IGD301
MR & HCI

VR in Unity + selection

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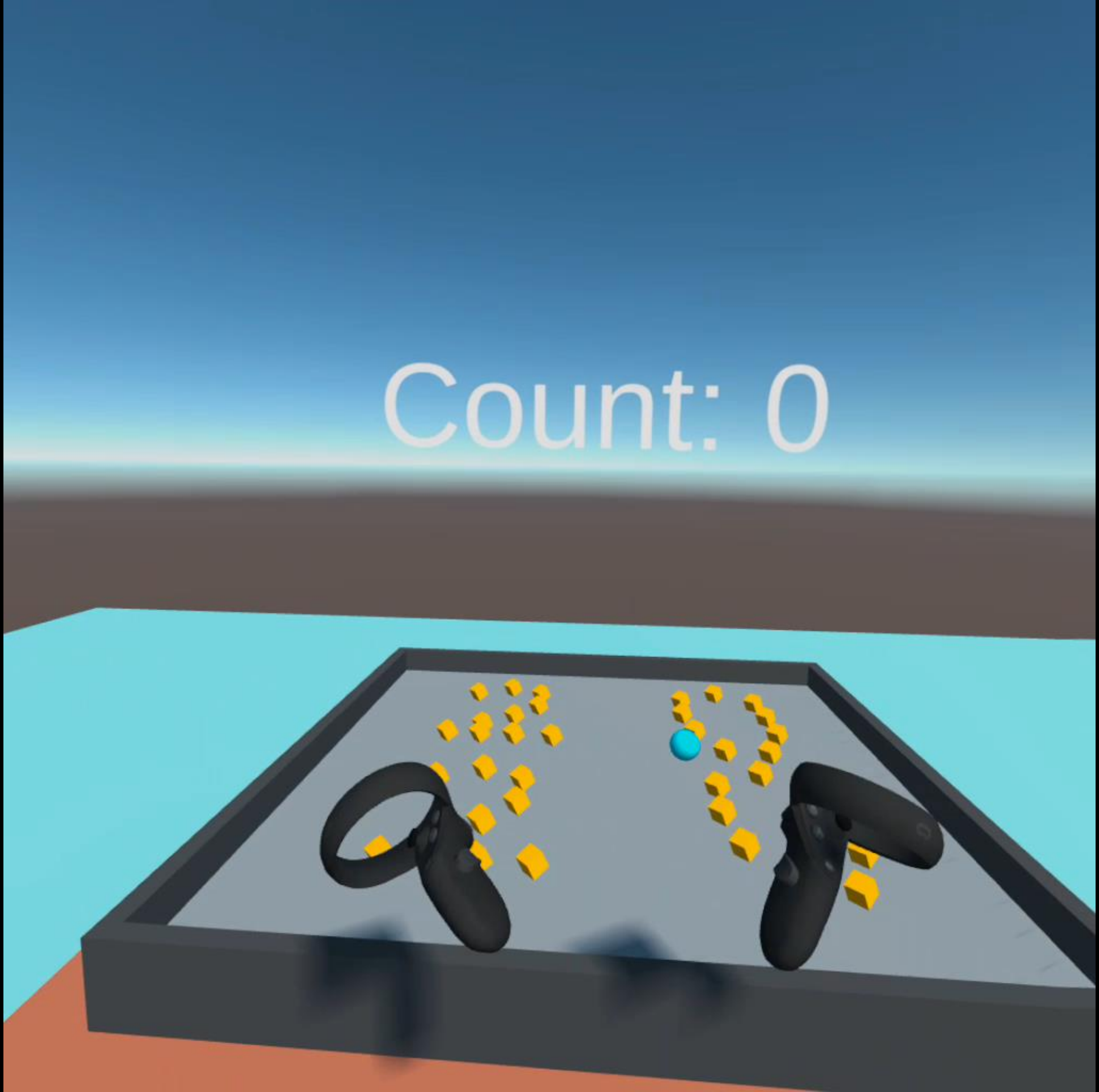
Labs

19.11	~~Website setup (hugo)~~
26.11	~~Introduction to Unity (roll-a-ball)~~
03.12	VR in Unity + selection
10.12	locomotion + VR parkour
17.12	idea pitching
(holidays)	
2021	TBA

today’s topics

I. setup VR in Unity
II. roll-a-ball + selection in VR


Count: 0

I. setup VR in Unity

tracking

…in our perspective, computers are

PC

smartphone

VR Head-Mounted Display (HMD)

…in their perspectives, humans are

PC

mouse cursor and **keystrokes**

smartphone

touch points

VR HMD

points (body parts) in a 3D space

…in their perspectives, humans are…

PC

mouse cursor and **keystrokes**

smartphone

touch points

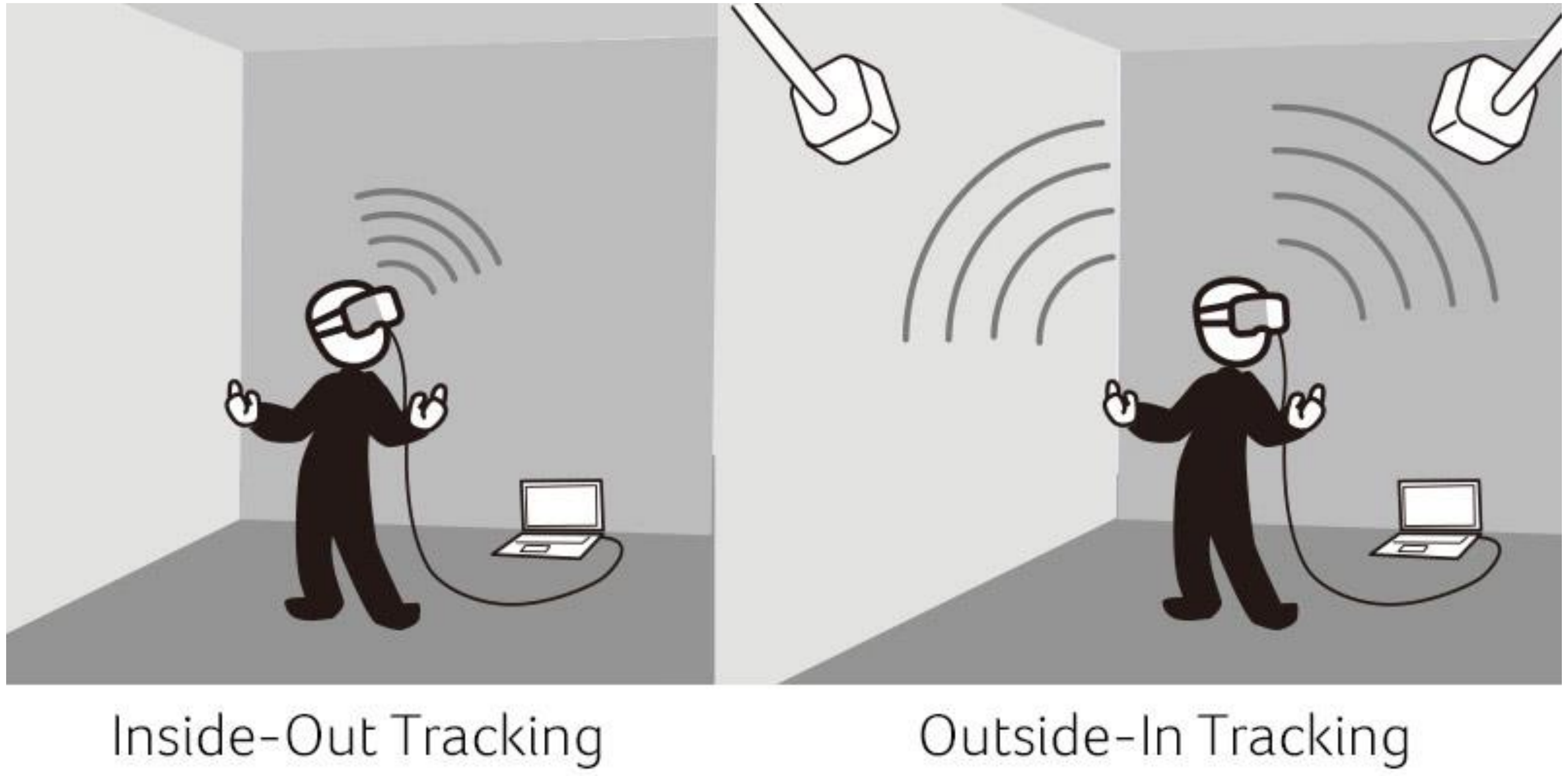
VR HMD

points (body parts) in the 3D space

In VR, computers have to understand the position and motions of users in the space.
Therefore, we need to **track** the user.

