Directions for Music Scene Set Up

NOTICE: This section assumes you have fully completed the General Setup, all Space Instruction and the Music scene setup instructions.

Getting Started

After completing setup for the project as well as the setup for the Music scene, we want to add the ability to:

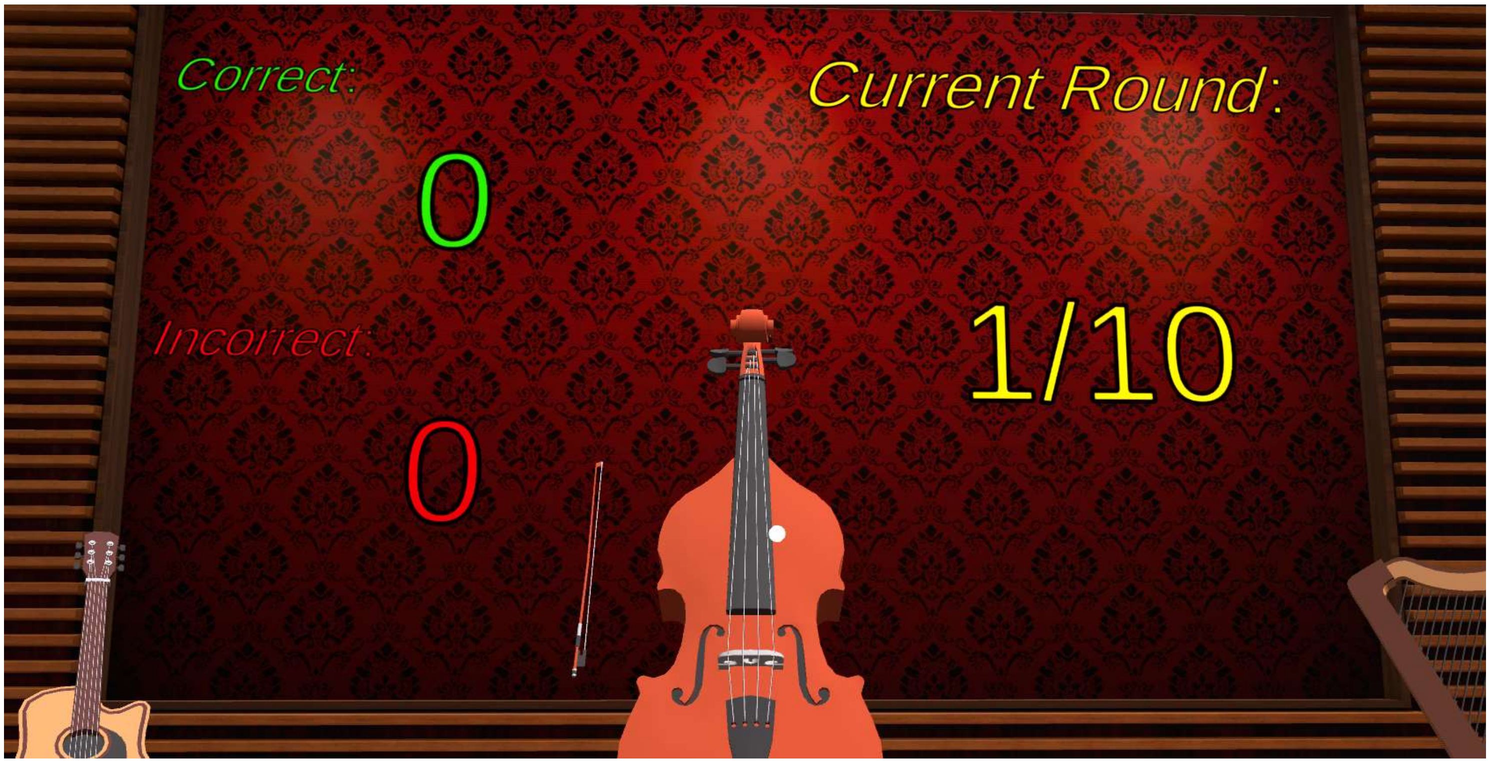
- Spawn three instruments on the stage.
- Pick one correct instrument
- Add the ability to select an instrument
- Compare the instrument selected to the previously set correct instrument.
- Play the set correct instrument every few seconds as a hint to the player
- Set the score on the scoreboard

For this project, we have two different game modes: **Infinite** and **Finite**. The code for both modes is very similar though there is one core difference. The infinite game mode will continuously cycle through the list of instruments forever therefore there is no need to have a round counter, unlike the Finite game mode where there are a finite set of rounds before the game is over.

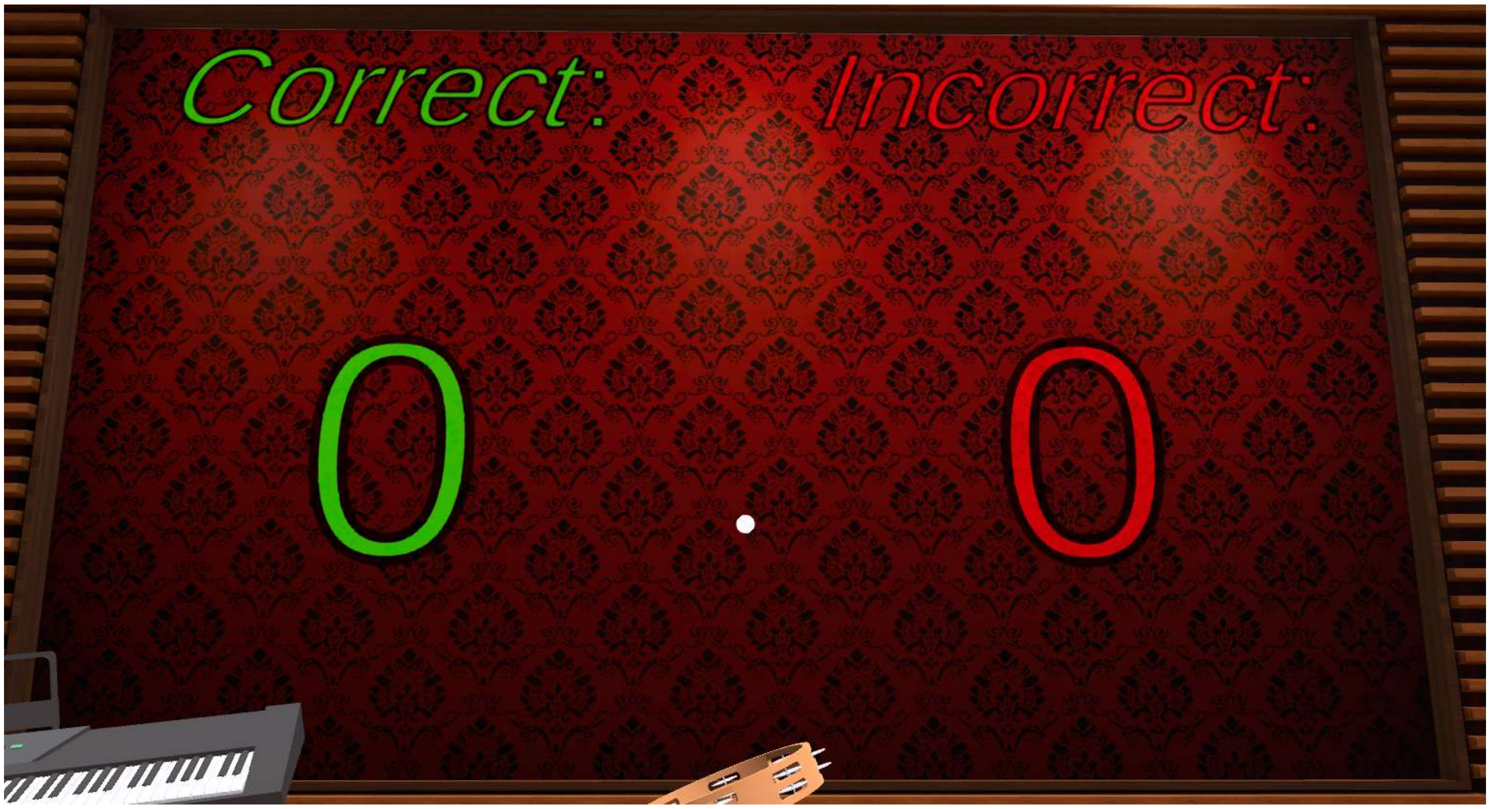
Each game mode has a scoreboard to display the number of correct guesses vs incorrect guesses and for the Finite game mode only a spot for the round count.

We will show you how to create the finite game mode in this documentation, inorder to make the infinite game mode you will just duplicate the instructions and remove any reference to the variables and code for the current round counter.

Finite:

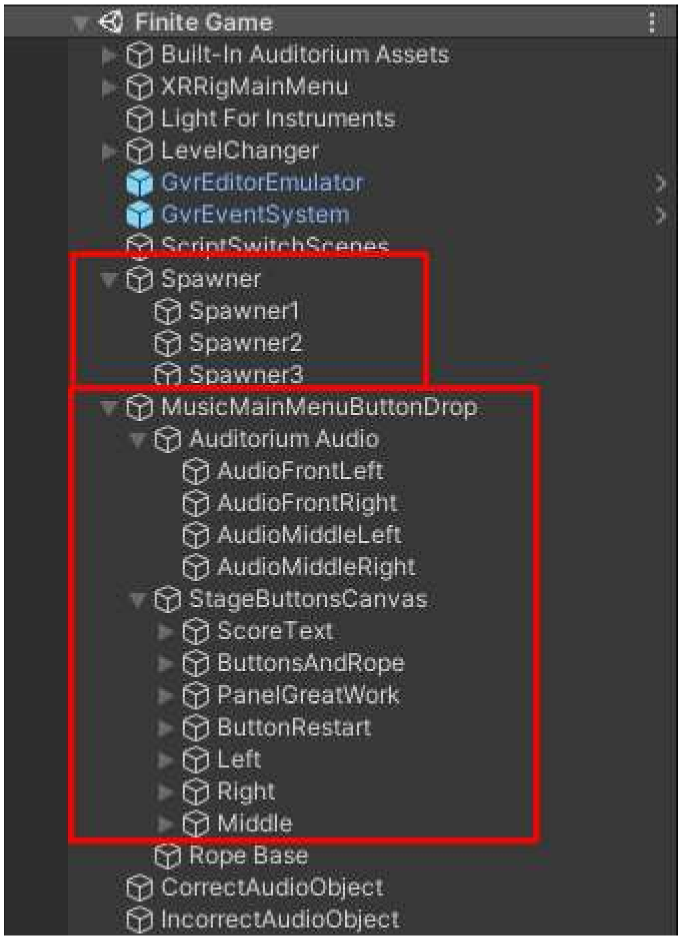


Infinite

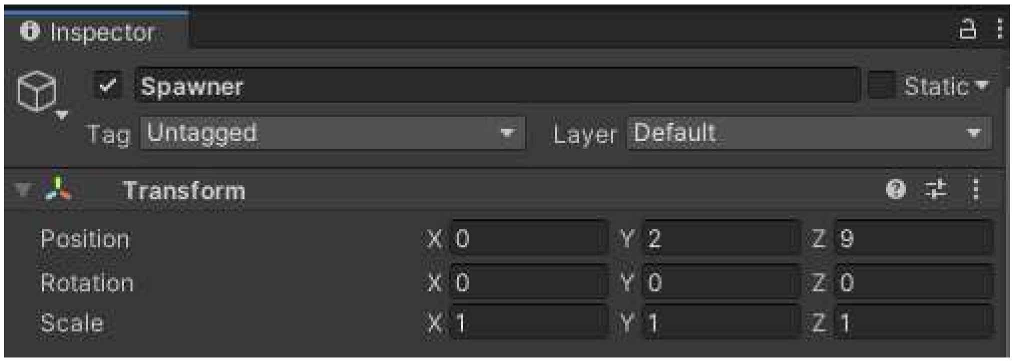


Creating the Game Objects

To begin we want to create the game objects in unity that we will need.

