2.1 Player Positioning

Steps:

Step 1: Create a new Project for Prototype 2

Step 2: Add the Player, Animals, and Food

Step 3: Get the user's horizontal input

Step 4: Move the player left-to-right

Step 5: Keep the player inbounds

Step 6: Clean up your code and variables

Example of project by end of lesson

Length: 60 minutes

Overview: You will begin this unit by creating a new project for your second Prototype and getting basic player movement working. You will first choose which character you would like, which types of animals you would like to interact with, and which food you would like to feed those animals. You will give the player basic side-to-side movement just like you did in Prototype 1, but then you will use if-then statements to keep the Player in bounds.

Project Outcome: The player will be able to move left and right on the screen based on the user's left and right key presses, but will not be able to leave the play area on either side.

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

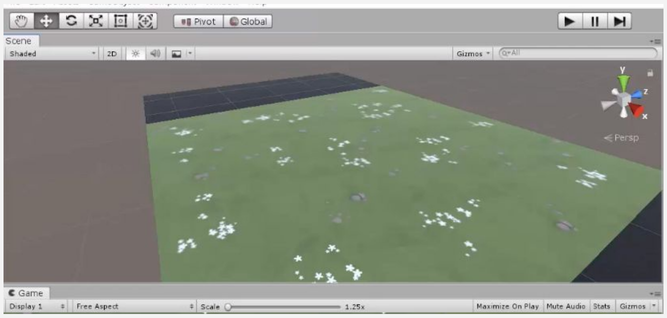
- Adjust the scale of an object proportionally in order to get it to the size you want
- More comfortably use the GetInput function in order to use user input to control an object
- Create an if-then statement in order to implement basic logic in your project, including the use of greater than (>) and less than (<) operators
- Use comments and automatic formatting in order to make their code more clean and readable to other programmers

Step 1: Create a new Project for Prototype 2

The first thing we need to do is create a new project and import the Prototype 2 starter files.

1. Open **Unity Hub** and create a **New** project named "Prototype 2" in your course directory
2. Click on the **link** to access the Prototype 2 starter files, then **import** them into Unity
3. Open the **Prototype 2 scene** and **delete** the SampleScene without saving
4. In the top-right of the Unity Editor, change your Layout from **Default** to your custom layout

- **Don't worry:** Unit 2 has far more assets than Unit 1, so the package might take a while to import.

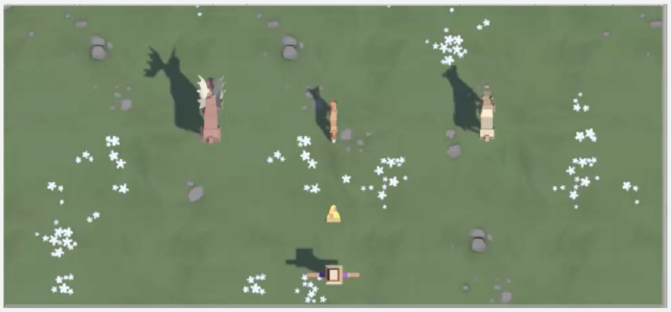


Step 2: Add the Player, Animals, and Food

Let's get all of our objects positioned in the scene, including the player, animals, and food.

1. If you want, drag a different **material** from *Course Library > Materials* onto the Ground object
2. Drag 1 **Human**, 3 **Animals**, and 1 **Food** object into the Hierarchy
3. Rename the human "Player", then **reposition** the animals and food so you can see them
4. Adjust the XYZ **scale** of the food so you can easily see it from above

- **New Technique:** Adjusting Scale
- **Warning:** Don't choose people for anything but the player, they don't have walking animations
- **Tip:** Remember, dragging objects into the hierarchy puts them at the origin



Step 3: Get the user’s horizontal input

If we want to move the Player left-to-right, we need a variable tracking the user’s input.