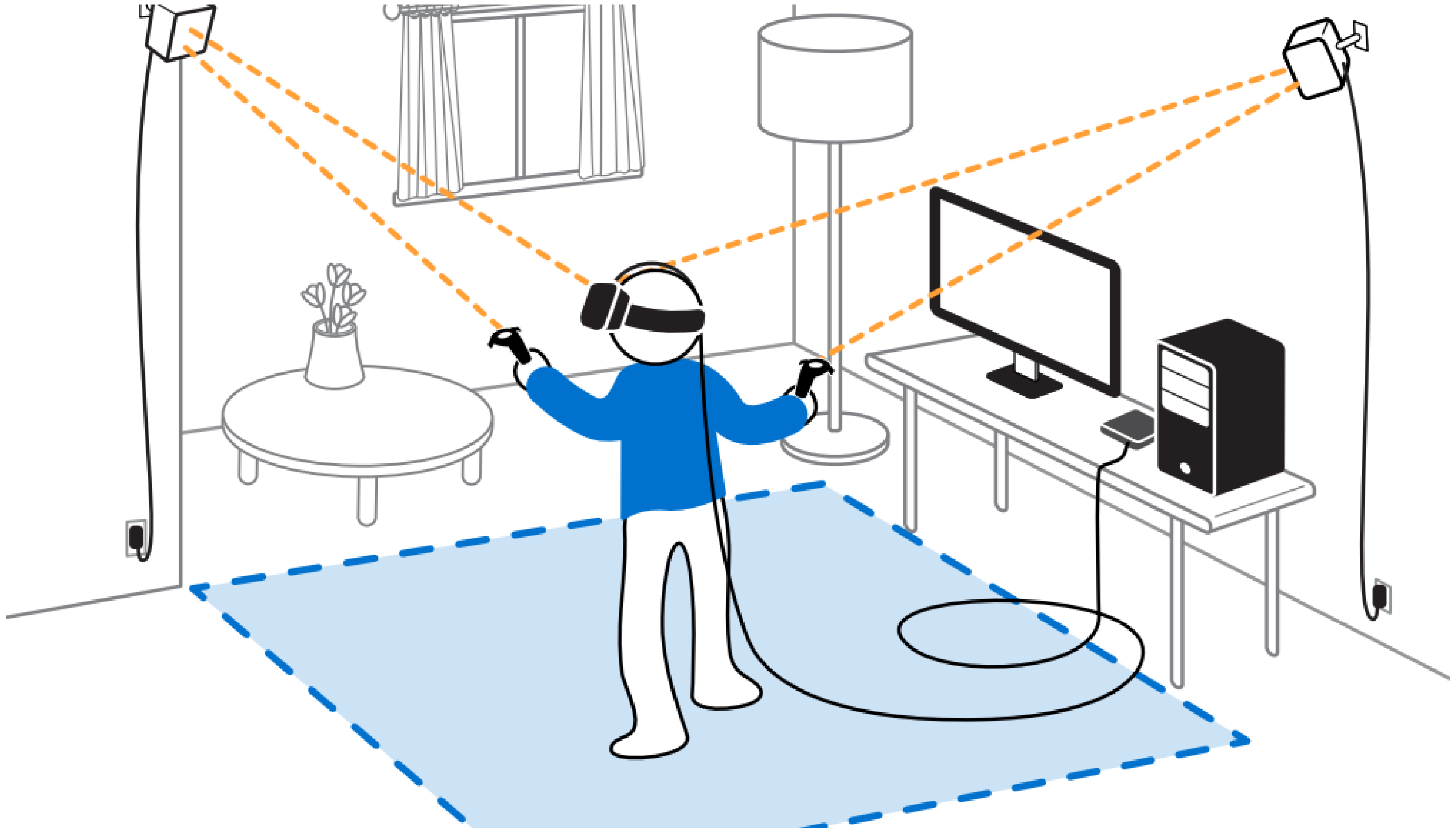
https://static.acer.com/up/Resource/Acer/Wearable/WMR/Design/Hotspot/20170922/Inside-Out%20Tracking.jpg

Tracking



https://forums.tomsguide.com/faq/how-to-set-up-your-vive-base-stations-for-cabled-sync.111306/ddd

Outside-In: HTC Vive Pro



https://hitmotion.games/oculus-quest-mixed-reality/

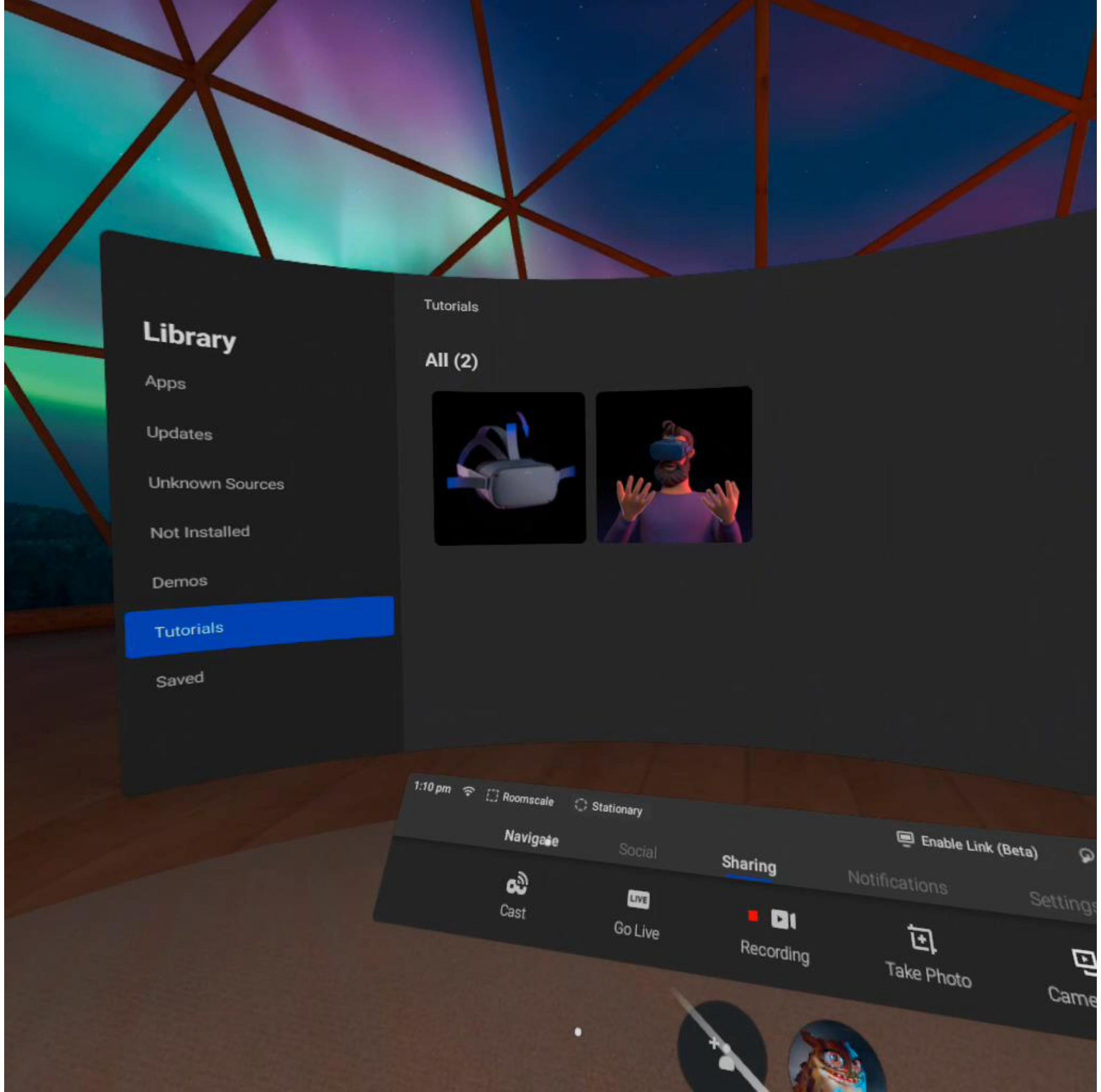
Inside-Out: Oculus Quest

setup HMDs

Quest (FYI)

- Room or stationary boundary
- Upload .apk
  - Enable developer mode on your Quest
  - Using SideQuest
- Editor debugging: Enable Oculus Link (windows only, Install OculusSetup)
- Enable hand tracking

start with two tutorials in HMD



Library

Apps

Updates

Unknown Sources

Not Installed

Demos

Tutorials

Saved

Tutorials

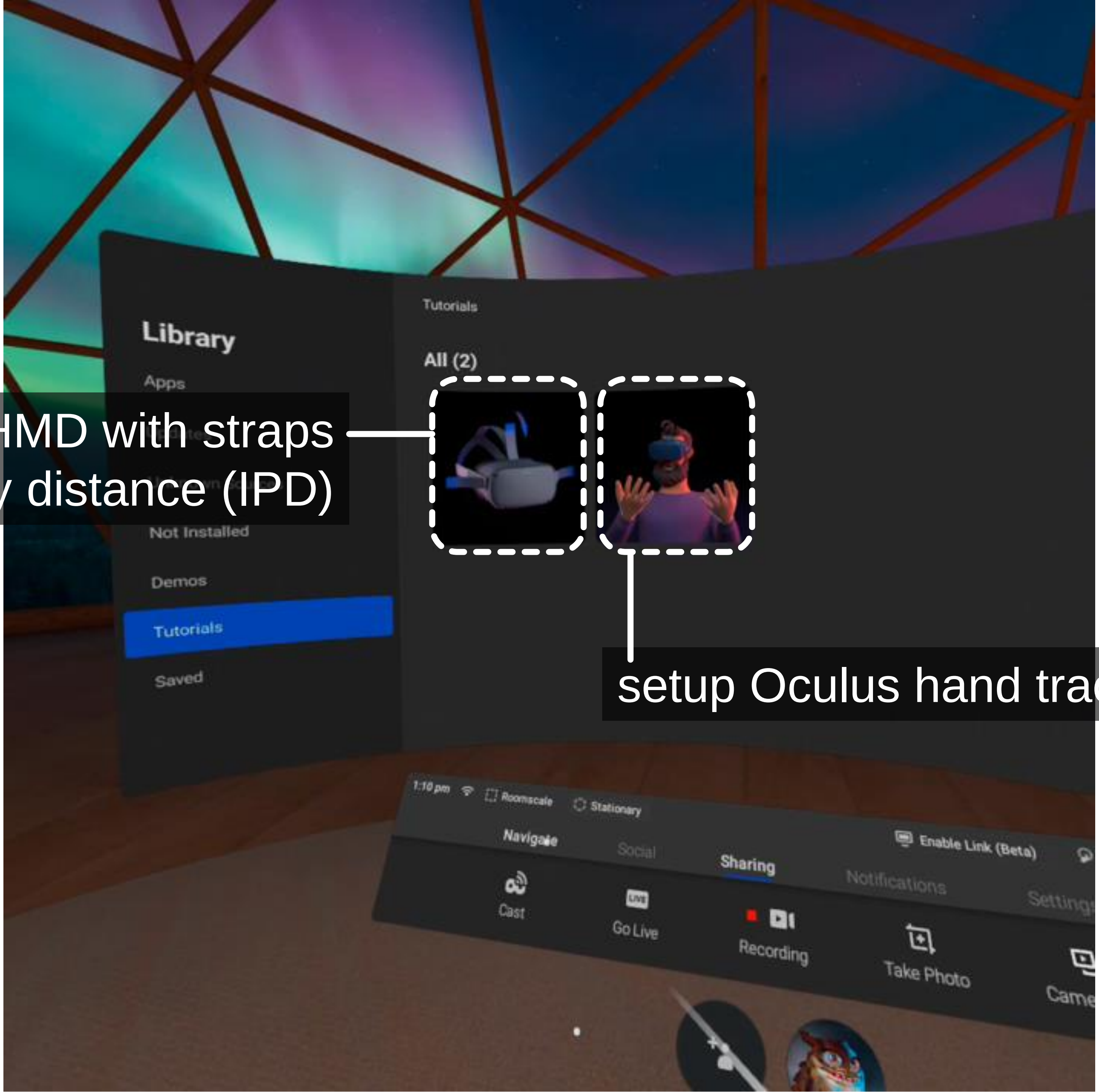
All (2)

