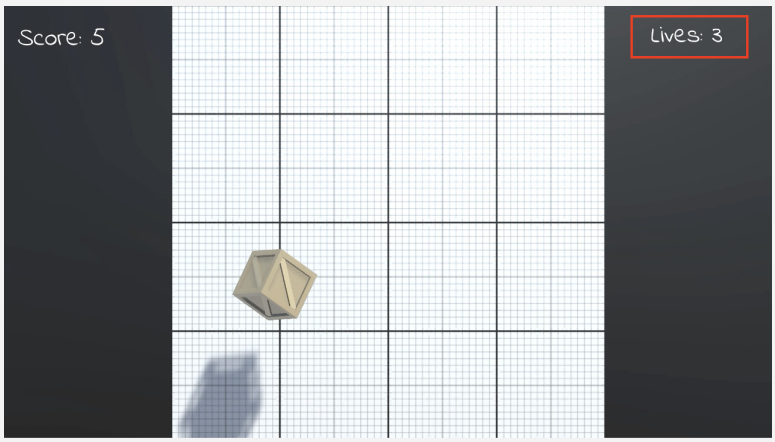
Then, at the end of this tutorial, there is an opportunity to share your work.

We highly recommend that you attempt these using relentless Googling and troubleshooting, but if you do get completely stuck, there are hints and step-by-step solutions available below.

Good luck!

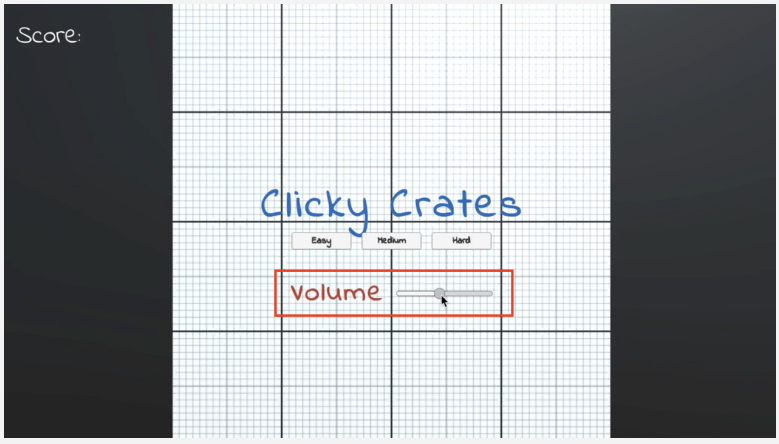
Step 2: Easy: Lives UI

Create a "Lives" UI element that counts down by 1 when an object leaves the bottom of the screen and triggers Game Over when Lives reaches 0.



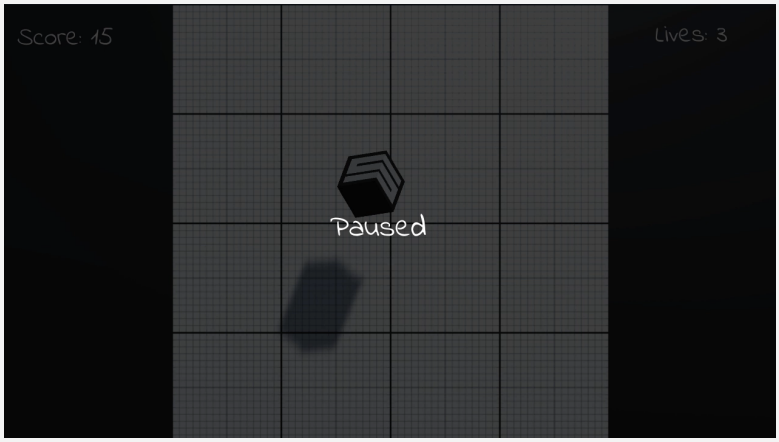
Step 3: Medium: Music volume

Add background music and a UI Slider element to adjust the volume.
Background music adds a lot of energy to a game, but not everyone likes it, so it's good to give people the option to lower the volume.



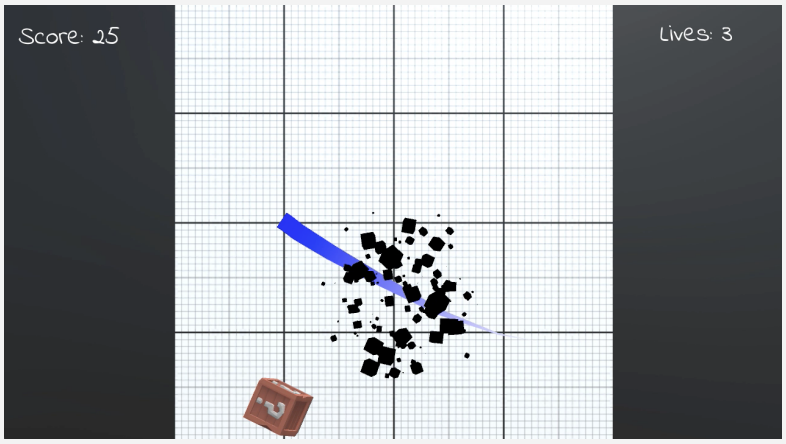
Step 5: Hard: Pause menu

During gameplay, allow the user to press a key to toggle between pausing and resuming the game, where a pause screen comes up while the game is paused.



Step 6: Expert: Click-and-swipe

Program click-and-swipe functionality instead of clicking, generating a trail where the mouse has been dragged. This does make the game easier, so you might also want to increase the gameplay difficulty on all levels if you implement this.



Step 7: Hints and solution walkthrough

Hints:

- Easy: Lives UI
  - Try using a Text GameObject like we did for the score
- Medium: Music volume
  - Try using the event on the Slider element
- Hard: Pause menu
  - Try using `Time.timeScale`
- Expert: Click-and-swipe
  - Camera.ScreenToWorldPoint will help convert a screen space position to world position

Solution walkthrough
If you are really stuck, download the step-by-step solution walkthrough.
Note that there are likely many ways to implement these features - this is only one suggestion.

Step 8: Share your work

Have you implemented any of these bonus features? Have you added any new, unique features? Have you applied these new features to another project?

We would love to see what you've created!

Please take a screenshot of your project or do a screen-recording walking us through it, then post it here to share what you've made.

We highly recommend that you comment on at least one other creator's submission. What do you like about the project? What would be a cool new feature they might consider adding?