1. In your **Assets** folder, create a “Scripts” folder, and a “PlayerController” script inside
2. **Attach** the script to the Player and open it
3. At the top of PlayerController.cs, declare a new ***public float horizontalInput***
4. In ***Update()***, set ***horizontalInput = Input.GetAxis(“Horizontal”)***, then test to make sure it works in the inspector

- **Warning:** Make sure to create your Scripts folder inside of the assets folder
- **Don’t worry:** We’re going to get VERY familiar with this process
- **Warning:** If you misspell the script name, just delete it and try again.

```
public float horizontalInput;

void Update()
{
  horizontalInput = Input.GetAxis("Horizontal");
}
```

Step 4: Move the player left-to-right

We have to actually use the horizontal input to translate the Player left and right.

1. Declare a new ***public float speed = 10.0f;***
2. In ***Update()***, Translate the player side-to-side based on ***horizontalInput*** and ***speed***

- **Tip:** You can look at your old scripts for code reference

```
public float horizontalInput;
public float speed = 10.0f;

void Update()
{
  horizontalInput = Input.GetAxis("Horizontal");
  transform.Translate(Vector3.right * horizontalInput * Time.deltaTime * speed);
}
```

Step 5: Keep the player inbounds

We have to prevent the player from going off the side of the screen with an if-then statement.

1. In ***Update()***, write an **if-statement** checking if the player's left X position is **less than** a certain value
2. In the if-statement, set the player's position to its current position, but with a **fixed X location**

- **Tip:** Move the player in scene view to determine the x positions of the left and right bounds
- **New Concept:** If-then statements
- **New Concept:** Greater than > and Less Than < operators

```
void Update() {
  if (transform.position.x < -10) {
    transform.position = new Vector3(-10, transform.position.y, transform.position.z);
  }
}
```

Step 6: Clean up your code and variables

We need to make this work on the right side, too, then clean up our code.

1. Repeat this process for the **right side** of the screen
2. Declare new ***xRange*** variable, then replace the hardcoded values with them
3. Add **comments** to your code

- **Warning:** Whenever you see hardcoded values in the body of your code, try to replace it with a variable
- **Warning:** Watch your greater than / less than signs!

```
public float xRange = 10;

void Update()
{
  // Keep the player in bounds
  if (transform.position.x < ~~-10~~ -xRange)
  {
    transform.position = new Vector3(~~-10~~ -xRange, transform.position.y, transform.position.z);
  }
  if (transform.position.x > xRange)
  {
    transform.position = new Vector3(xRange, transform.position.y, transform.position.z);
  }
}
```

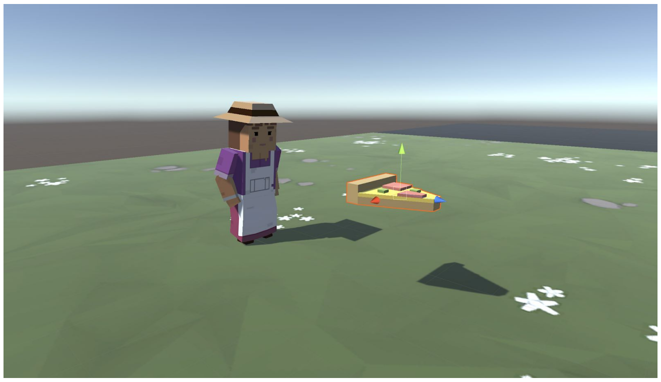
Lesson Recap

New Functionality	- The player can move left and right based on the user's left and right key presses - The player will not be able to leave the play area on either side
New Concepts and Skills	- Adjust object scale - If-statements - Greater/Less than operators
Next Lesson	- We'll learn how to create and throw endless amounts of food to feed our animals!

2.2 Food Flight

Steps:

Example of project by end of lesson



Length:	70 minutes
Overview:	In this lesson, you will allow the player to launch the projectile through the scene. First you will write a new script to send the projectile forwards. Next you will store the projectile along with all of its scripts and properties using an important new concept in Unity called Prefabs. The player will be able to launch the projectile prefab with a tap of the spacebar. Finally, you will add boundaries to the scene, removing any objects that leave the screen.
Project Outcome:	The player will be able to press the Spacebar and launch a projectile prefab into the scene, which destroys itself when it leaves the game's boundaries. The animals will also be removed from the scene when they leave the game boundaries.
Learning Objectives:	By the end of this lesson, you will be able to: - Transform a game object into a prefab that can be used as a template - Instantiate Prefabs to spawn them into the scene - Override Prefabs to update and save their characteristics - Get user input with GetKey and KeyCode to test for specific keyboard presses - Apply components to multiple objects at once to work as efficiently as possible

Step 1: Make the projectile fly forwards

The first thing we must do is give the projectile some forward movement so it can zip across the scene when it's launched by the player.