1:10 pm Roomscale Stationary

Navigate Social Sharing Notifications Settings

Enable Link (Beta)

Cast Go Live Recording Take Photo



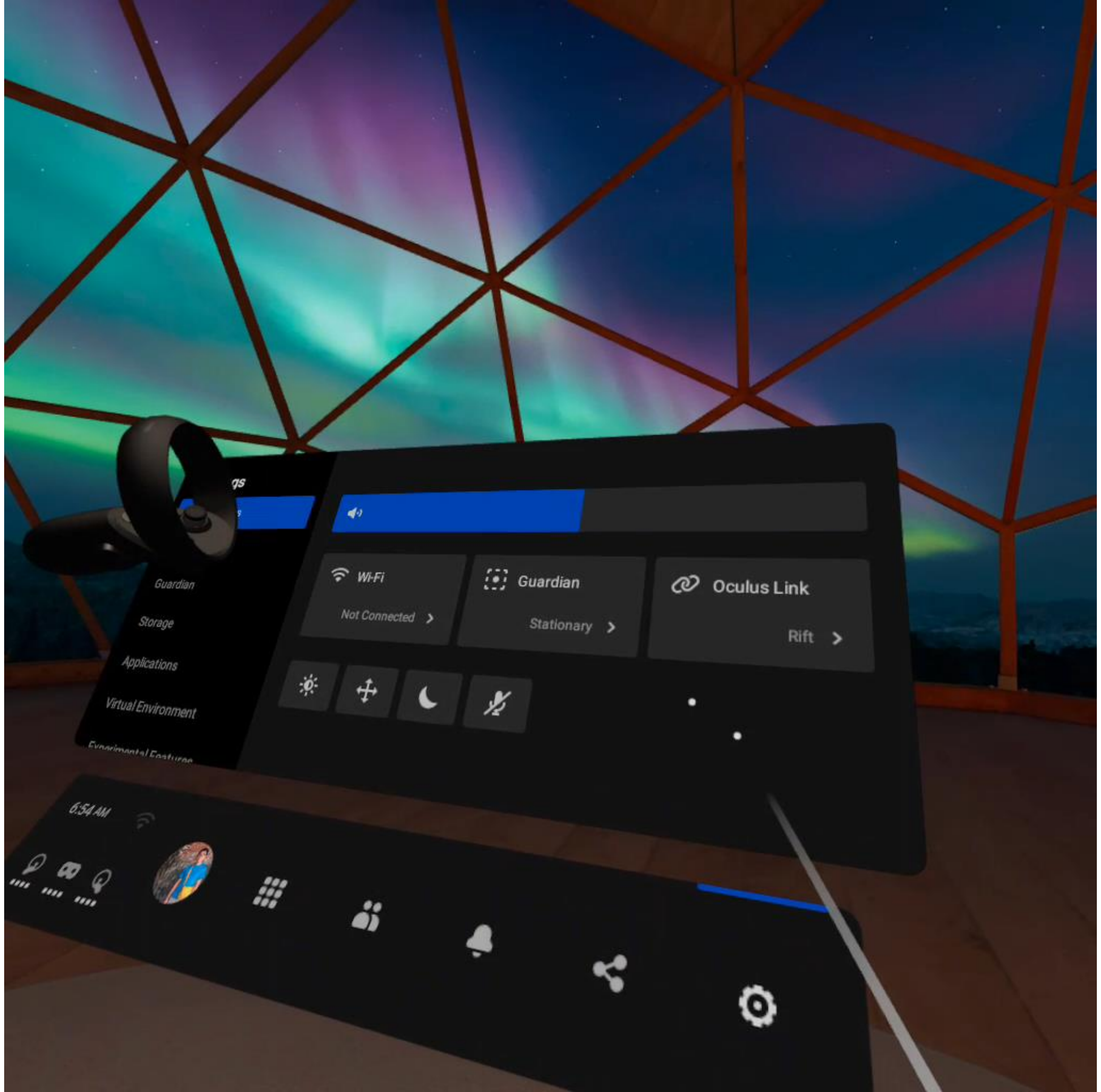
setup HMD with straps
adjust interpupillary distance (IPD)

setup Oculus hand tracking

Oculus Link requirement

- Quest can work as a Rift (stationary setup)
- VR ready machine: see compatibility
- Cable: USB 3 C to C / USB A to C (Anker)
- Software: Install OculusSetup, update to the latest version (> 1.43)
- Quest: update to the latest version (> 11.00)

Enable Oculus Link



setup unity

VR APIs in Unity

Oculus Integration
link

Unity XR Input
link

VRTK 4
link

- develop with the original code from oculus
- the latest feature included (e.g., hand tracking)

- a wrapper so that you don’t need to touch oculus code
- not always have the latest feature

VR APIs in Unity

Oculus Integration
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- the latest feature included (e.g., hand tracking)

Unity XR Input
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VRTK 4
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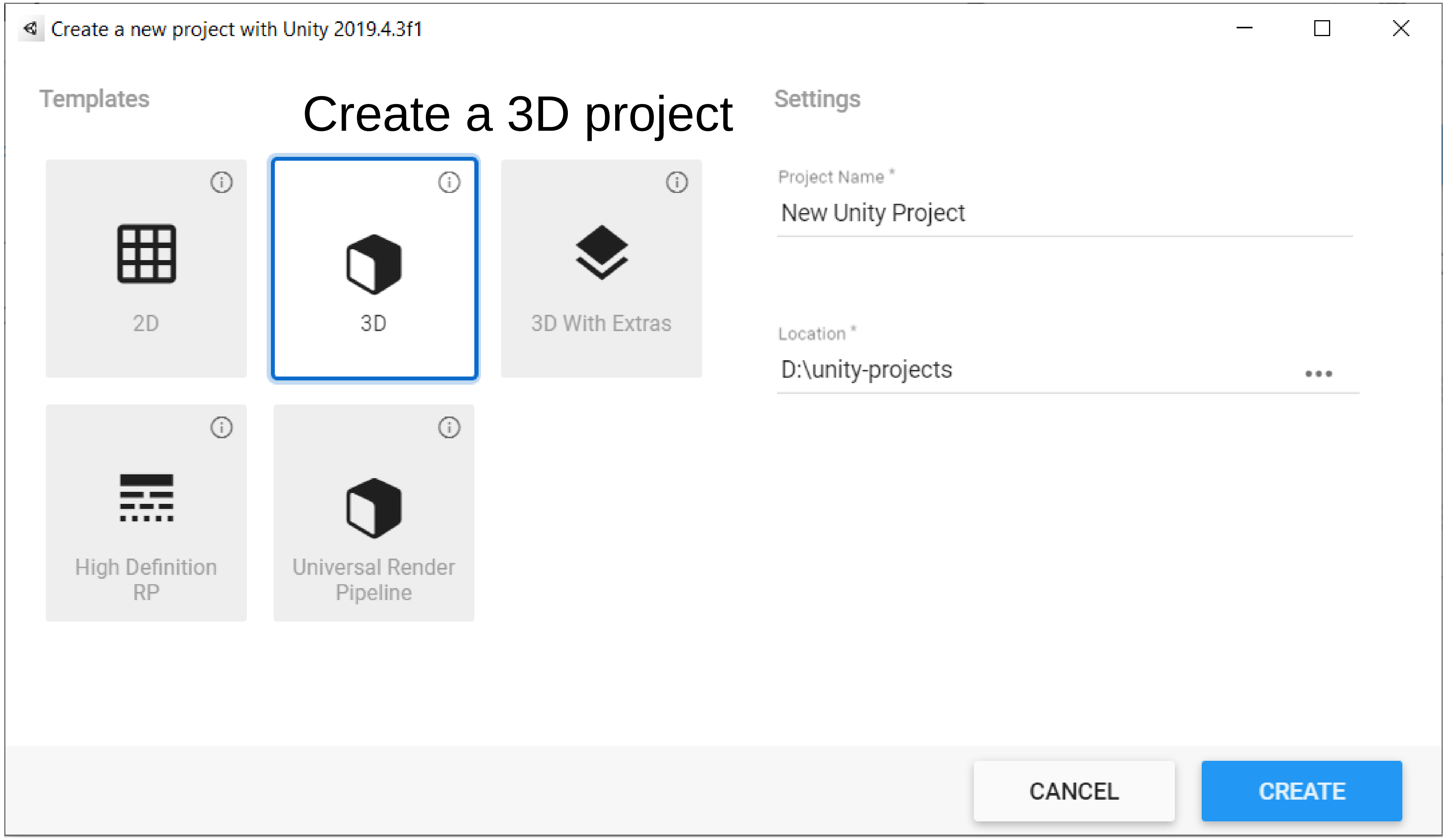
- not always have the latest feature