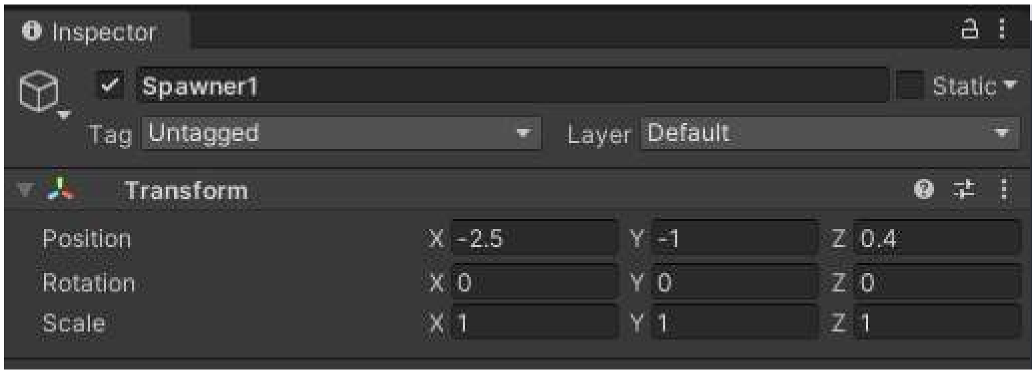


We will first create an empty game object and call it "Main_Spawner". This spawner will contain the three instrument spawners as well as the script for all the game logic. Since this Spawner game object will be an empty game object, it doesn't matter where it is put in the scene. We decided to put it here:


Inspector
Spawner
Static
Tag Untagged
Layer Default
Transform

	X	Y	Z
Position	0	2	9
Rotation	0	0	0
Scale	1	1	1

Next we will create all the individual instrument spawners which are three empty objects called "Spawner1", "Spawner2" and "Spawner3" (left to right on the stage respectively). The three positions we have set for these spawners are as follows:



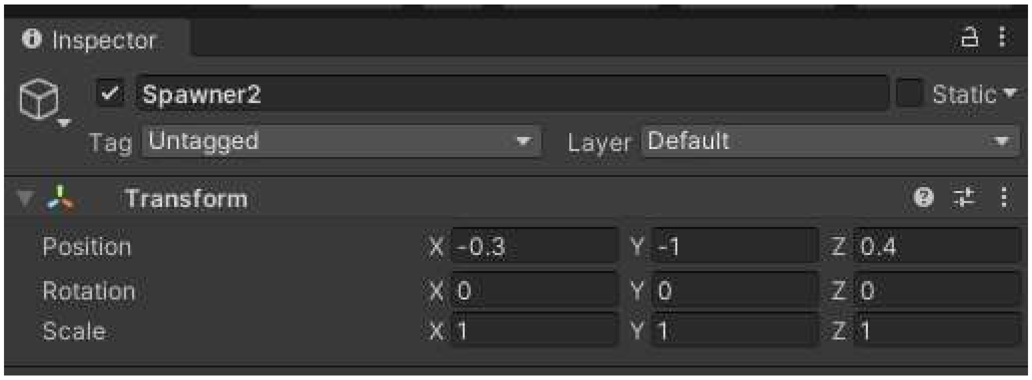
Inspector

Spawner1 Static

Tag Untagged Layer Default

Transform

	X	Y	Z
Position	-2.5	-1	0.4
Rotation	0	0	0
Scale	1	1	1



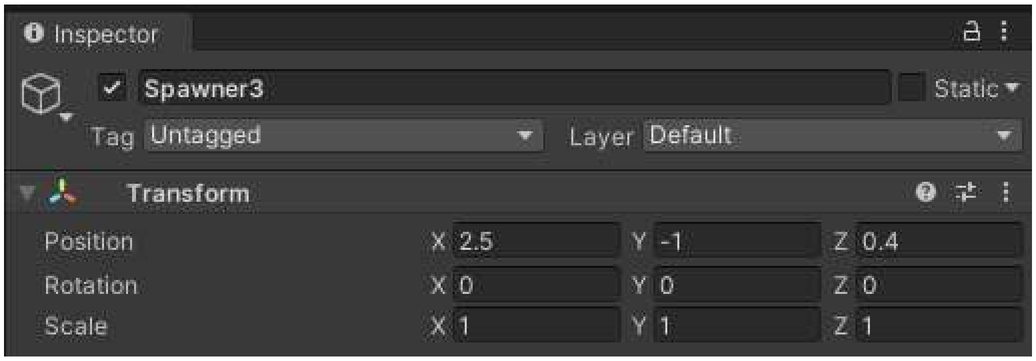
Inspector

Spawner2 Static

Tag Untagged Layer Default

Transform

	X	Y	Z
Position	-0.3	-1	0.4
Rotation	0	0	0
Scale	1	1	1



Inspector

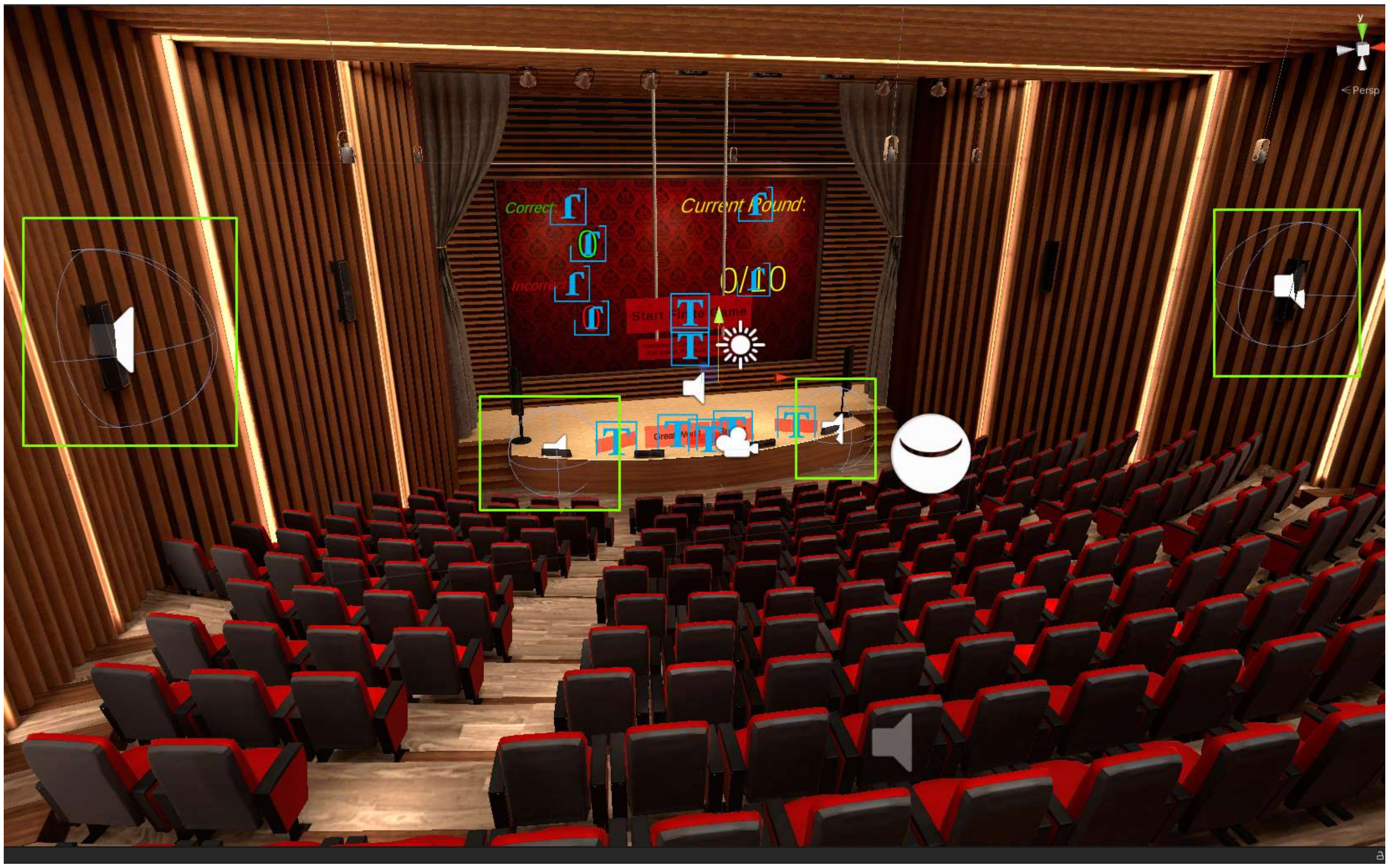
Spawner3 Static

Tag Untagged Layer Default

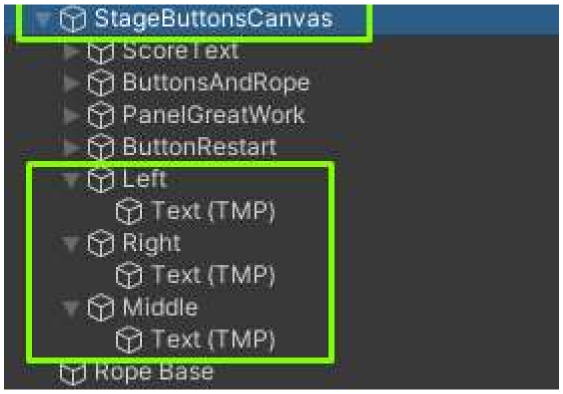
Transform

	X	Y	Z
Position	2.5	-1	0.4
Rotation	0	0	0
Scale	1	1	1

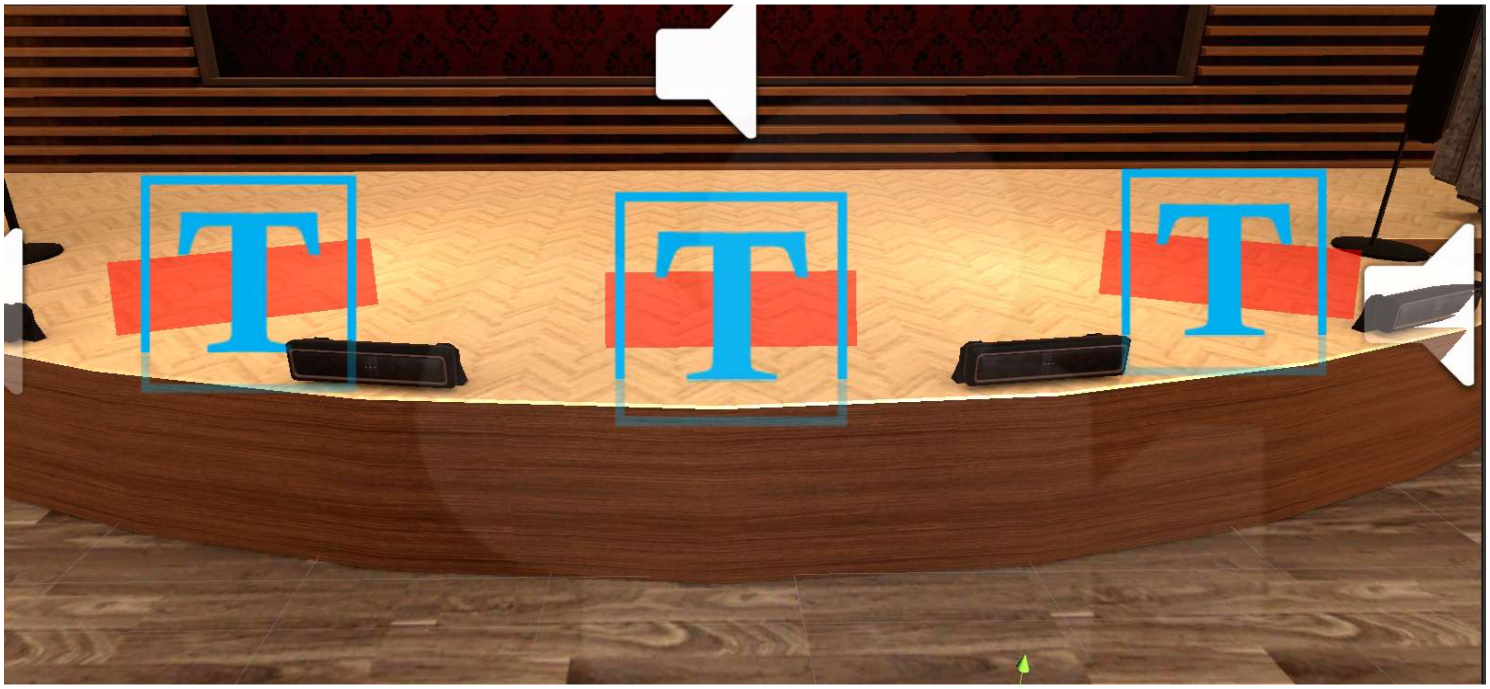
Next we will create all the speakers for the audio to play when a correct instrument is selected. There will be four audio sources to match the two speakers on stage as well as speakers to the left and right of the player. The image below shows where to place the audio source game objects:



Next we want to create the Buttons for the player to be able to select the instruments when they spawn. So we will create a Canvas for teh scene and call it "StageButtonCanvas." Under the canvas create three "Button - TextMeshPro" buttons and name them "Left", "Middle" and "Right" respectively. Your Hierarchy should look like this:

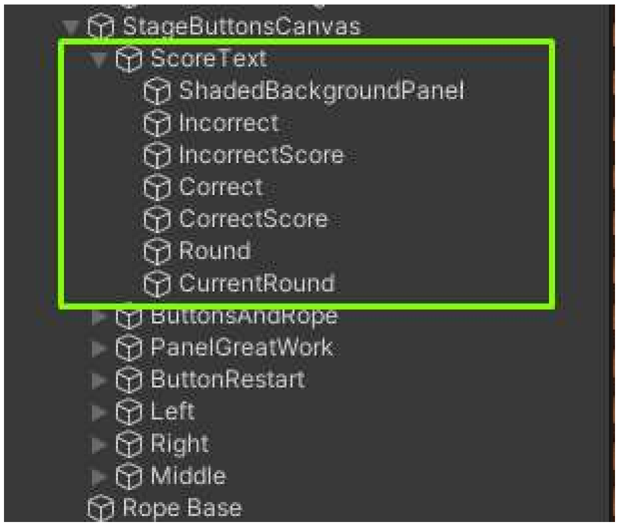

```
StageButtonsCanvas
    ScoreText
    ButtonsAndRope
    PanelGreatWork
    ButtonRestart
    Left
        Text (TMP)
    Right
        Text (TMP)
    Middle
        Text (TMP)
Rope Base
```

After setting your font size of the button text to the correct value (For us it was 0.1), make sure to place the buttons like so:



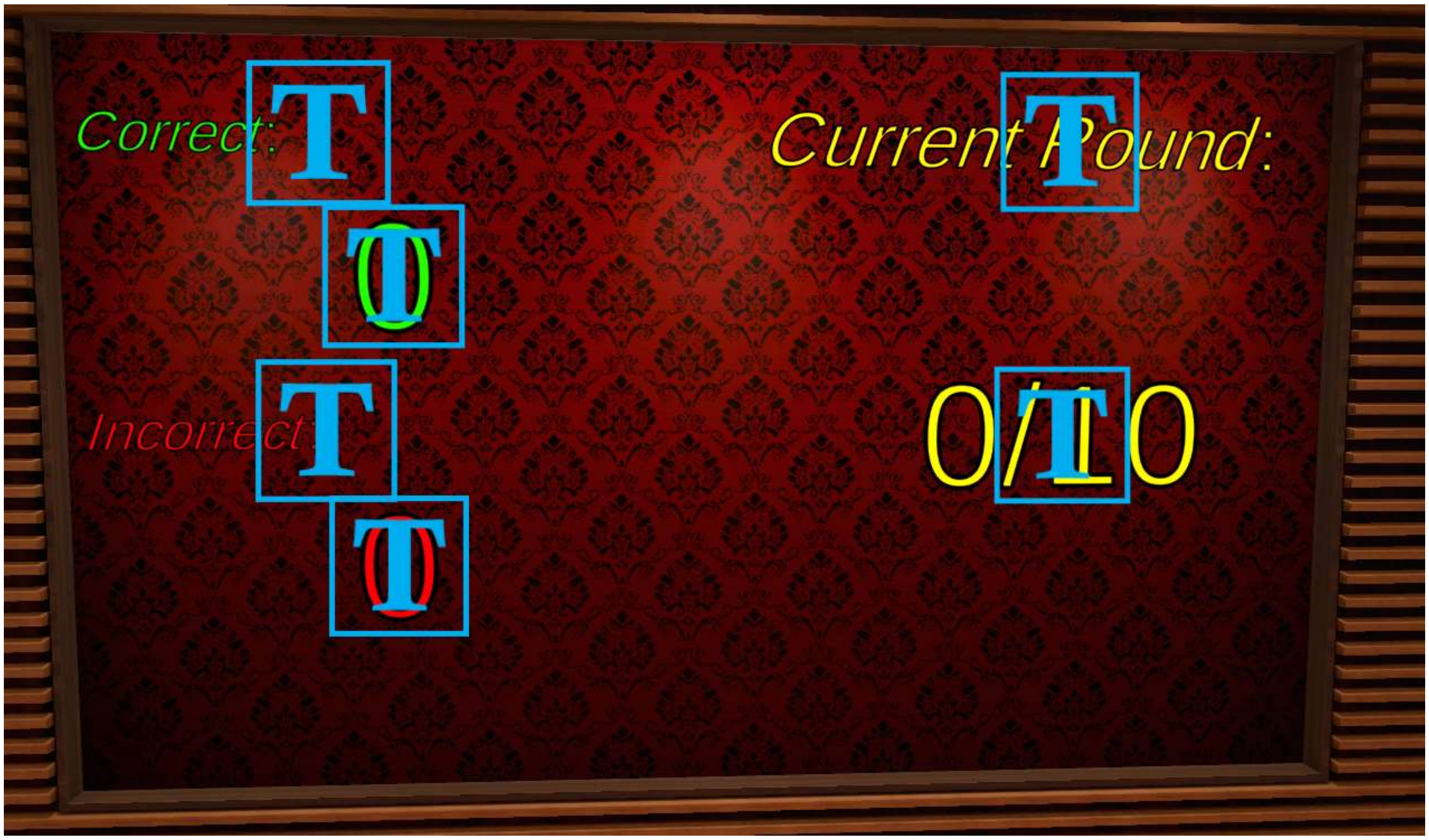
Finally we will create the scoreboard text objects. To start we will create a new Panel that we will set all the text onto. This panel will be under the "StageButtonsCanvas" object we created earlier. Under the new panel we will call "ScoreText" we will create a few different "TextMeshPro" objects that contain the titles for Correct and Incorrect score as well as Current Round. We will also have a few for the actual scores and current round count.

Your Hierarchy should look like so:



```
StageButtonsCanvas
  ScoreText
    ShadedBackgroundPanel
    Incorrect
    IncorrectScore
    Correct
    CorrectScore
    Round
    CurrentRound
  ButtonsAndRope
  PanelGreatWork
  ButtonRestart
  Left
  Right
  Middle
Rope Base
```

Your scene should look as follows after moving all the text objects and panel objects to the correct positions:



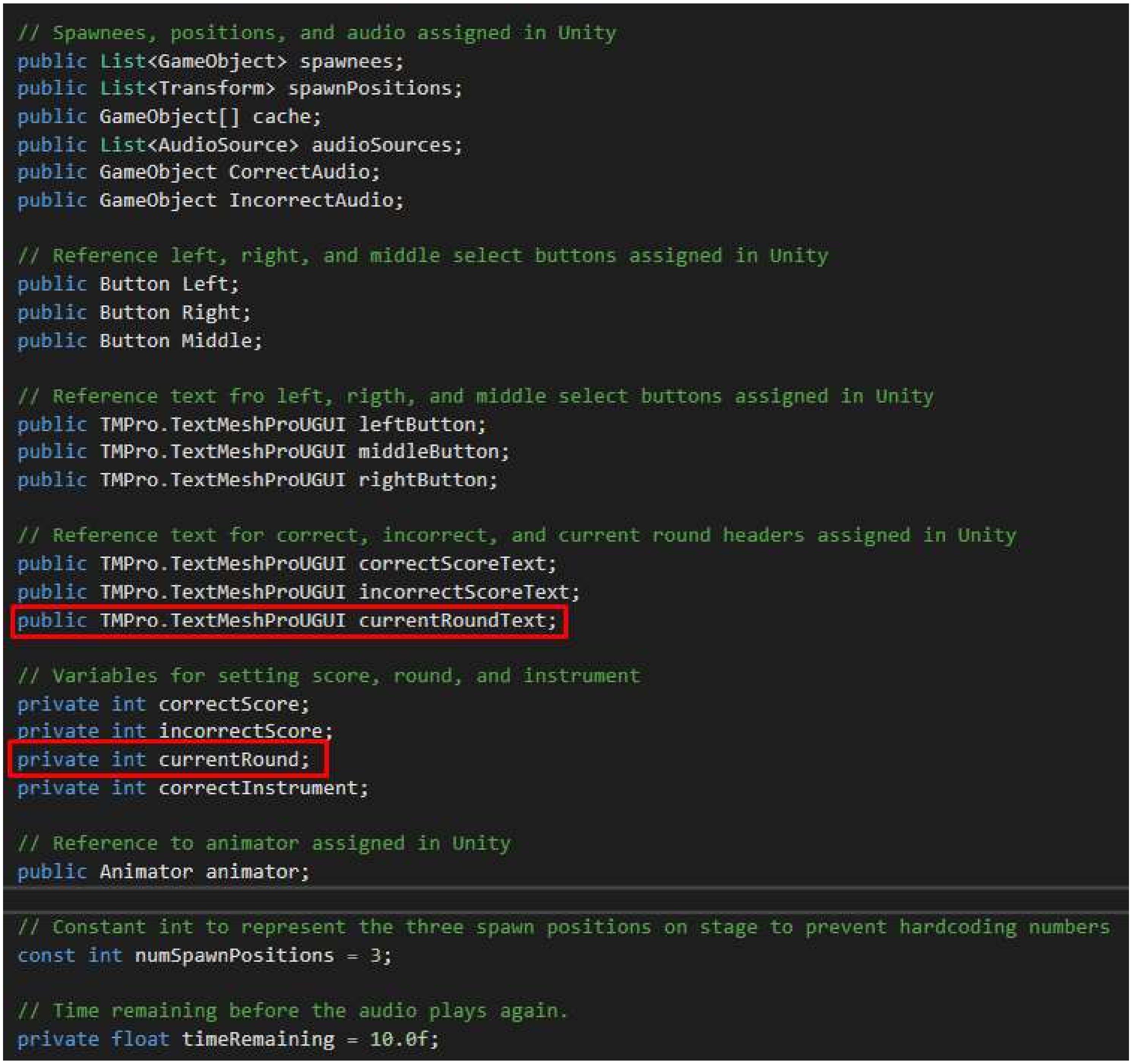
That should be it for the game objects that need to be created. From here on we will focus on writing the game logic code in a new script!