1. Create a new "MoveForward" script, **attach** it to the food object, then open it
2. Declare a new ***public float speed*** variable;
3. In ***Update()***, add ***transform.Translate(Vector3.forward * Time.deltaTime * speed);***, then **save**
4. In the **Inspector**, set the projectile's **speed** variable, then test

- **Don't worry:** You should all be super familiar with this method now… getting easier, right?

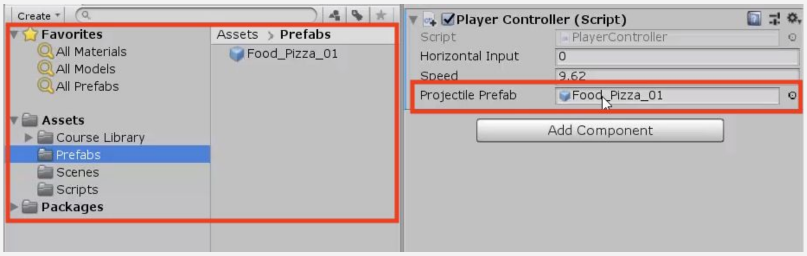
```
public float speed = 40;

void Update() {
  transform.Translate(Vector3.forward * Time.deltaTime * speed);
}
```

Step 2: Make the projectile into a prefab

Now that our projectile has the behavior we want, we need to make it into a prefab it so it can be reused anywhere and anytime, with all its behaviors included.

1. Create a new "Prefabs" folder, drag your food into it, and choose **Original Prefab**
2. In PlayerController.cs, declare a new ***public GameObject projectilePrefab;*** variable
3. **Select** the Player in the hierarchy, then **drag** the object from your Prefabs folder onto the new **Prefab Variant box** in the inspector
4. Try **dragging** the projectile into the scene at runtime to make sure they fly

- **New Concept:** Prefabs
- **New Concept:** Original vs Variant Prefabs
- **Tip:** Notice that this your projectile already has a move script if you drag it in



☑ Player Controller (Script)
Script: PlayerController
Horizontal Input: 0
Speed: 9.62
Projectile Prefab: Food_Pizza_01

Step 3: Test for spacebar press

Now that we have a projectile prefab assigned to PlayerController.cs, the player needs a way to launch it with the space bar.

1. In PlayerController.cs, in ***Update()***, add an **if-statement** checking for a spacebar press: ***if (Input.GetKeyDown(KeyCode.Space)) {***
2. Inside the if-statement, add a comment saying that you should ***// Launch a projectile from the player***

- **Tip:** Google a solution. Something like "How to detect key press in Unity"
- **New Functions:** Input.GetKeyDown, GetKeyUp, GetKey
- **New Function:** KeyCode

```
void Update()
{
  if (Input.GetKeyDown(KeyCode.Space))
  {
    // Launch a projectile from the player
  }
}
```

Step 4: Launch projectile on spacebar press

We've created the code that tests if the player presses spacebar, but now we actually need spawn a projectile when that happens

1. Inside the if-statement, use the **Instantiate** method to spawn a projectile at the player's location with the prefab's rotation

- **New Concept:** Instantiation

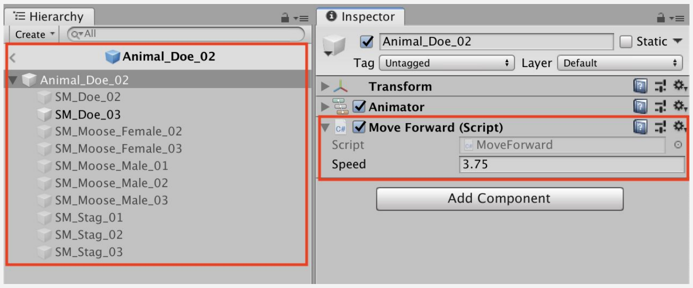
```
if (Input.GetKeyDown(KeyCode.Space))
{
  // Launch a projectile from the player
  Instantiate(projectilePrefab, transform.position, projectilePrefab.transform.rotation);
}
```

Step 5: Make animals into prefabs

The projectile is now a prefab, but what about the animals? They need to be prefabs too, so they can be instantiated during the game.