Create a new project



Create a new project with Unity 2019.4.3f1

Create a 3D project

Templates

- 2D
- 3D
- 3D With Extras
- High Definition RP
- Universal Render Pipeline

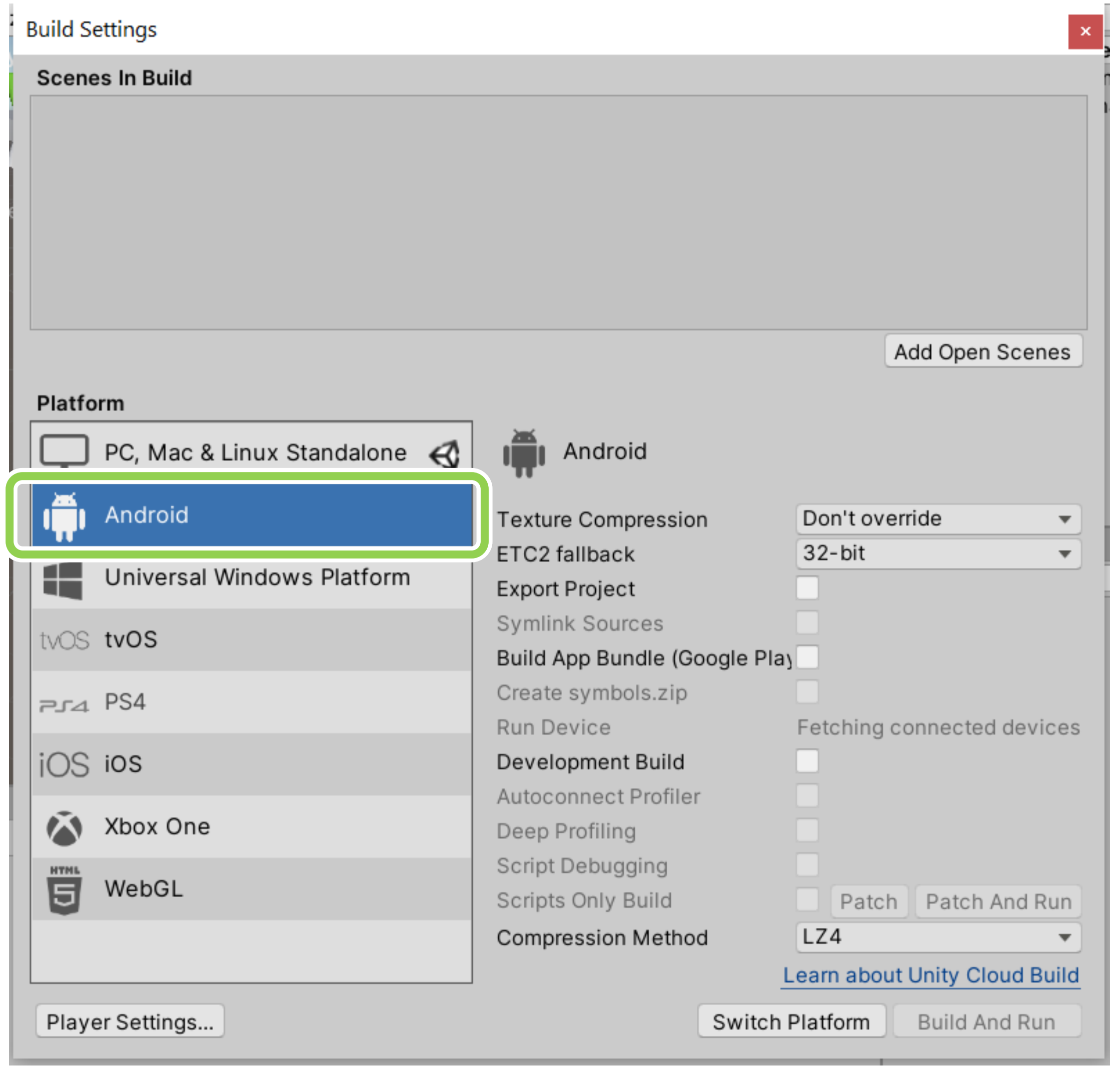
Settings

Project Name *
New Unity Project

Location *
D:\unity-projects

Build platform for Quest

- File > Build settings > select Android
- Switch Platform



Build Settings

Scenes In Build

Add Open Scenes

Platform

PC, Mac & Linux Standalone
Android
Universal Windows Platform
tvOS
PS4
iOS
Xbox One
WebGL

Android

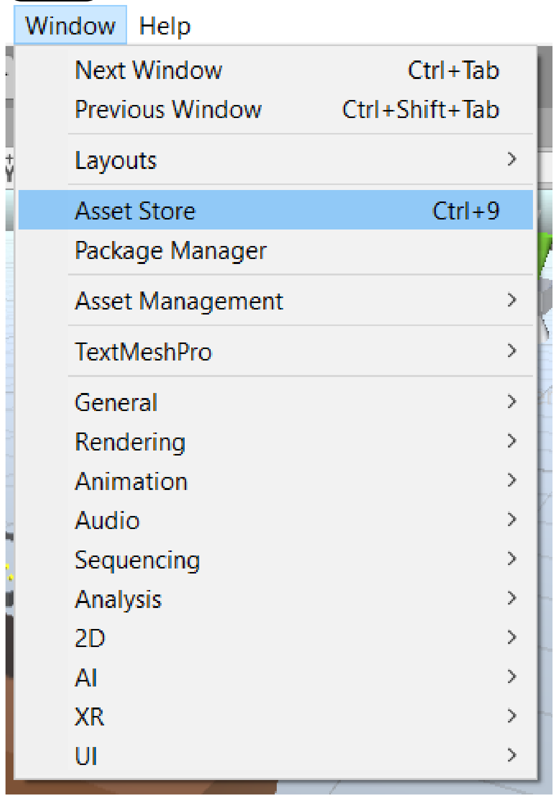
Texture Compression: Don't override
ETC2 fallback: 32-bit
Export Project
Symlink Sources
Build App Bundle (Google Play
Create symbols.zip
Run Device: Fetching connected devices
Development Build
Autoconnect Profiler
Deep Profiling
Script Debugging
Scripts Only Build — Patch — Patch And Run
Compression Method: LZ4

Learn about Unity Cloud Build

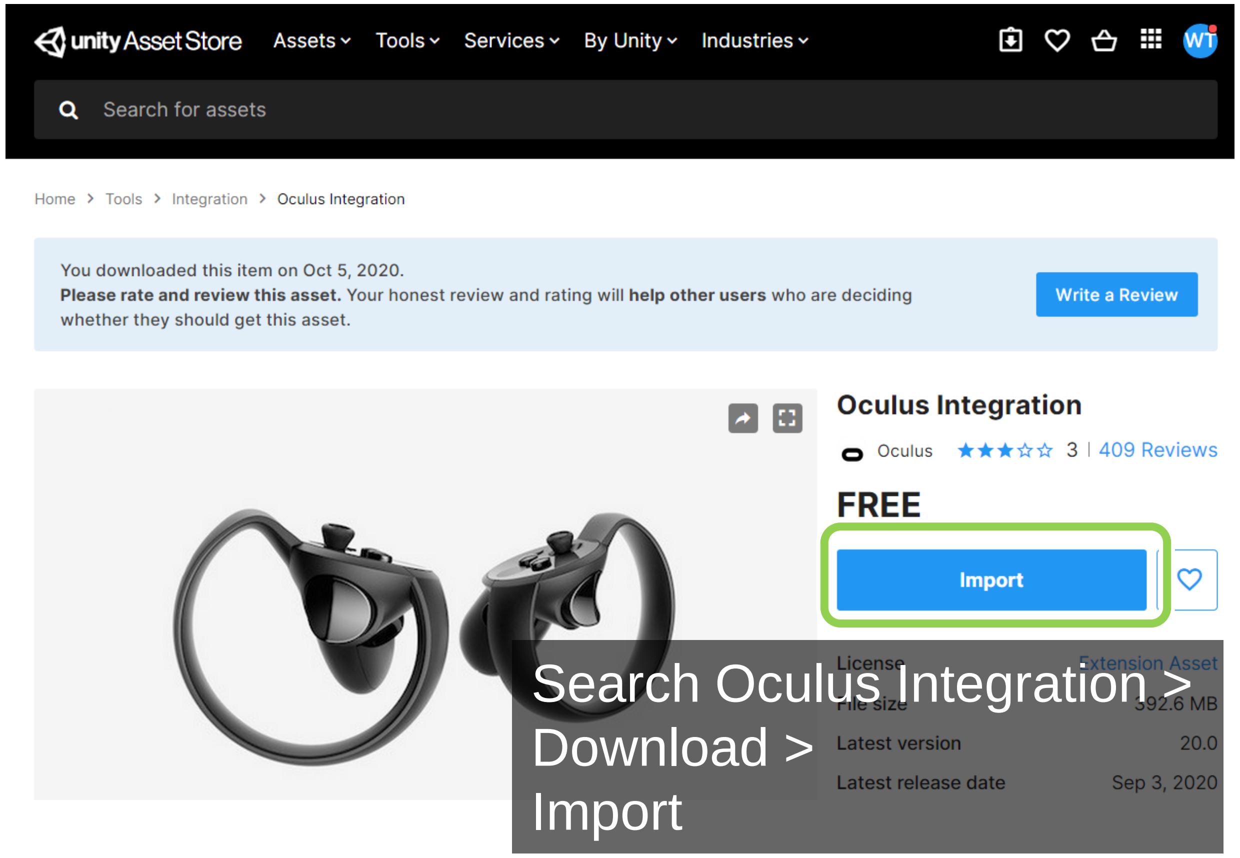
Player Settings... Switch Platform Build And Run