Writing the code

Before we get into the code we first need to create the script that allows us to play the game. So make a new script called "FiniteSpawner.cs" and open it up in a code editor like Visual Studio.

We need a way to access all the different parts of the scene to control what happens to them during the game. So, to do this, we will create a bunch of class variables that we will drag and drop the various scene objects into.

You will notice some red outlines of certain code bits and that is to specify that bit of code is specific to the finite game mode.



```
// Spawnees, positions, and audio assigned in Unity
public List<GameObject> spawnees;
public List<Transform> spawnPositions;
public GameObject[] cache;
public List<AudioSource> audioSources;
public GameObject CorrectAudio;
public GameObject IncorrectAudio;

// Reference left, right, and middle select buttons assigned in Unity
public Button Left;
public Button Right;
public Button Middle;

// Reference text fro left, rigth, and middle select buttons assigned in Unity
public TMPro.TextMeshProUGUI leftButton;
public TMPro.TextMeshProUGUI middleButton;
public TMPro.TextMeshProUGUI rightButton;

// Reference text for correct, incorrect, and current round headers assigned in Unity
public TMPro.TextMeshProUGUI correctScoreText;
public TMPro.TextMeshProUGUI incorrectScoreText;
public TMPro.TextMeshProUGUI currentRoundText;

// Variables for setting score, round, and instrument
private int correctScore;
private int incorrectScore;
private int currentRound;
private int correctInstrument;

// Reference to animator assigned in Unity
public Animator animator;

// Constant int to represent the three spawn positions on stage to prevent hardcoding numbers
const int numSpawnPositions = 3;

// Time remaining before the audio plays again.
private float timeRemaining = 10.0f;
```

Public Variables:

- **List spawnees** -- List of GameObjects we want to pick from to spawn in the scene.
- **List spawnPositions** -- The spawn positions of the different spawners in the scene (Left, Middle, Right).
- **GameObject[] cache** -- A cache array to hold the three music instruments that are currently spawned and in the scene.
- **List audioSources** -- The Audio sources in the scene that will play the audio of each correct instrument.
- **GameObject CorrectAudio** -- The Audio that plays when the player selects the correct instrument.

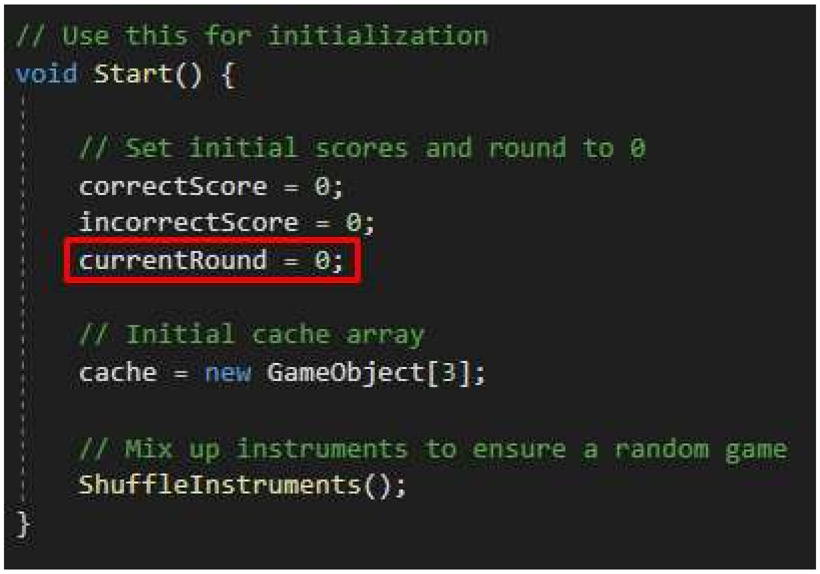
- **GameObject IncorrectAudio** -- The Audio that plays when the player selects the incorrect instrument
- **Button Left** -- The Left button for selecting the left-most instrument.
- **Button Right** -- The Left button for selecting the right-most instrument.
- **Button Middle** -- The Left button for selecting the middle-most instrument.
- **TMPro.TextMeshProUGUI leftButton** -- The text part of the left button for setting the name of the button to the spawned instrument.
- **TMPro.TextMeshProUGUI middleButton** -- The text part of the middle button for setting the name of the button to the spawned instrument.
- **TMPro.TextMeshProUGUI rightButton** -- The text part of the right button for setting the name of the button to the spawned instrument.
- **TMPro.TextMeshProUGUI correctScoreText** -- Text for the correct score count.
- **TMPro.TextMeshProUGUI incorrectScoreText** -- Text for the incorrect score.
- **TMPro.TextMeshProUGUI currentRoundText** -- Text for the current round.
- **Animator animator** -- The animator to manage the transitions.

Private Variables:

- **int correctScore** -- The variable that holds the correct score.
- **int incorrectScore** -- The variable that holds the incorrect score.
- **int currentRound** -- The variable that holds the current round.
- **int correctInstrument** -- The variable taht holds the correctInstrument value.
- **const int numSpawnPositions** -- The number of spawn positions available.
- **float timeRemaining** -- The time remaining in the timer to play the audio in loop.

Start method:

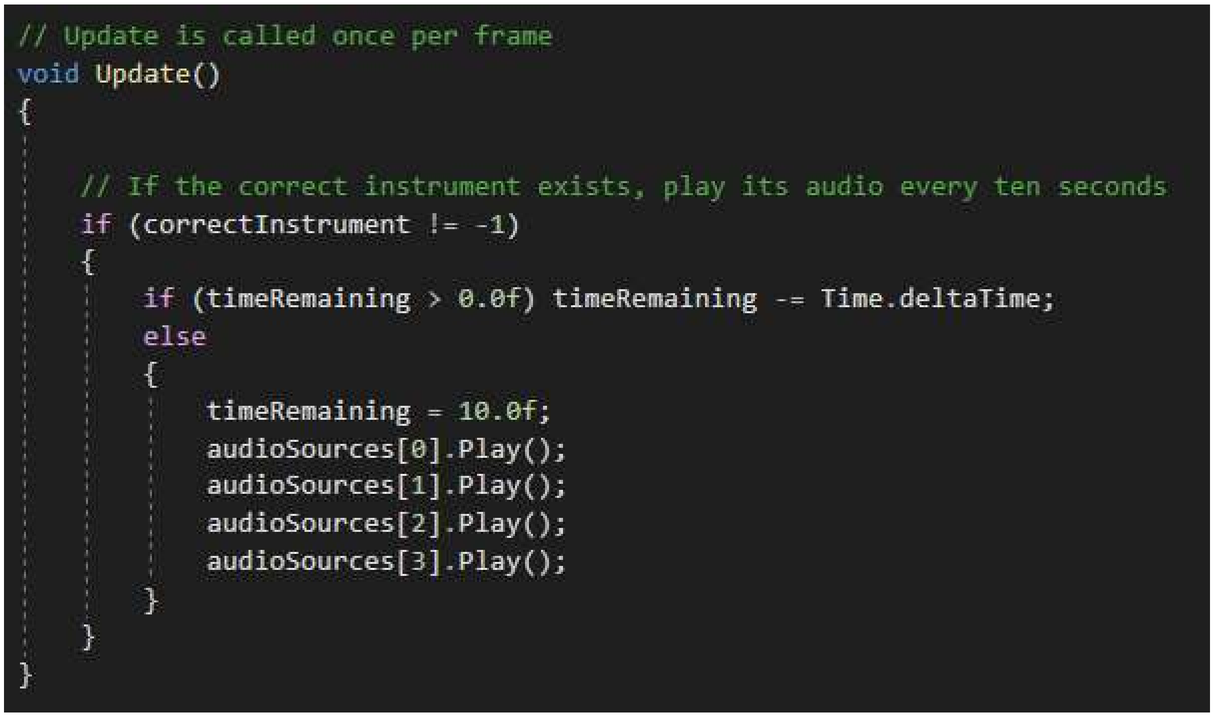
In the start method we want to set the "correctScore" variable to zero as well as "incorrectScore" and "currentRound" since we haven't started the game yet. We will instantiate the cache array with a size of three since we will be spawning three instruments per round. And finally, in order for the game to be a little random, we will shuffle the instrument order by calling a function we will create further in the directions.



```
// Use this for initialization
void Start() {

    // Set initial scores and round to 0
    correctScore = 0;
    incorrectScore = 0;
    currentRound = 0;

    // Initial cache array
    cache = new GameObject[3];

    // Mix up instruments to ensure a random game
    ShuffleInstruments();
}
```

Update method:

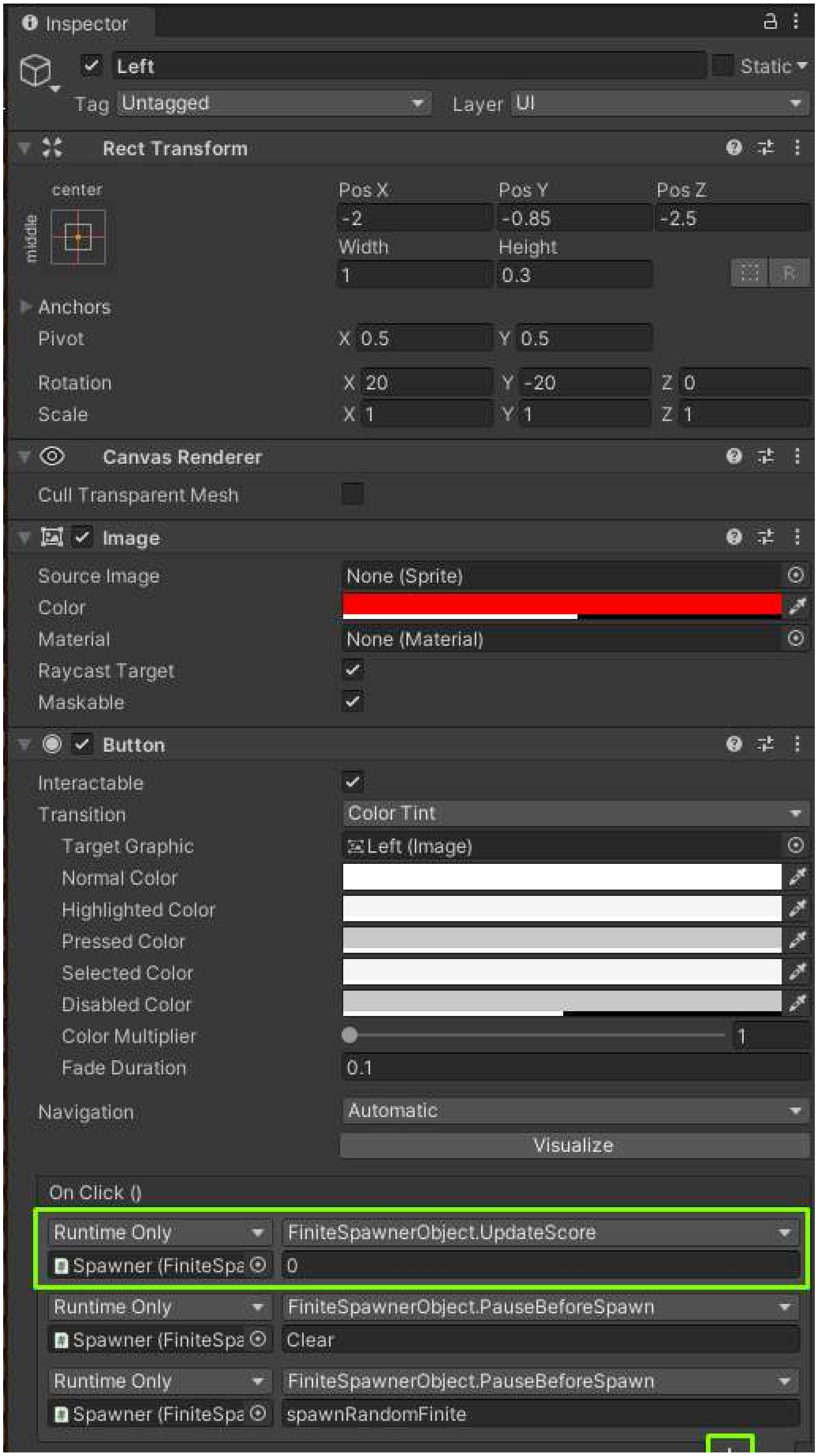
The update method runs every frame of the game so it is the best place to put our timer for playing the correct instruments audio. First we check if a correct instrument is selected, if not we just exit the functions. Assuming a correct instrument is selected, we will check the time remaining. If the time remaining is still greater than Zero then we will subtract the time since the last frame. Once the timeRemaining has fallen below zero then we will reset the timeRemaining to ten seconds and play all the audio sources in the array. We will figure out how to set the audio for each source in a method later in the directions.



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

    // If the correct instrument exists, play its audio every ten seconds
    if (correctInstrument != -1)
    {
        if (timeRemaining > 0.0f) timeRemaining -= Time.deltaTime;
        else
        {
            timeRemaining = 10.0f;
            audioSources[0].Play();
            audioSources[1].Play();
            audioSources[2].Play();
            audioSources[3].Play();
        }
    }
}
```

UpdateScore method:

The UpdateScore method takes in an integer value that contains the value of the selected instrument. We get that value from the value we set on the button in the scene. An image of this is shown below:



Inspector

Left · Static

Tag Untagged · Layer UI

Rect Transform

center / middle

Pos X -2 · Pos Y -0.85 · Pos Z -2.5

Width 1 · Height 0.3

Anchors

Pivot X 0.5 Y 0.5

Rotation X 20 Y -20 Z 0

Scale X 1 Y 1 Z 1

Canvas Renderer

Cull Transparent Mesh

Image

Source Image None (Sprite)

Color 🟥

Material None (Material)

Raycast Target ✓

Maskable ✓

Button

Interactable ✓

Transition Color Tint

Target Graphic Left (Image)

Normal Color

Highlighted Color

Pressed Color

Selected Color

Disabled Color

Color Multiplier 1

Fade Duration 0.1

Navigation Automatic

Visualize

On Click ()

Runtime Only · FiniteSpawnerObject.UpdateScore

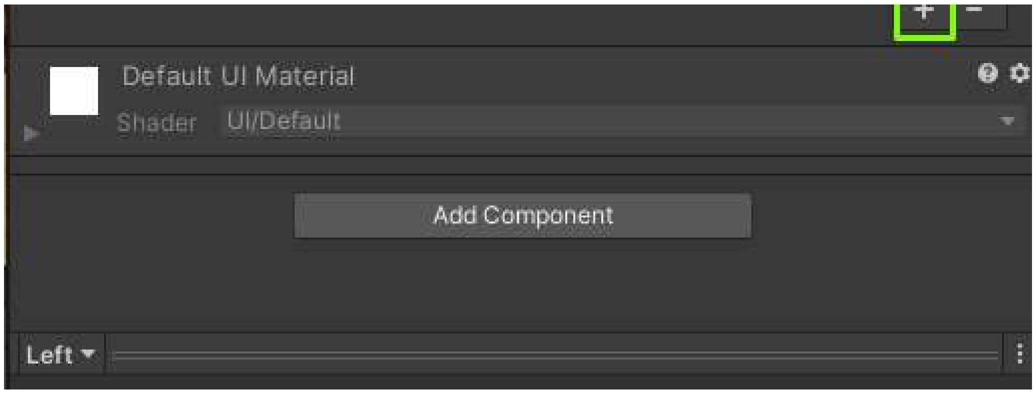
Spawner (FiniteSpa · 0

Runtime Only · FiniteSpawnerObject.PauseBeforeSpawn

Spawner (FiniteSpa · Clear

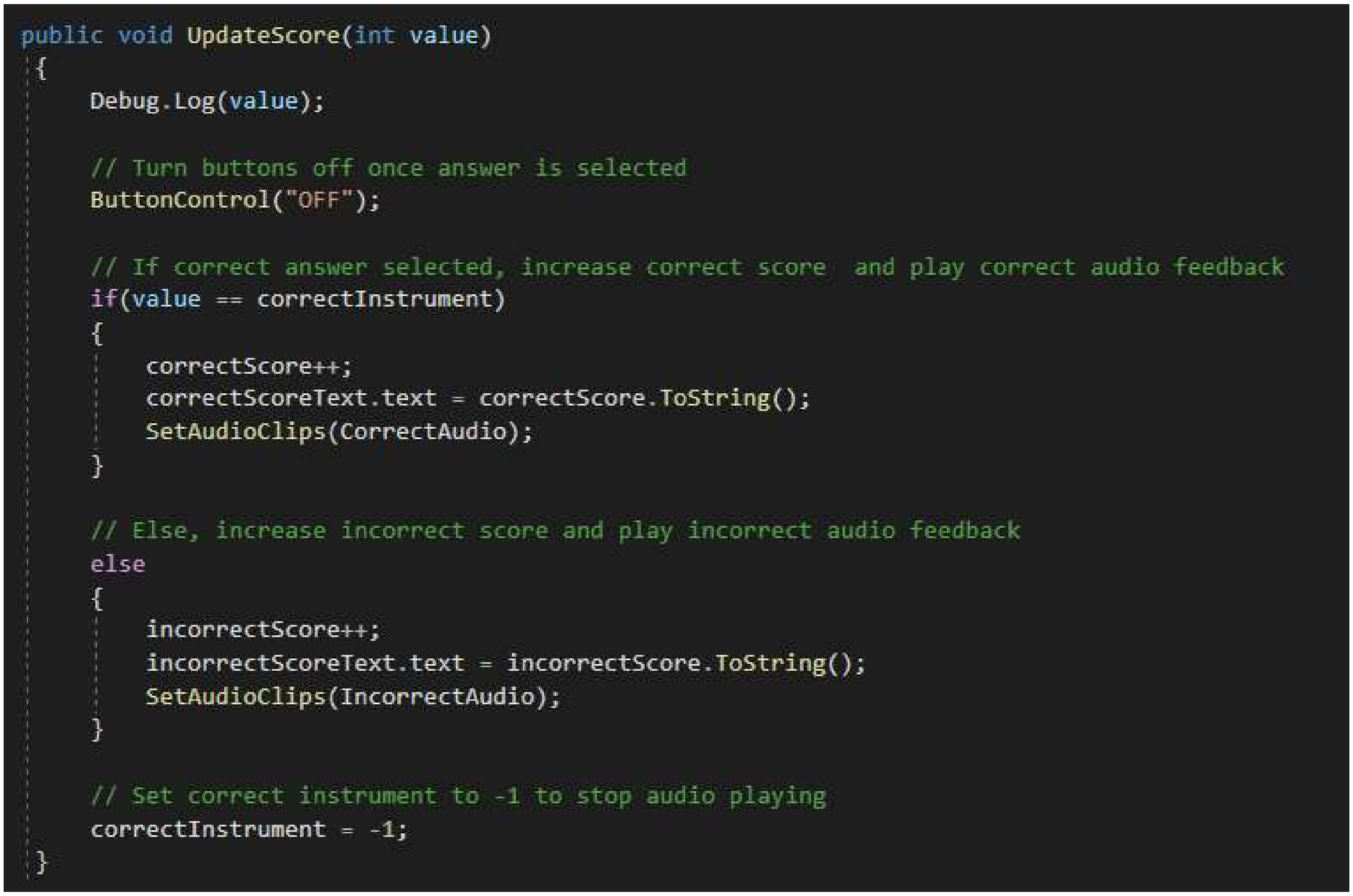
Runtime Only · FiniteSpawnerObject.PauseBeforeSpawn

Spawner (FiniteSpa · spawnRandomFinite



As you can see in the image, for the left button we send the method a 0 to this method if the left button is selected.

So the first thing we do in this method is Debug.Log(value) to see the value that was passed, this allows us as the programmer to see if we are passing the correct value or if a value is being passed at all. Next we will set the ButtonControl to off (Another method we will get to further in the directions) and we will check the value passed in to the value of the correctly selected instrument. If they match then we will increment the correct score, set the correct score text and set the audio clip for each audio source in the scene to the correct audio clip. Otherwise, we will increment the incorrect score, set the incorrect score text and set the Incorrect audio clip. Finally we will set correctInstrument to -1 to signify to the timer that it no longer needs to count down.