1. **Rotate** all animals on the Y axis by **180 degrees** to face down
2. **Select** all three animals in the hierarchy and *Add Component > **Move Forward***
3. Edit their **speed values** and **test** to see how it looks
4. Drag all three animals into the **Prefabs folder**, choosing “Original Prefab”
5. **Test** by dragging prefabs into scene view during gameplay

- **Tip:** You can change all animals at once by selecting all them in the hierarchy while holding Cmd/Ctrl
- **Tip:** Adding a Component from inspector is same as dragging it on
- **Warning:** Remember, anything you change while the game is playing will be reverted when you stop it



Animal_Doe_02

- Animal_Doe_02
  - SM_Doe_02
  - SM_Doe_03
  - SM_Moose_Female_02
  - SM_Moose_Female_03
  - SM_Moose_Male_01
  - SM_Moose_Male_02
  - SM_Moose_Male_03
  - SM_Stag_01
  - SM_Stag_02
  - SM_Stag_03

☑ Animal_Doe_02 □ Static
Tag Untagged Layer Default
Transform
☑ Animator
☑ Move Forward (Script)
Script MoveForward
Speed 3.75

Step 6: Destroy projectiles offscreen

Whenever we spawn a projectile, it drifts past the play area into eternity. In order to improve game performance, we need to destroy them when they go out of bounds.

1. Create “DestroyOutOfBounds” script and apply it to the **projectile**
2. Add a new ***private float topBound*** variable and initialize it ***= 30;***
3. Write code to destroy if out of top bounds ***if (transform.position.z > topBound) { Destroy(gameObject); }***
4. In the Inspector **Overrides** drop-down, click **Apply all** to apply it to prefab

- **Warning:** Too many objects in the hierarchy will slow the game
- **Tip:** Google “How to destroy gameobject in Unity”
- **New Function:** Destroy
- **New Technique:** Override prefab

```
private float topBound = 30;

void Update() {
  if (transform.position.z > topBound) {
    Destroy(gameObject);   }}
```

Step 7: Destroy animals offscreen

If we destroy projectiles that go out of bounds, we should probably do the same for animals. We don't want critters getting lost in the endless abyss of Unity Editor...

1. Create a new **private float lowerBound** variable and initialize it = -10;
2. Create **else-if statement** to check if objects are beneath ***lowerBound***:
   else if (transform.position.z > topBound)
3. **Apply** the script to all of the animals, then **Override** the prefabs

- **New Function:** Else-if statement
- **Warning:** Don't make topBound too tight or you'll destroy the animals before they before they can spawn

```
private float topBound = 30;
private float lowerBound = -10;

void Update() {
  if (transform.position.z > topBound)
  {
    Destroy(gameObject);
  } else if (transform.position.z < lowerBound) {
    Destroy(gameObject);
  }
}
```

Lesson Recap

New Functionality	● The player can press the Spacebar to launch a projectile prefab, ● Projectile and Animals are removed from the scene if they leave the screen
New Concepts and Skills	● Create Prefabs ● Override Prefabs ● Test for Key presses ● Instantiate objects ● Destroy objects ● Else-if statements
Next Lesson	● Instead of dropping all these animal prefabs onto the scene, we'll create a herd of animals roaming the plain!

2.3 Random Animal Stampede

Steps:

Step 1: Create a spawn manager

Step 2: Spawn an animal if S is pressed

Step 3: Spawn random animals from array

Step 4: Randomize the spawn location

Step 5: Change the perspective of the camera

Example of project by end of lesson

Length: 50 minutes

Overview: Our animal prefabs walk across the screen and get destroyed out of bounds, but they don't actually appear in the game unless we drag them in! In this lesson we will allow the animals to spawn on their own, in a random location at the top of the screen. In order to do so, we will create a new object and a new script to manage the entire spawning process.