Import Oculus Integration

1



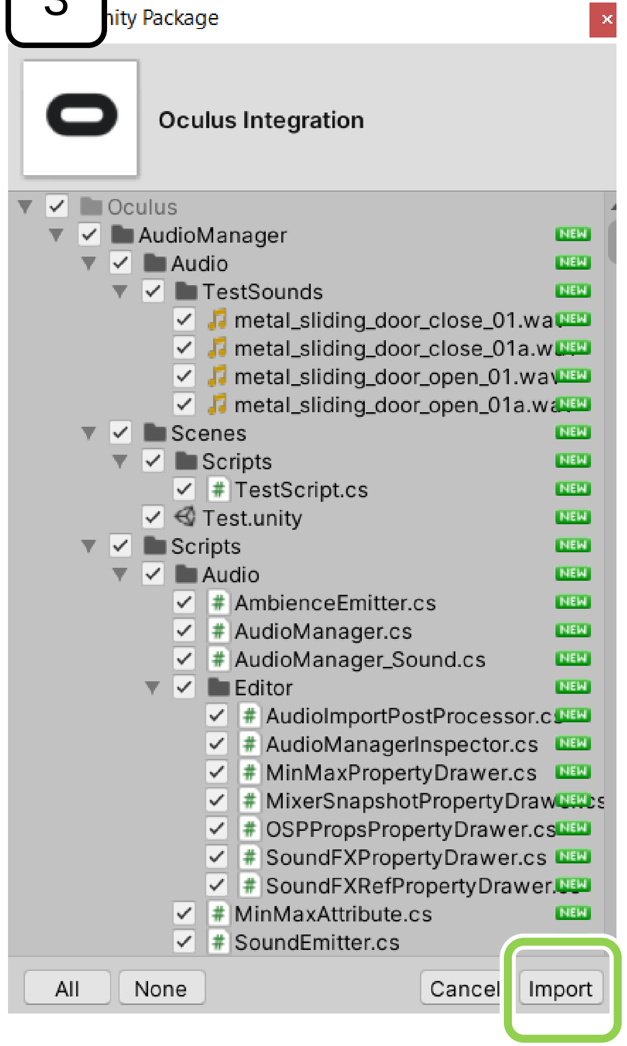
2



You downloaded this item on Oct 5, 2020.
Please rate and review this asset. Your honest review and rating will **help other users** who are deciding whether they should get this asset.

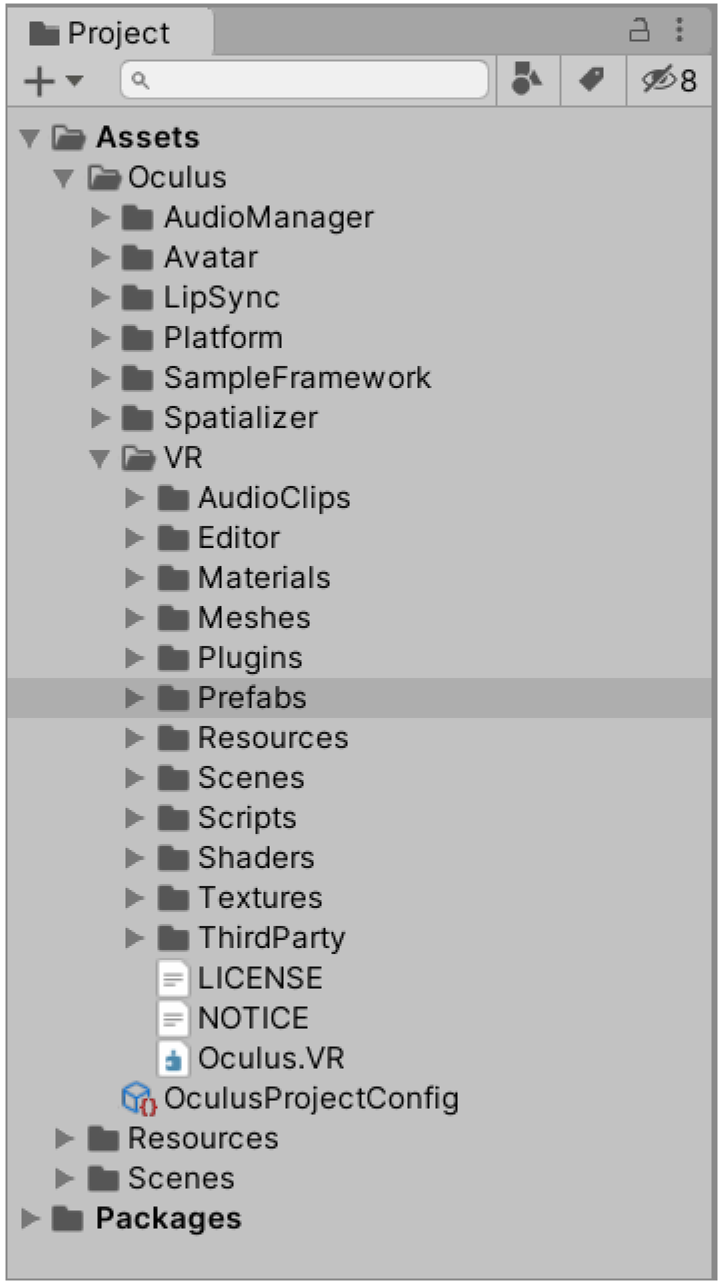
Search Oculus Integration > Download > Import

3



Takes a while to import

- You will see Oculus folder in your project window.



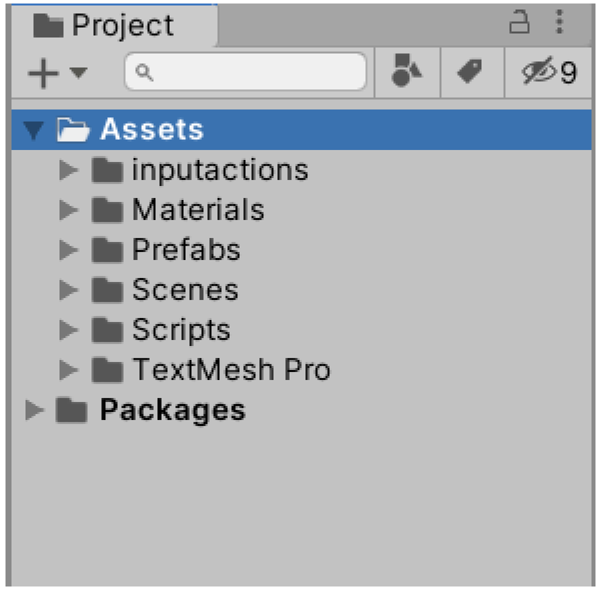
```
Project
8
▼ Assets
  ▼ Oculus
    ▶ AudioManager
    ▶ Avatar
    ▶ LipSync
    ▶ Platform
    ▶ SampleFramework
    ▶ Spatializer
    ▼ VR
      ▶ AudioClips
      ▶ Editor
      ▶ Materials
      ▶ Meshes
      ▶ Plugins
      ▶ Prefabs
      ▶ Resources
      ▶ Scenes
      ▶ Scripts
      ▶ Shaders
      ▶ Textures
      ▶ ThirdParty
        LICENSE
        NOTICE
        Oculus.VR
      OculusProjectConfig
  ▶ Resources
  ▶ Scenes
▶ Packages
```

we also want to use the roll-a-ball project.

