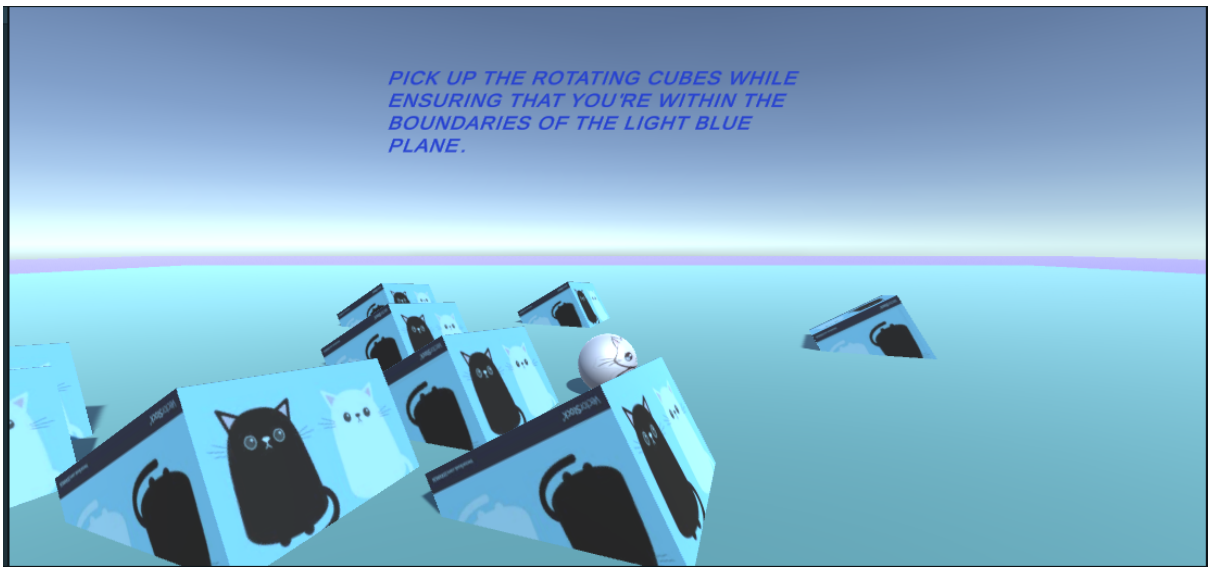

Interactive Physics Scene

Overview

The interactive Physics scene displayed above is a modified version of Unity's Roll-a-ball tutorial that demonstrates how to create a third person camera, move an object using forces and display a text score based on the player's collisions with collectable objects, also referred to as pickups [1].

The modifications made in contrast to the tutorial include: placing a smaller plane over a larger one to indicate a boundary, adding a *BoundaryManager* script as opposed to several walls to stop the player from moving outside of the smaller plane's coordinates, spawning the two cat textured cubes programmatically and making the inputs less restrained by applying impulse to the forces used on the player object across various directions [2]. Other modifications include changes to the game over text in terms of its implementation to ensure that it is modified in accordance with the player's behaviour.

Extension

The extension applied to this scene is a game mechanism that allows the player, represented by a white cat textured sphere, to move around the scene within the boundary that is represented by the smaller plane: the transform vector for that plane has been scaled to be 10, 10, 10 across its x, y and z coordinates. Additionally, the larger plane has been given a *RigidBody* component that is kinematic in order to avoid the player from falling through the floor [3]. In order to enable collision with the collectables, tags are used to distinguish the pickups from the player object and a *BoxCollider* has been added with the trigger function enabled [4].

Tags are also used for the *BoundaryManager* script that destroys the player object once it has reached the specified boundary. The player collects points by colliding with the pickups, which are represented by the cubes that use an image of two cats as a material. The game score is updated whenever such a collision has occurred. Moreover, when the player moves outside of the boundaries of the smaller plane's coordinates, a game over text appears.

Game Objects Acting under Physics

Unity enables an object to obey the laws of physics by using the *RigidBody* component that is attached to it. A *RigidBody* allows a body to collide with other objects and be pulled downwards by gravity [3]. For this scene, a rigid body component has been added to the *Inspector*, while the *PlayerController* script handles the player's movements and collisions with the pickups.

The sphere bounces using Unity's input system, and – given that the original Unity tutorial was outdated, the following script was used as a starting point to get the player moving [5]. The horizontal and vertical inputs are mapped into a *movement* vector as x and y coordinates. Using the sphere's rigid body, a force is applied to it, along with a given *speed* – a float of 5.0 – to make the player move at a quick pace. Lastly, a function called *ApplyForce* is called, which applies more force to the sphere depending on the provided user input.

In the *ApplyForce* function, using a variable called *appliedForce*, a new vector is created that is then added as a force to the rigid body component; however, this time around, impulse [2] is applied to the force that enables the object to move further [4]. This makes for more sudden / abrupt movements in the scene. The options for the player are to move up, down, right and left: these movements are handled by a *MoveSphere* script.

References

[1] https://learn.unity.com/project/roll-a-ball
[2] https://www.physicsclassroom.com/class/momentum/Lesson-1/Momentum-and-Impulse-Connection
[3] https://docs.unity3d.com/ScriptReference/Rigidbody.html
[4] https://docs.unity3d.com/Manual/class-BoxCollider.html
[5] https://gist.github.com/brismithSFHS/8dd4439b3857066665d3e69c5a3b5fac
[4] https://gamedevbeginner.com/how-to-move-objects-in-unity/#move_with_physics
[5]https://answers.unity.com/questions/1623695/how-to-make-multiple-objects-spawn-at-random-order.html