Project Outcome: When the user presses the S key, a randomly selected animal will spawn at a random position at the top of the screen, walking towards the player.

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

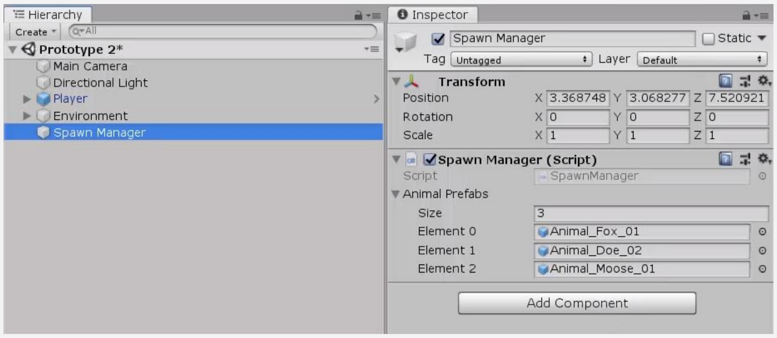
- Create an empty object with a script attached
- Use arrays to create an accessible list of objects or values
- Use integer variables to determine an array index
- Randomly generate values with Random.Range in order to randomize objects in arrays and spawn positions
- Change the camera's perspective to better suit your game

Step 1: Create a spawn manager

If we are going to be doing all of this complex spawning of objects, we should have a dedicated script to manage the process, as well as an object to attach it to.

1. In the hierarchy, create an **empty object** called "Spawn Manager"
2. Create a new script called "SpawnManager", attach it to the **Spawn Manager**, and open it
3. Declare new ***public GameObject[ ] animalPrefabs;***
4. In the inspector, change the **Array size** to match your animal count, then **assign** your animals by **dragging** them in

- **Tip:** Empty objects can be used to store objects or used to store scripts
- **Warning:** You can use spaces when naming your empty object, but make sure your script name uses PascalCase!
- **New Concept:** Arrays



☑ Spawn Manager □ Static

Tag Untagged Layer Default

Transform

Position X 3.368748 Y 3.068277 Z 7.520921

Rotation X 0 Y 0 Z 0

Scale X 1 Y 1 Z 1

☑ Spawn Manager (Script)

Script SpawnManager

Animal Prefabs

Size 3

Element 0 Animal_Fox_01

Element 1 Animal_Doe_02

Element 2 Animal_Moose_01

Step 2: Spawn an animal if S is pressed

We've created an array and assigned our animals to it, but that doesn't do much good until we have a way to spawn them during the game. Let's create a temporary solution for choosing and spawning the animals.

1. In ***Update()***, write an if-then statement to **instantiate** a new animal prefab at the top of the screen if **S** is pressed
2. Declare a new ***public int animalIndex*** and incorporate it in the **Instantiate** call, then test editing the value in the Inspector

- **New Concept:** Array Indexes
- **Tip:** Array indexes start at 0 instead of 1. An array of 3 animals would look like [0, 1, 2]
- **New Concept:** Integer Variables
- **Don't worry:** We'll declare a new variable for the Vector3 and index later

```
public GameObject[] animalPrefabs;
public int animalIndex;

void Update() {
  if (Input.GetKeyDown(KeyCode.S)) {
    Instantiate(animalPrefabs[animalIndex], new Vector3(0, 0, 20),
    animalPrefabs[animalIndex].transform.rotation);
  }
}
```

Step 3: Spawn random animals from array

We can spawn animals by pressing S, but doing so only spawns an animal at the array index we specify. We need to randomize the selection so that S can spawn a random animal based on the index, without our specification.

1. In the if-statement checking if S is pressed, generate a random ***int animalIndex*** between 0 and the length of the array
2. Remove the global ***animalIndex*** variable, since it is only needed locally in the **if-statement**

- **Tip:** Google “how to generate a random integer in Unity”
- **New Function:** Random.Range
- **New Function:** .Length
- **New Concept:** Global vs Local variables

```
public GameObject[] animalPrefabs;
~~public int animalIndex;~~

void Update() {
  if (Input.GetKeyDown(KeyCode.S)) {
    int animalIndex = Random.Range(0, animalPrefabs.Length);
    Instantiate(animalPrefabs[animalIndex], new Vector3(0, 0, 20),
            animalPrefabs[animalIndex].transform.rotation); }}
```

Step 4: Randomize the spawn location

We can press S to spawn random animals from animalIndex, but they all pop up in the same place! We need to randomize their spawn position, so they don’t march down the screen in a straight line.