1) export project as .unitypackage
2) import custom package

Export the roll-a-ball project as .unitypacakge

1 Select Assets in your Project Window

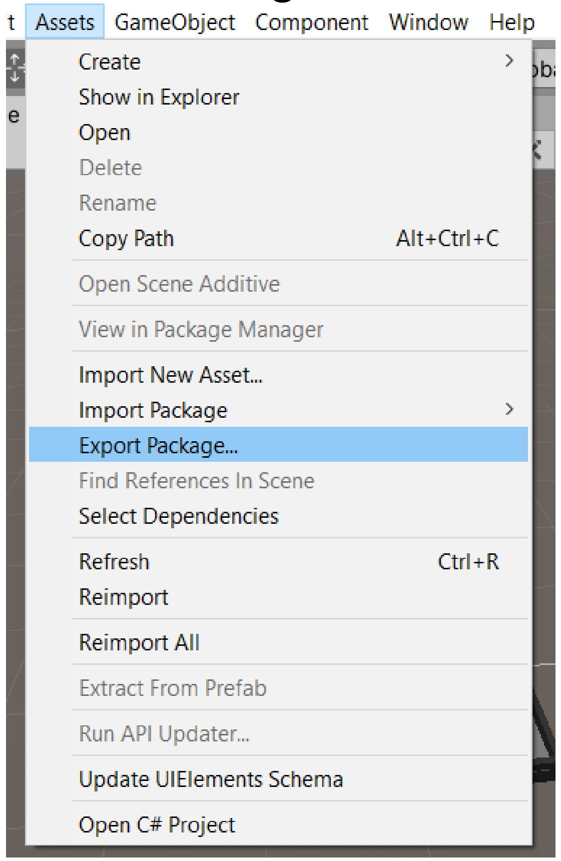


Project

Assets
- inputactions
- Materials
- Prefabs
- Scenes
- Scripts
- TextMesh Pro

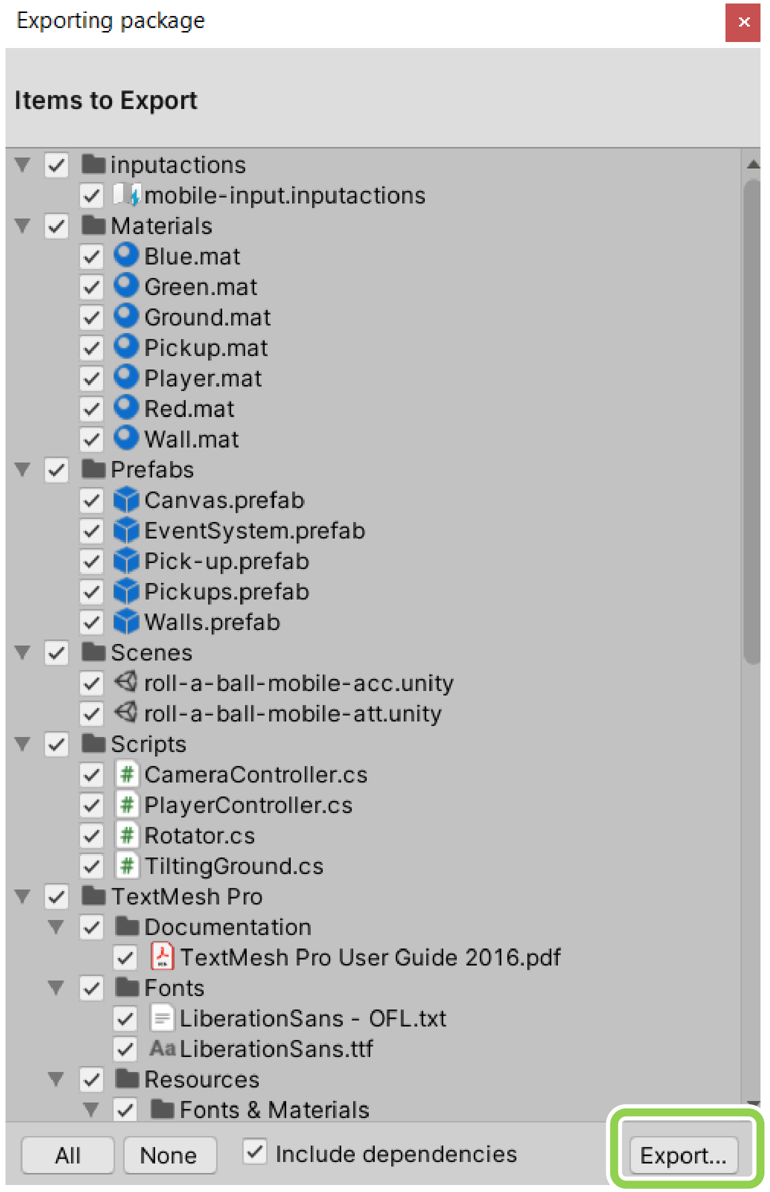
Packages

2 Assets > Export Package



Create
Show in Explorer
Open
Delete
Rename
Copy Path Alt+Ctrl+C
Open Scene Additive
View in Package Manager
Import New Asset...
Import Package
Export Package...
Find References In Scene
Select Dependencies
Refresh Ctrl+R
Reimport
Reimport All
Extract From Prefab
Run API Updater...
Update UIElements Schema
Open C# Project

3



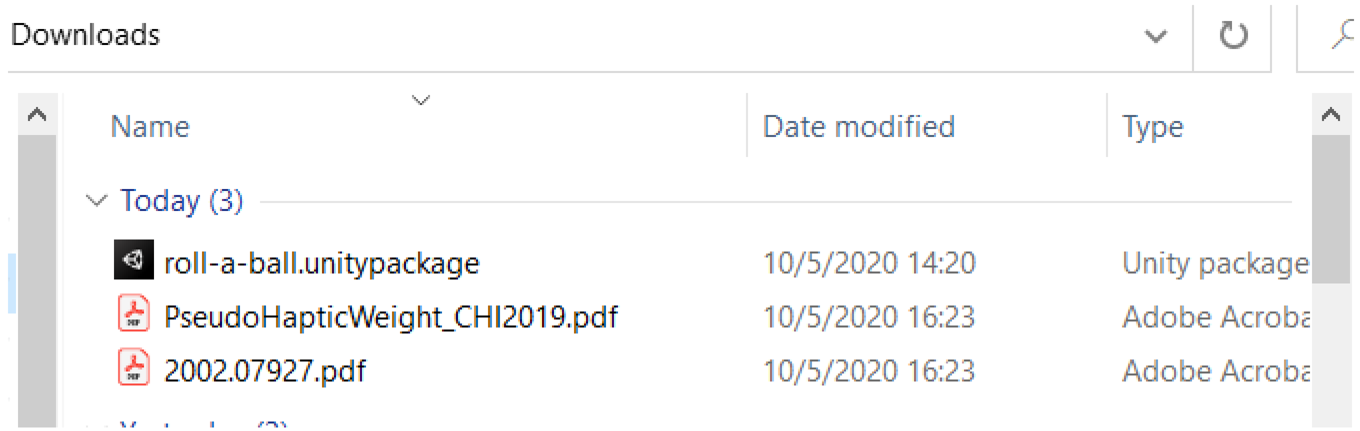
Exporting package

Items to Export

- ✓ inputactions
  - ✓ mobile-input.inputactions
- ✓ Materials
  - ✓ Blue.mat
  - ✓ Green.mat
  - ✓ Ground.mat
  - ✓ Pickup.mat
  - ✓ Player.mat
  - ✓ Red.mat
  - ✓ Wall.mat
- ✓ Prefabs
  - ✓ Canvas.prefab
  - ✓ EventSystem.prefab
  - ✓ Pick-up.prefab
  - ✓ Pickups.prefab
  - ✓ Walls.prefab
- ✓ Scenes
  - ✓ roll-a-ball-mobile-acc.unity
  - ✓ roll-a-ball-mobile-att.unity
- ✓ Scripts
  - ✓ CameraController.cs
  - ✓ PlayerController.cs
  - ✓ Rotator.cs
  - ✓ TiltingGround.cs
- ✓ TextMesh Pro
  - ✓ Documentation
    - ✓ TextMesh Pro User Guide 2016.pdf
  - ✓ Fonts
    - ✓ LiberationSans - OFL.txt
    - ✓ LiberationSans.ttf
  - ✓ Resources
    - ✓ Fonts & Materials

All None ✓ Include dependencies Export...