```
public void UpdateScore(int value)
 {
     Debug.Log(value);

     // Turn buttons off once answer is selected
     ButtonControl("OFF");

     // If correct answer selected, increase correct score  and play correct audio feedback
     if(value == correctInstrument)
     {
         correctScore++;
         correctScoreText.text = correctScore.ToString();
         SetAudioClips(CorrectAudio);
     }

     // Else, increase incorrect score and play incorrect audio feedback
     else
     {
         incorrectScore++;
         incorrectScoreText.text = incorrectScore.ToString();
         SetAudioClips(IncorrectAudio);
     }

     // Set correct instrument to -1 to stop audio playing
     correctInstrument = -1;
 }
```

SpawnRandomFinite Method:

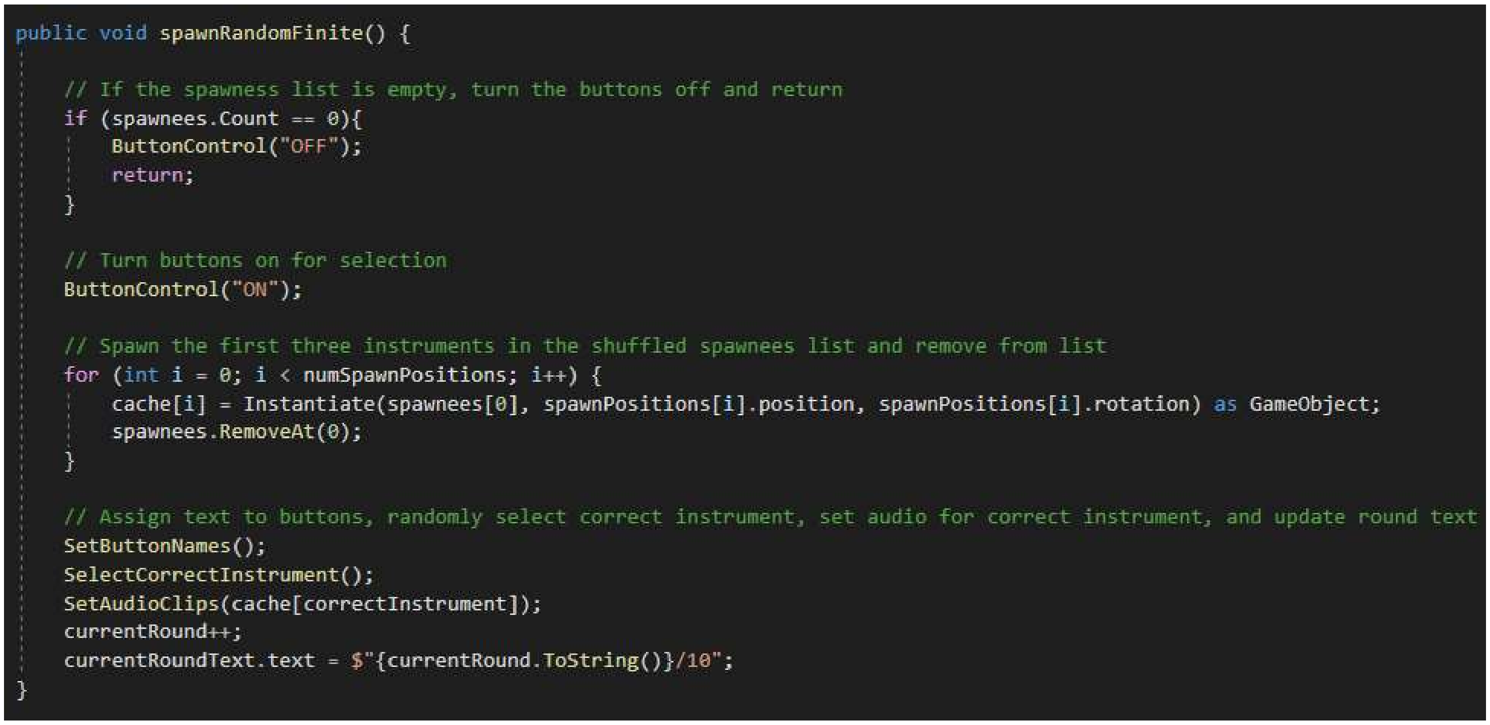
This method will actually spawn the instruments on the stage.

First we need to do a check to make sure the List of instruments is not empty. This is because after each round, the previously used instruments are removed from the List so that they don't show up twice in a game. If the List is empty then we must have reached the end of the game and so we need to turn the ButtonControl off.

Next we make sure that the ButtonControl is on and we loop through each of the spawn positions, setting the instrument in the cache array to an instantiated game object of the instrument first in the List. Then we remove the instrument in the front of the List.

Next we call SetButtonNames() to set the button names correctly, SelectCorrectInstrument() to correctly determine which of the three instruments is going to be the correct answer for this round and finally SetAudioClips(cache[correctInstrument]) passing the correct instrument in order to set the correct audio clip to each of our audio sources in the scene. **Note**: We will get to the aforementioned methods further in the directions.

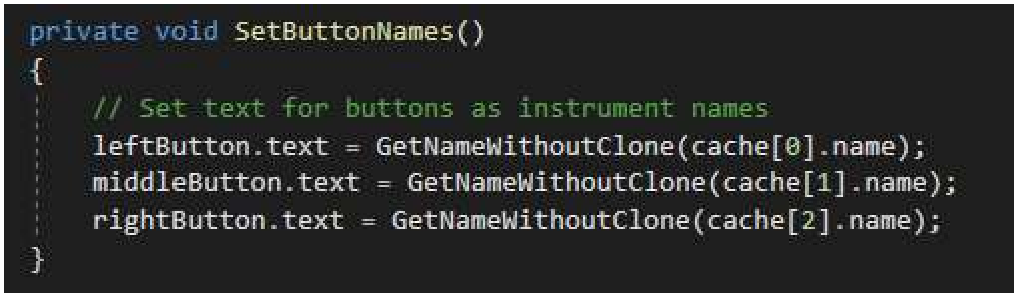
Lastly we increment the current round and set the current round text.



```
public void spawnRandomFinite() {

    // If the spawness list is empty, turn the buttons off and return
    if (spawnees.Count == 0){
        ButtonControl("OFF");
        return;
    }

    // Turn buttons on for selection
    ButtonControl("ON");

    // Spawn the first three instruments in the shuffled spawnees list and remove from list
    for (int i = 0; i < numSpawnPositions; i++) {
        cache[i] = Instantiate(spawnees[0], spawnPositions[i].position, spawnPositions[i].rotation) as GameObject;
        spawnees.RemoveAt(0);
    }

    // Assign text to buttons, randomly select correct instrument, set audio for correct instrument, and update round text
    SetButtonNames();
    SelectCorrectInstrument();
    SetAudioClips(cache[correctInstrument]);
    currentRound++;
    currentRoundText.text = $"{currentRound.ToString()}/10";
}
```

SetButtonNames Method:

Each position on the stage has an instrument spawned in it. We want to set the button text to the name of that instrument and that is what this method does. It sets the text field of each button to the returned value of the GetNameWithoutClone method. (The next method in the directions)



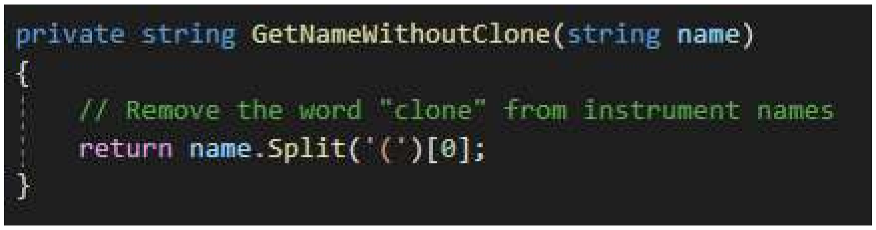
```
private void SetButtonNames()
{
    // Set text for buttons as instrument names
    leftButton.text = GetNameWithoutClone(cache[0].name);
    middleButton.text = GetNameWithoutClone(cache[1].name);
    rightButton.text = GetNameWithoutClone(cache[2].name);
}
```

GetNameWithoutClone Method:

When we instantiate a GameObject in Unity it automatically appends "(Clone)" to the end of the name.

i.e. If we instantiated an object titled "Map" then Unity would name it "Map(Clone)" once instantiated.

So what we do is we split the string by the '(' character and take the beginning part of the string, giving us just the name of the object we spawned.



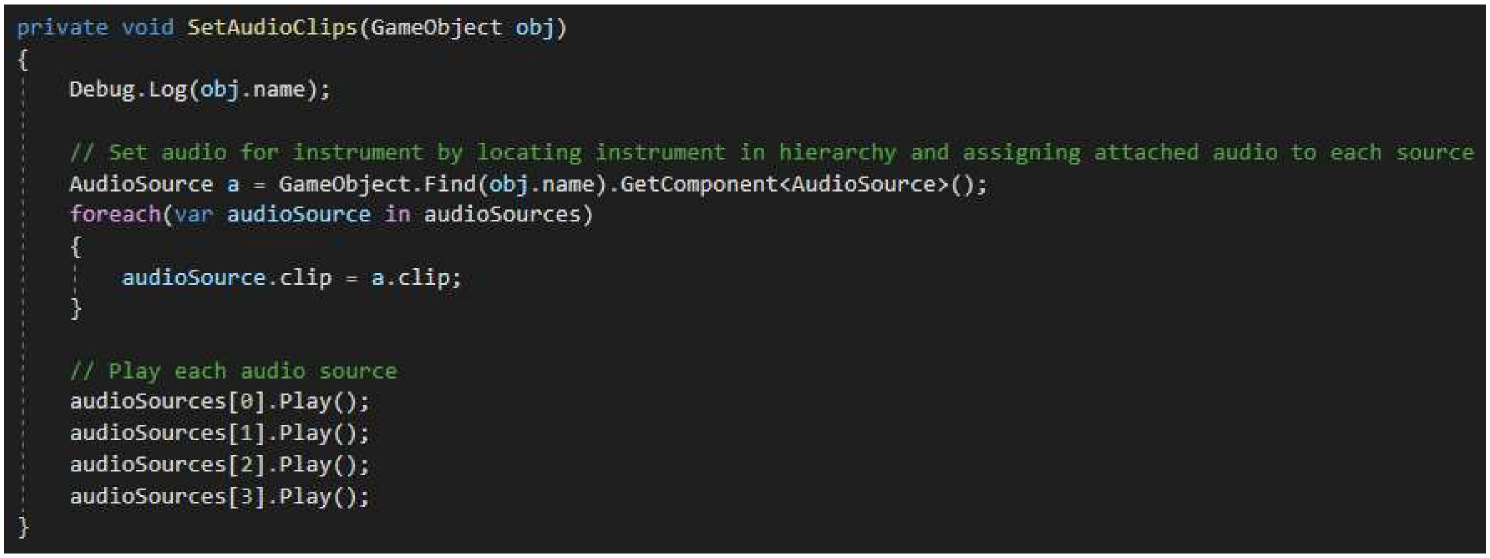
```
private string GetNameWithoutClone(string name)
{
    // Remove the word "clone" from instrument names
    return name.Split('(')[0];
}
```

SetAudioClips Method:

This method will set the audio clip of all the audio source objects in our scene.

First we want to do another Debug.Log(obj.name) to see that the correct instrument is being sent to set the audio sources.

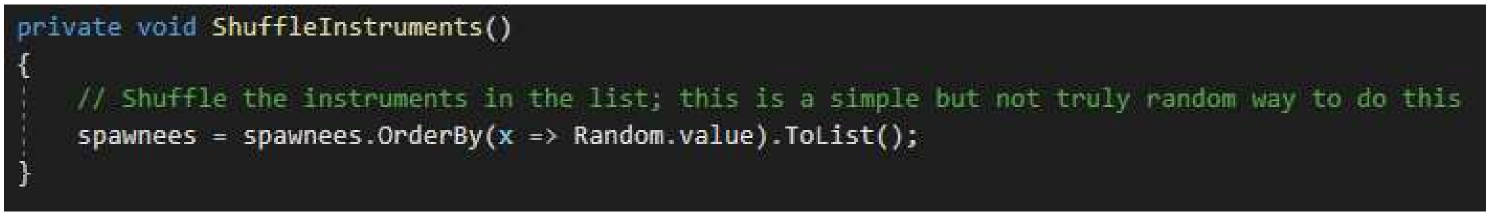
Next we grab the audio clip attached to the instrument object passed to the method. Then we loop through each of the audio sources in our array and set the audio clip. Finally we play the audio clip once for each audio source.