1. **Replace** the X value for the Vector3 with ***Random.Range(-20, 20)***, then test
2. Within the **if-statement**, make a new local ***Vector3 spawnPos*** variable
3. At the top of the class, create ***private float*** variables for ***spawnRangeX*** and ***spawnPosZ***

- **Tip:** Random.Range for floats is inclusive of all numbers in the range, while Random.Range for integers is exclusive!
- **Tip:** Keep using variables to clean your code and make it more readable

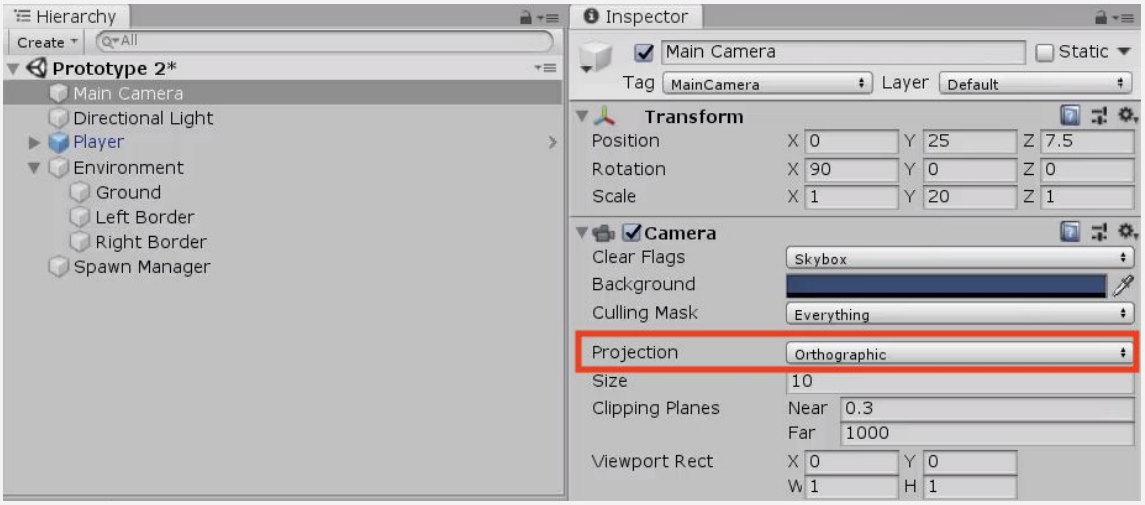
```
private float spawnRangeX = 20;
private float spawnPosZ = 20;

void Update() {
  if (Input.GetKeyDown(KeyCode.S)) {
    // Randomly generate animal index and spawn position
    Vector3 spawnPos = new Vector3(Random.Range(-spawnRangeX, spawnRangeX),
    0, spawnPosZ);
    int animalIndex = Random.Range(0, animalPrefabs.Length);
    Instantiate(animalPrefabs[animalIndex], spawnPos,
    animalPrefabs[animalIndex].transform.rotation); }}
```

Step 5: Change the perspective of the camera

Our Spawn Manager is coming along nicely, so let's take a break and mess with the camera.Changing the camera's perspective might offer a more appropriate view for this top-down game.

1. Toggle between **Perspective** and **Isometric** view in Scene view to appreciate the difference
2. Select the **camera** and change the **Projection** from "Perspective" to "Orthographic"

- **New:** Orthographic vs Perspective Camera Projection
- **Tip:** Test the game in both views to appreciate the difference



☑ Main Camera ☐ Static

Tag MainCamera Layer Default

Transform

Position	X 0	Y 25	Z 7.5
Rotation	X 90	Y 0	Z 0
Scale	X 1	Y 20	Z 1

☑ Camera

Clear Flags: Skybox

Background

Culling Mask: Everything

Projection: Orthographic

Size: 10

Clipping Planes: Near 0.3, Far 1000

Viewport Rect: X 0, Y 0, W 1, H 1

Lesson Recap

New Functionality

- The player can press the S to spawn an animal
- Animal selection and spawn location are randomized
- Camera projection (perspective/orthographic) selected