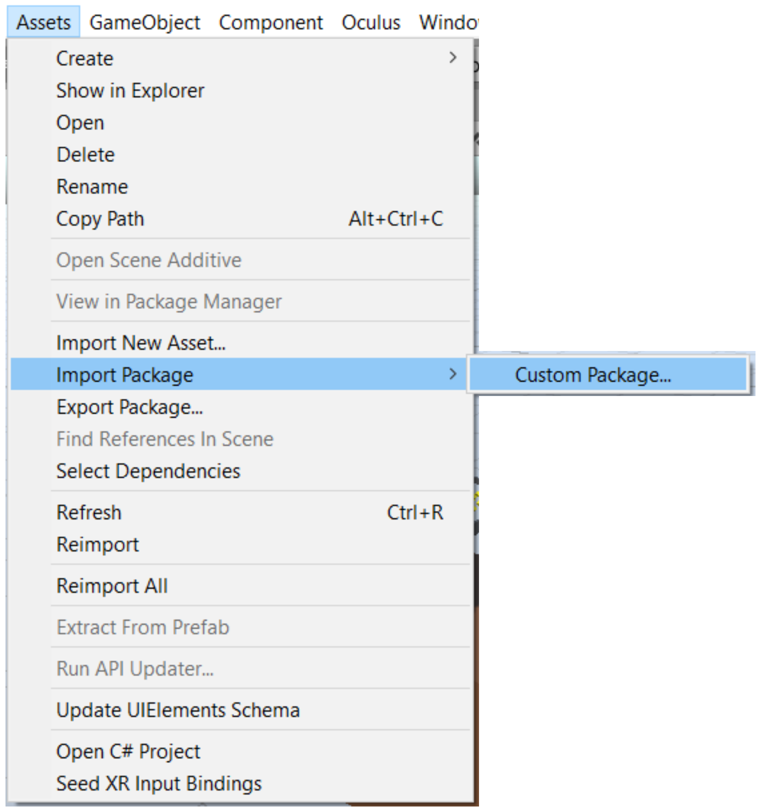
Export your project as .unitypackage

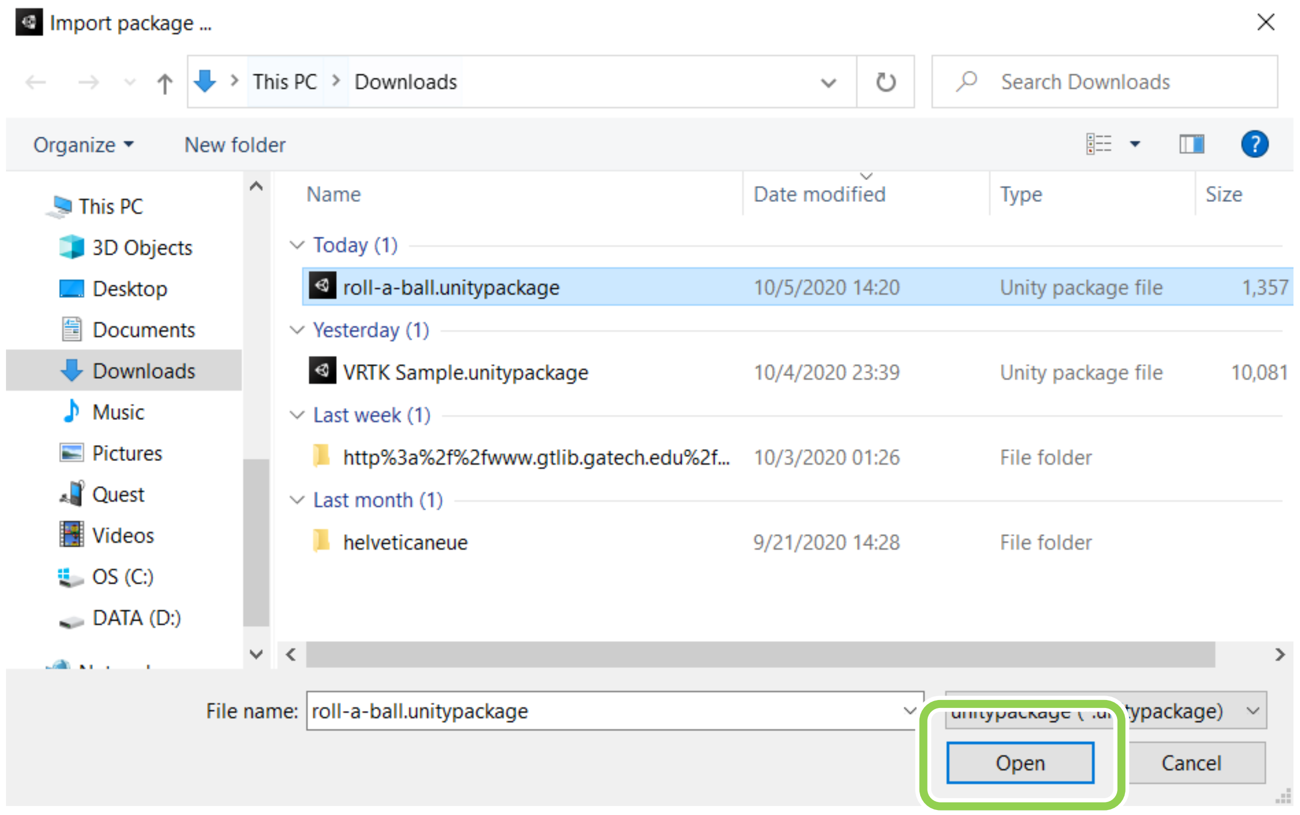

Downloads

Name	Date modified	Type
Today (3)		
roll-a-ball.unitypackage	10/5/2020 14:20	Unity package
PseudoHapticWeight_CHI2019.pdf	10/5/2020 16:23	Adobe Acroba
2002.07927.pdf	10/5/2020 16:23	Adobe Acroba

Import the roll-a-ball

- Assets > Import Package > Custom Package



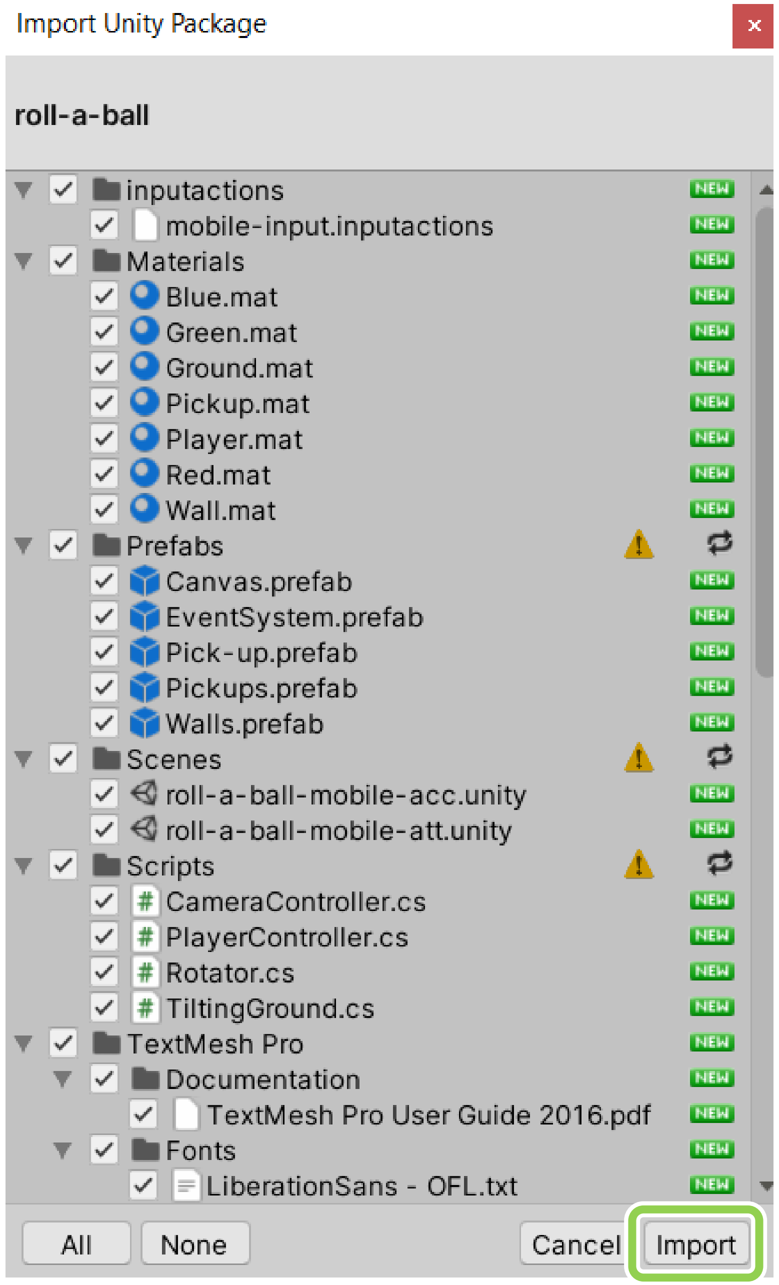


Name	Date modified	Type	Size
Today (1)			
roll-a-ball.unitypackage	10/5/2020 14:20	Unity package file	1,357
Yesterday (1)			
VRTK Sample.unitypackage	10/4/2020 23:39	Unity package file	10,081
Last week (1)			
http%3a%2f%2fwww.gtlib.gatech.edu%2f...	10/3/2020 01:26	File folder	
Last month (1)			
helveticaneue	9/21/2020 14:28	File folder	

File name: roll-a-ball.unitypackage

unitypackage (*.unitypackage)

Import !



Import Unity Package

roll-a-ball

- ✓ inputactions NEW
  - ✓ mobile-input.inputactions NEW
- ✓ Materials NEW
  - ✓ Blue.mat NEW
  - ✓ Green.mat NEW
  - ✓ Ground.mat NEW
  - ✓ Pickup.mat NEW
  - ✓ Player.mat NEW
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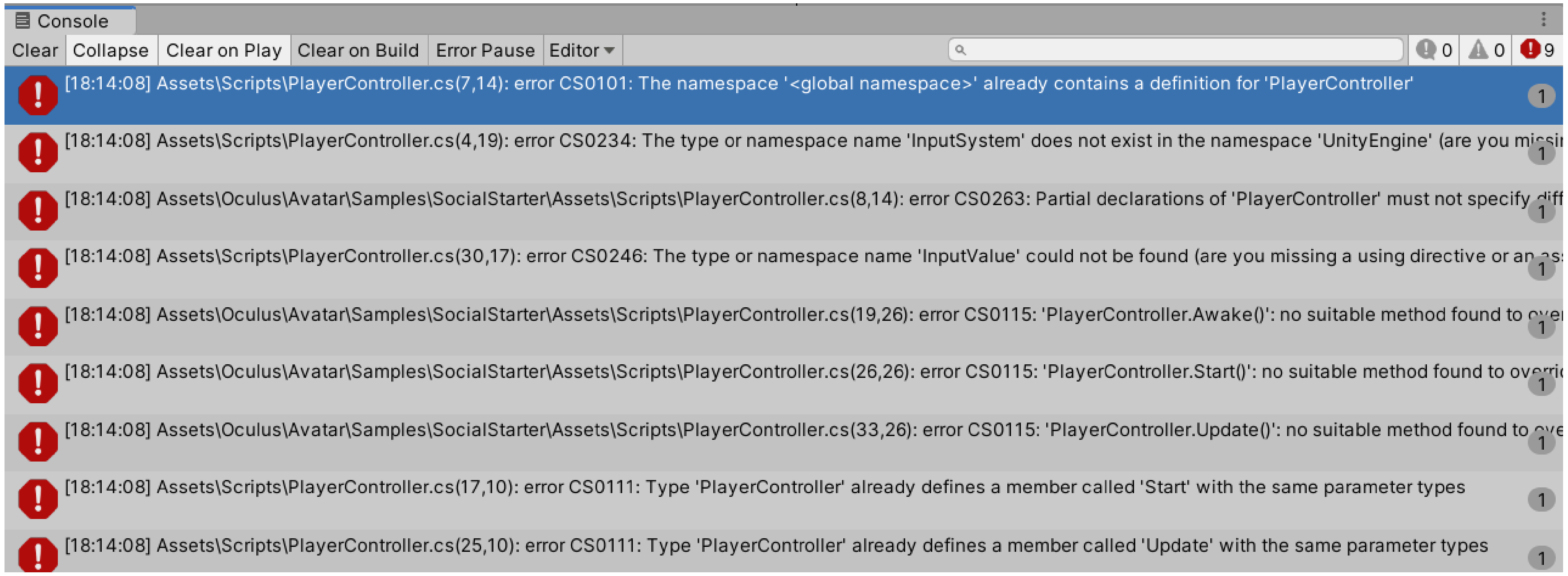
  - ✓ Rotator.cs NEW
  - ✓ TiltingGround.cs NEW
- ✓ TextMesh Pro NEW
  - ✓ Documentation NEW
    - ✓ TextMesh Pro User Guide 2016.pdf NEW
  - ✓ Fonts NEW
    - ✓ LiberationSans - OFL.txt NEW