```
private void SetAudioClips(GameObject obj)
{
    Debug.Log(obj.name);

    // Set audio for instrument by locating instrument in hierarchy and assigning attached audio to each source
    AudioSource a = GameObject.Find(obj.name).GetComponent<AudioSource>();
    foreach(var audioSource in audioSources)
    {
        audioSource.clip = a.clip;
    }

    // Play each audio source
    audioSources[0].Play();
    audioSources[1].Play();
    audioSources[2].Play();
    audioSources[3].Play();
}
```

ShuffleInstruments

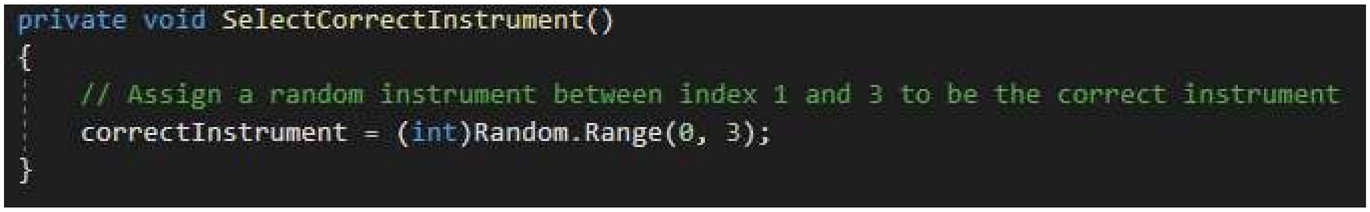
This method will use C#'s LINQ library to re-arrange the List of instruments in a random way to make the game less repetitive.

We Order the List by a random seed and re-cast the value to a List.


```
private void ShuffleInstruments()
{
    // Shuffle the instruments in the list; this is a simple but not truly random way to do this
    spawnees = spawnees.OrderBy(x => Random.value).ToList();
}
```

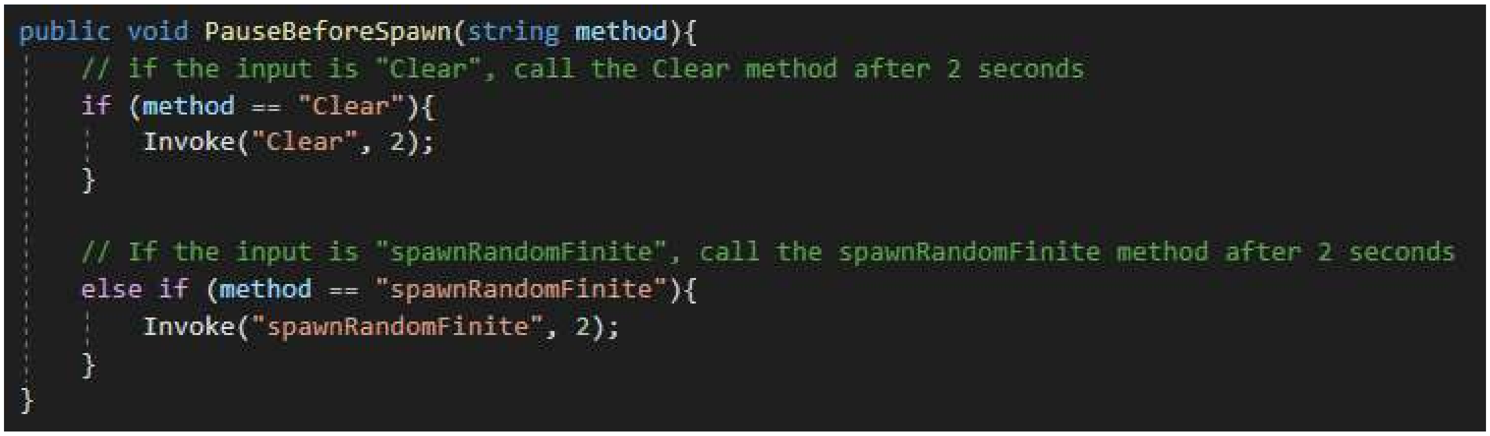
SelectCorrectInstrument Method:

This method will select a random integer between 0 and 3 exclusive and set it to the correctInstrument variable.


```
private void SelectCorrectInstrument()
{
    // Assign a random instrument between index 1 and 3 to be the correct instrument
    correctInstrument = (int)Random.Range(0, 3);
}
```

PauseBeforeSpawn Method:

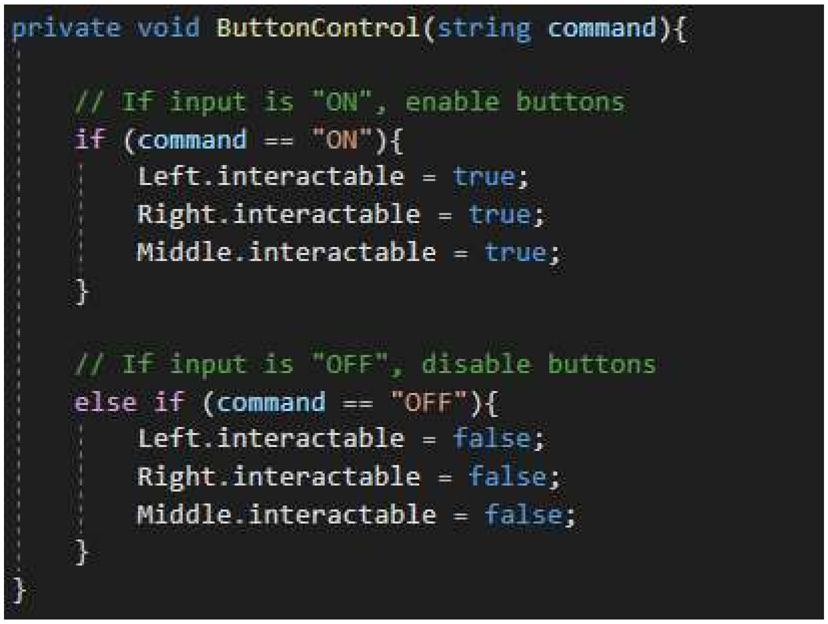
This method determines the correct method to call with the correct delay after each round. If we pass "Clear" it will clear all the data from the scene, If we pass "spawnRandomFinite" Then it will spawn another round for the game. Each method we use a delay of two seconds.



```
public void PauseBeforeSpawn(string method){
    // if the input is "Clear", call the Clear method after 2 seconds
    if (method == "Clear"){
        Invoke("Clear", 2);
    }

    // If the input is "spawnRandomFinite", call the spawnRandomFinite method after 2 seconds
    else if (method == "spawnRandomFinite"){
        Invoke("spawnRandomFinite", 2);
    }
}
```

ButtonControl Method:

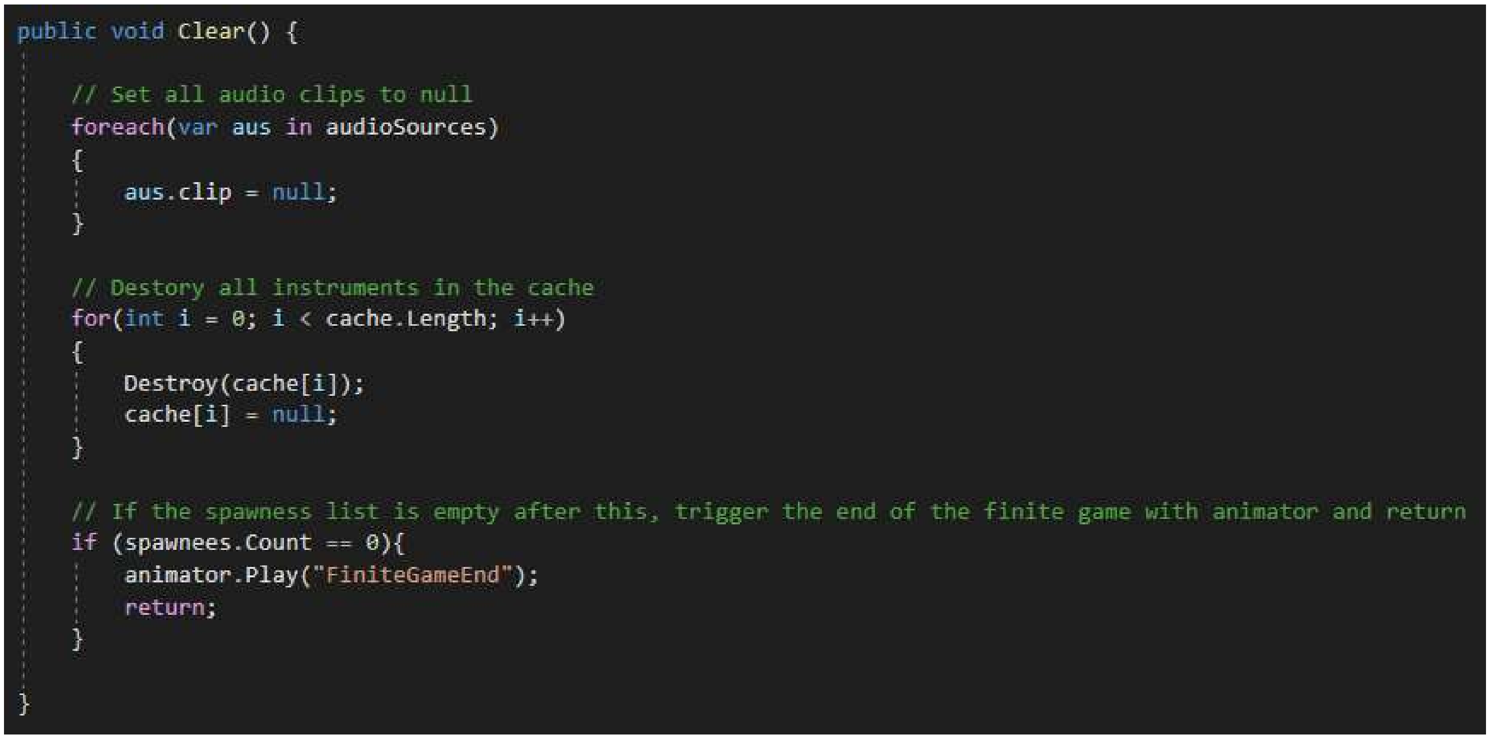
This method will set the interactable value of each button to either treu or false if we send the commands "ON" or "OFF" respectively.