New Concepts and Skills

- Spawn Manager
- Arrays
- Keycodes
- Random generation
- Local vs Global variables
- Perspective vs Isometric projections

Next Lesson

- Using collisions to feed our animals!

unity

2.4 Collision Decisions

Steps:

Step 1: Make a new method to spawn animals

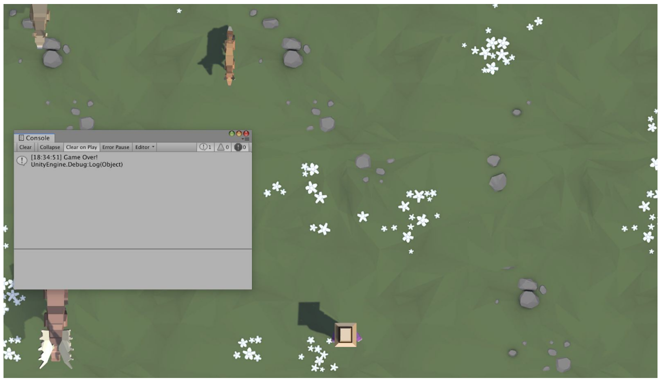
Step 2: Spawn the animals at timed intervals

Step 3: Add collider and trigger components

Step 4: Destroy objects on collision

Step 5: Trigger a "Game Over" message

Example of project by end of lesson



```
[18:34:51] Game Over!
UnityEngine.Debug:Log(Object)
```

Length: 50 minutes

Overview: Our game is coming along nicely, but there are are some critical things we must add before it's finished. First off, instead of pressing S to spawn the animals, we will spawn them on a timer so that they appear every few seconds. Next we will add colliders to all of our prefabs and make it so launching a projectile into an animal will destroy it. Finally, we will display a "Game Over" message if any animals make it past the player.

Project Outcome: The animals will spawn on a timed interval and walk down the screen, triggering a "Game Over" message if they make it past the player. If the player hits them with a projectile to feed them, they will be destroyed.

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

- Repeat functions on a timer with InvokeRepeating
- Write custom functions to make your code more readable
- Edit Box Colliders to fit your objects properly
- Detect collisions and destroy objects that collide with each other
- Display messages in the console with Debug Log

Step 1: Make a new method to spawn animals

Our Spawn Manager is looking good, but we're still pressing S to make it work! If we want the game to spawn animals automatically, we need to start by writing our very first custom function.

1. In **SpawnManager.cs**, create a new ***void SpawnRandomAnimal() {}*** function beneath ***Update()***
2. Cut and paste the code from the **if-then statement** to the **new function**
3. Call ***SpawnRandomAnimal();*** if **S** is pressed

- **New Concept:** Custom Void Functions
- **New Concept:** Compartmentalization / Abstraction

```
void Update() {
  if (Input.GetKeyDown(KeyCode.S)) {
    SpawnRandomAnimal();
    ~~Vector3 spawnpos ~~... (Cut and Pasted Below) }}

void SpawnRandomAnimal() {
  Vector3 spawnpos = new Vector3(Random.Range(-xSpawnRange,
  xSpawnRange), 0, zSpawnPos);
  int animalIndex = Random.Range(0, animalPrefabs.Length);
  Instantiate(animalPrefabs[animalIndex], new Vector3(0, 0, 20) spawnpos,
  animalPrefabs[animalIndex].transform.rotation); }
```

Step 2: Spawn the animals at timed intervals

We've stored the spawn code in a custom function, but we're still pressing S! We need to spawn the animals on a timer, so they randomly appear every few seconds.

1. In ***Start()***, use ***InvokeRepeating*** to spawn the animals based on an interval, then **test**.
2. Remove the **if-then statement** that tests for **S** being pressed
3. Declare new ***private startDelay*** and ***spawnInterval*** variables then playtest and tweak variable values

- **Tip:** Google "Repeating function in Unity"
- **New Function:** InvokeRepeating

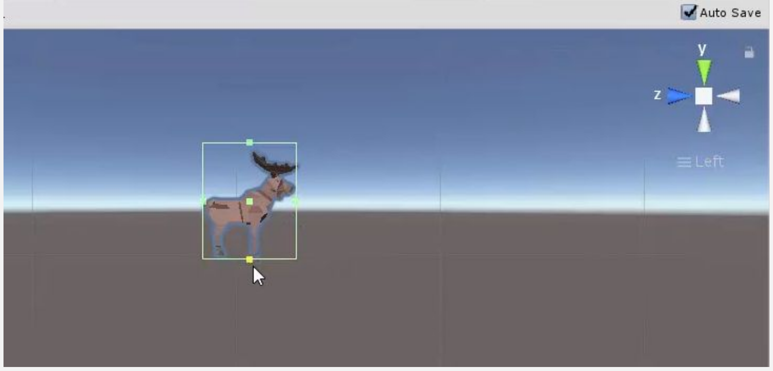
```
private float startDelay = 2;
private float spawnInterval = 1.5f;

void Start() {
  InvokeRepeating("SpawnRandomAnimal", startDelay, spawnInterval); }

void Update() {
~~  if (Input.GetKeyDown(KeyCode.S)) {~~
    ~~SpawnRandomAnimal(); }~~ }
```

Step 3: Add collider and trigger components

Animals spawn perfectly and the player can fire projectiles at them, but nothing happens when the two collide! If we want the projectiles and animals to be destroyed on collision, we need to give them some familiar components - "colliders."

1. Double-click on one of the **animal prefabs**, then *Add Component > Box Collider*
2. Click **Edit Collider**, then **drag** the collider handles to encompass the object
3. Check the "**Is Trigger**" checkbox
4. Repeat this process for each of the **animals** and the **projectile**
5. Add a **RigidBody component** to the projectile and uncheck "use gravity"

- **New Component:** Box Colliders
- **Warning:** Avoid Box Collider 2D
- **Tip:** Use isometric view and the gizmos to cycle around and edit the collider with a clear perspective
- **Tip:** For the Trigger to work, at least one of the objects needs a rigidbody component



Step 4: Destroy objects on collision

Now that the animals and the projectile have Box Colliders with triggers, we need to code a new script in order to destroy them on impact.

1. Create a new **DetectCollisions.cs** script, add it to each animal prefab, then **open** it
2. Before the final **}** add ***OnTriggerEnter*** function using **autocomplete**
3. In ***OnTriggerEnter***, put ***Destroy(gameObject);***, then test
4. In ***OnTriggerEnter***, put ***Destroy(other.gameObject);***

- **New Concept:** Overriding Functions
- **New Function:** OnTriggerEnter
- **Tip:** The "other" in OnTriggerEnter refers to the collider of the other object
- **Tip:** Use VS's Auto-Complete feature for OnTriggerEnter and any/all override functions

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

Step 5: Trigger a “Game Over” message

The player can defend their field against animals for as long as they wish, but we should let them know when they’ve lost with a “Game Over” message if any animals get past the player.

1. In DestroyOutOfBounds.cs, in the **else-if condition** that checks if the animals reach the bottom of the screen, add a Game Over messsage: ***Debug.Log(“Game Over!”)***
2. Clean up your code with **comments**
3. If using Visual Studio, Click *Edit > Advanced > **Format document*** to fix any indentation issues (On a **Mac**, click *Edit > Format > Format Document)*

- **New Functions:** Debug.Log, LogWarning, LogError
- **Tip:** Tweak some values to adjust the difficulty of your game. It might too easy!

```
void Update() {
  if (transform.position.z > topBound)
  {
    Destroy(gameObject);
  } else if (transform.position.z < lowerBound)
  {
    Debug.Log("Game Over!");
    Destroy(gameObject);
  }
}
```

Lesson Recap

New Functionality	● Animals spawn on a timed interval and walk down the screen ● When animals get past the player, it triggers a “Game Over” message ● If a projectile collides with an animal, both objects are removed
New Concepts and Skills	● Create custom methods/functions ● InvokeRepeating() to repeat code ● Colliders and Triggers ● Override functions ● Log Debug messages to console