```
private void ButtonControl(string command){

    // If input is "ON", enable buttons
    if (command == "ON"){
        Left.interactable = true;
        Right.interactable = true;
        Middle.interactable = true;
    }

    // If input is "OFF", disable buttons
    else if (command == "OFF"){
        Left.interactable = false;
        Right.interactable = false;
        Middle.interactable = false;
    }
}
```

Clear Method:

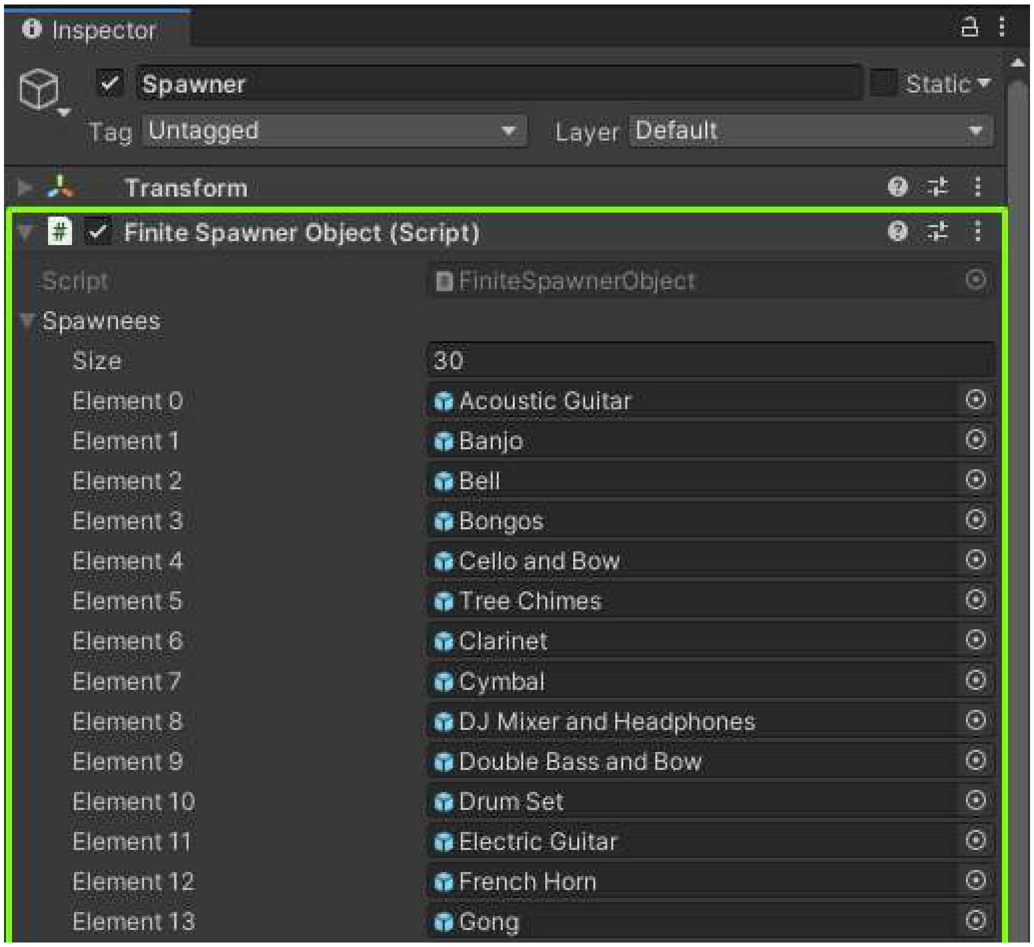
This method clears out the values from the the scene. First we loop through all the audio sources and set the audio clip for each to null. Then we loop through all the cache objects, destroy them and set them to null. Finally we check that the List of instruments is zero and if it is we play the FiniteGameEnd animation.



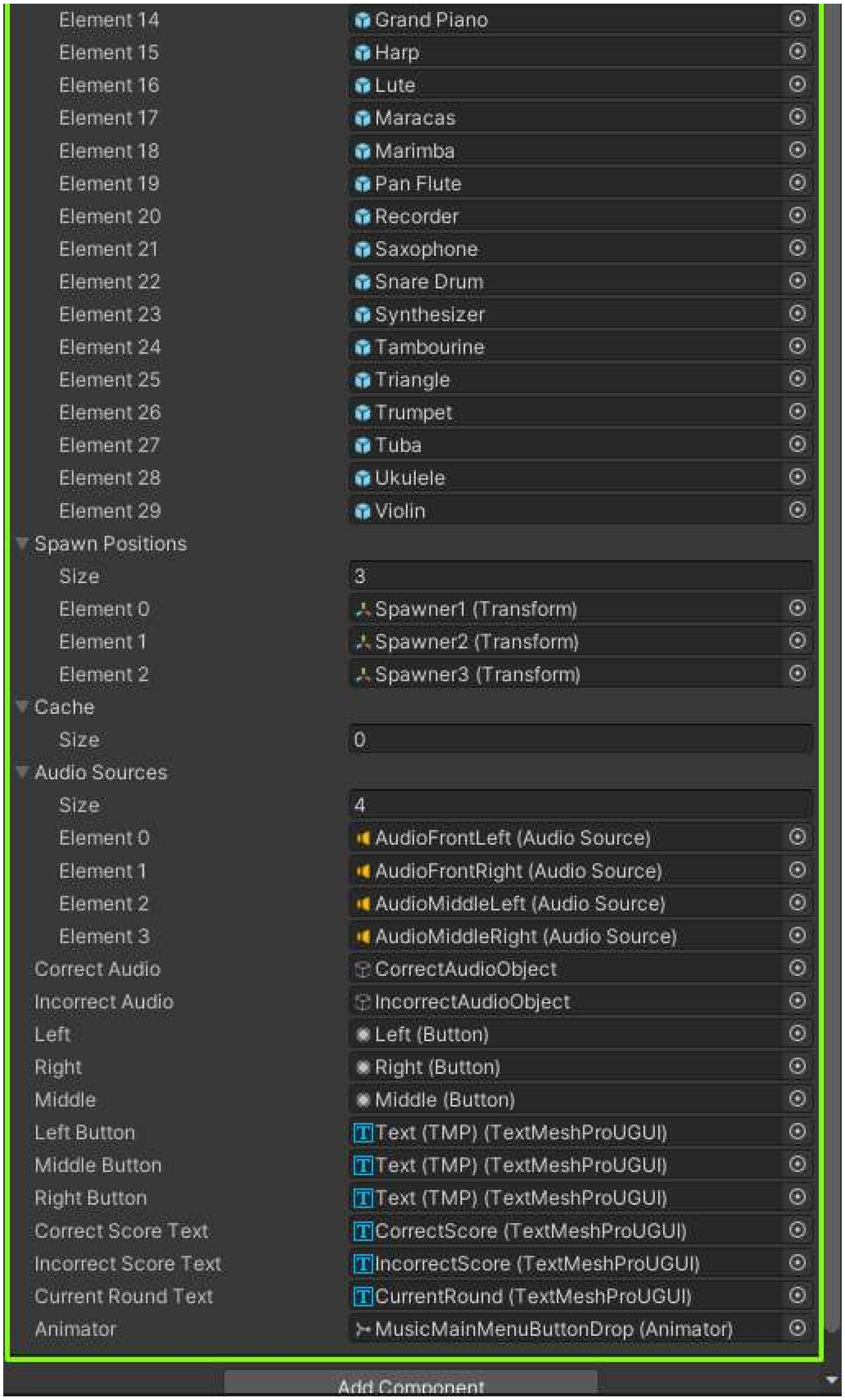
```
public void Clear() {

    // Set all audio clips to null
    foreach(var aus in audioSources)
    {
        aus.clip = null;
    }

    // Destory all instruments in the cache
    for(int i = 0; i < cache.Length; i++)
    {
        Destroy(cache[i]);
        cache[i] = null;
    }

    // If the spawness list is empty after this, trigger the end of the finite game with animator and return
    if (spawnees.Count == 0){
        animator.Play("FiniteGameEnd");
        return;
    }

}
```

Attaching the script to our Main_Spawner Object:

Finally the last step is to attach the script to the Main_Spawner game object we created and click and drag all of our GameObjects from our scene to the script. The Main_Spawner script should look like such:



Script	FiniteSpawnerObject
Spawnees	
Size	30
Element 0	Acoustic Guitar
Element 1	Banjo
Element 2	Bell
Element 3	Bongos
Element 4	Cello and Bow
Element 5	Tree Chimes
Element 6	Clarinet
Element 7	Cymbal
Element 8	DJ Mixer and Headphones
Element 9	Double Bass and Bow
Element 10	Drum Set
Element 11	Electric Guitar
Element 12	French Horn
Element 13	Gong



Element 14	Grand Piano
Element 15	Harp
Element 16	Lute
Element 17	Maracas
Element 18	Marimba
Element 19	Pan Flute
Element 20	Recorder
Element 21	Saxophone
Element 22	Snare Drum
Element 23	Synthesizer
Element 24	Tambourine
Element 25	Triangle
Element 26	Trumpet
Element 27	Tuba
Element 28	Ukulele
Element 29	Violin
Spawn Positions	
Size	3
Element 0	Spawner1 (Transform)
Element 1	Spawner2 (Transform)
Element 2	Spawner3 (Transform)
Cache	
Size	0
Audio Sources	
Size	4
Element 0	AudioFrontLeft (Audio Source)
Element 1	AudioFrontRight (Audio Source)
Element 2	AudioMiddleLeft (Audio Source)
Element 3	AudioMiddleRight (Audio Source)
Correct Audio	CorrectAudioObject
Incorrect Audio	IncorrectAudioObject
Left	Left (Button)
Right	Right (Button)
Middle	Middle (Button)
Left Button	Text (TMP) (TextMeshProUGUI)
Middle Button	Text (TMP) (TextMeshProUGUI)
Right Button	Text (TMP) (TextMeshProUGUI)
Correct Score Text	CorrectScore (TextMeshProUGUI)
Incorrect Score Text	IncorrectScore (TextMeshProUGUI)
Current Round Text	CurrentRound (TextMeshProUGUI)
Animator	MusicMainMenuButtonDrop (Animator)

In order to fill the List of Spawnees we just drag and drop all the Instrument prefabs to into each element slot of the script.

Finish

Once you have populated the parts of the script that are necessary then you should be able to run the game and see the finite mode running, counting each correct, incorrect and round the player plays.