There are some errors after the import

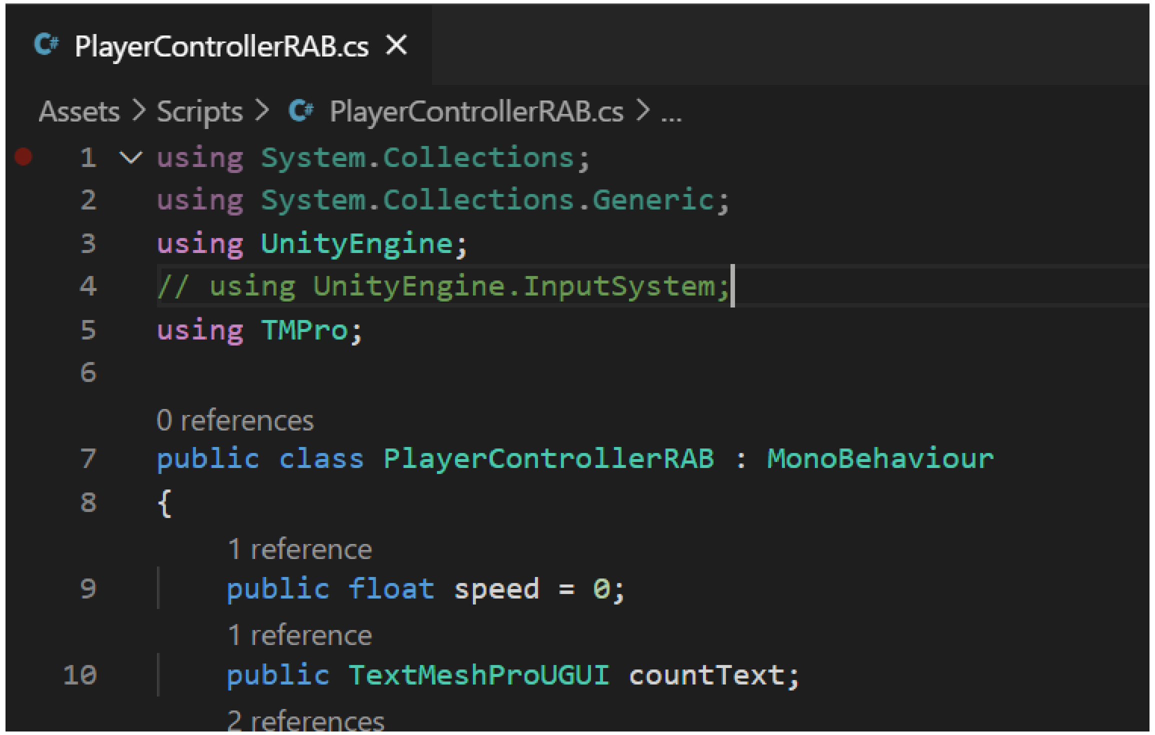
- Because Oculus Integration has a script also named as PlayerController.
- We don't have Input System in this new project. We will use the input provided by Oculus, therefore we need to remove the code from the input system.



```
[18:14:08] Assets\Scripts\PlayerController.cs(7,14): error CS0101: The namespace '<global namespace>' already contains a definition for 'PlayerController'   1
[18:14:08] Assets\Scripts\PlayerController.cs(4,19): error CS0234: The type or namespace name 'InputSystem' does not exist in the namespace 'UnityEngine' (are you missi   1
[18:14:08] Assets\Oculus\Avatar\Samples\SocialStarter\Assets\Scripts\PlayerController.cs(8,14): error CS0263: Partial declarations of 'PlayerController' must not specify diff   1
[18:14:08] Assets\Scripts\PlayerController.cs(30,17): error CS0246: The type or namespace name 'InputValue' could not be found (are you missing a using directive or an as   1
[18:14:08] Assets\Oculus\Avatar\Samples\SocialStarter\Assets\Scripts\PlayerController.cs(19,26): error CS0115: 'PlayerController.Awake()': no suitable method found to over   1
[18:14:08] Assets\Oculus\Avatar\Samples\SocialStarter\Assets\Scripts\PlayerController.cs(26,26): error CS0115: 'PlayerController.Start()': no suitable method found to overri   1
[18:14:08] Assets\Oculus\Avatar\Samples\SocialStarter\Assets\Scripts\PlayerController.cs(33,26): error CS0115: 'PlayerController.Update()': no suitable method found to ove   1
[18:14:08] Assets\Scripts\PlayerController.cs(17,10): error CS0111: Type 'PlayerController' already defines a member called 'Start' with the same parameter types   1
[18:14:08] Assets\Scripts\PlayerController.cs(25,10): error CS0111: Type 'PlayerController' already defines a member called 'Update' with the same parameter types   1
```

How to fix?

- Change the name of PlayerController.cs in the roll-a-ball
- Comment the Input System code

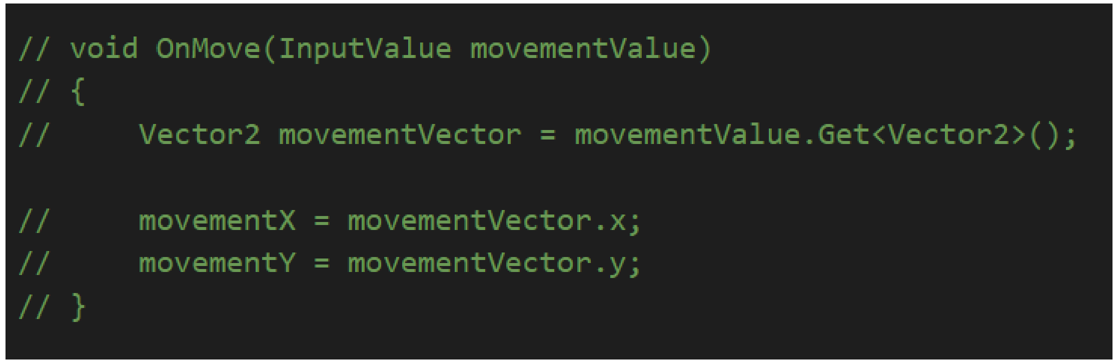


PlayerControllerRAB.cs

Assets > Scripts > PlayerControllerRAB.cs > ...

```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;
// using UnityEngine.InputSystem;
using TMPro;

0 references
public class PlayerControllerRAB : MonoBehaviour
{
    1 reference
    public float speed = 0;
    1 reference
    public TextMeshProUGUI countText;
    2 references
```

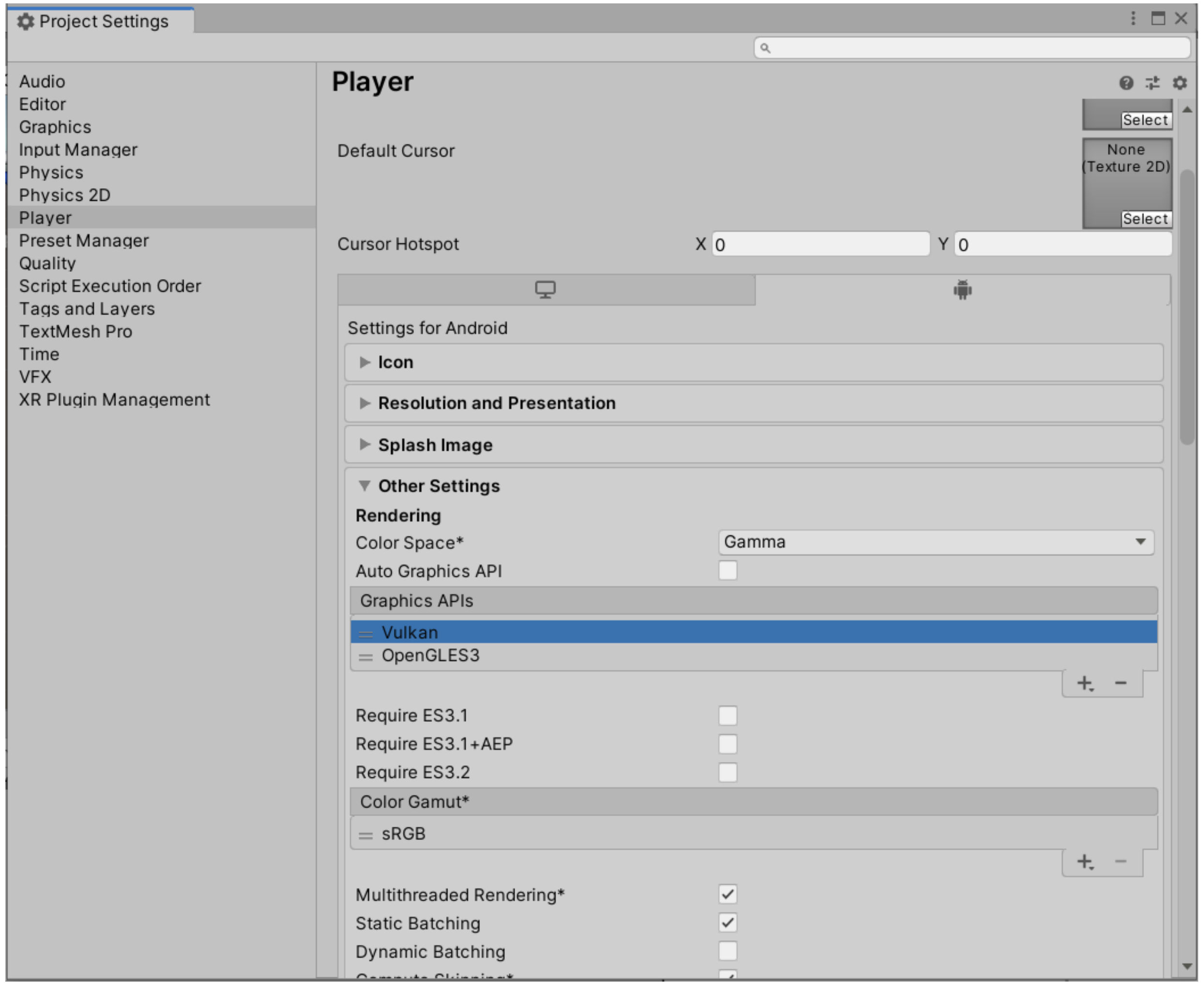


```
// void OnMove(InputValue movementValue)
// {
//     Vector2 movementVector = movementValue.Get<Vector2>();

//     movementX = movementVector.x;
//     movementY = movementVector.y;
// }
```

Project Settings

- Edit > Project Settings > Player
- Other settings > Graphic API > remove Vulkan



Default Cursor

Cursor Hotspot X 0 Y 0

Settings for Android

Color Space* Gamma

Auto Graphics API ☐

Graphics APIs
- Vulkan
- OpenGLES3

Require ES3.1 ☐

Require ES3.1+AEP ☐

Require ES3.2 ☐

Color Gamut*
- sRGB

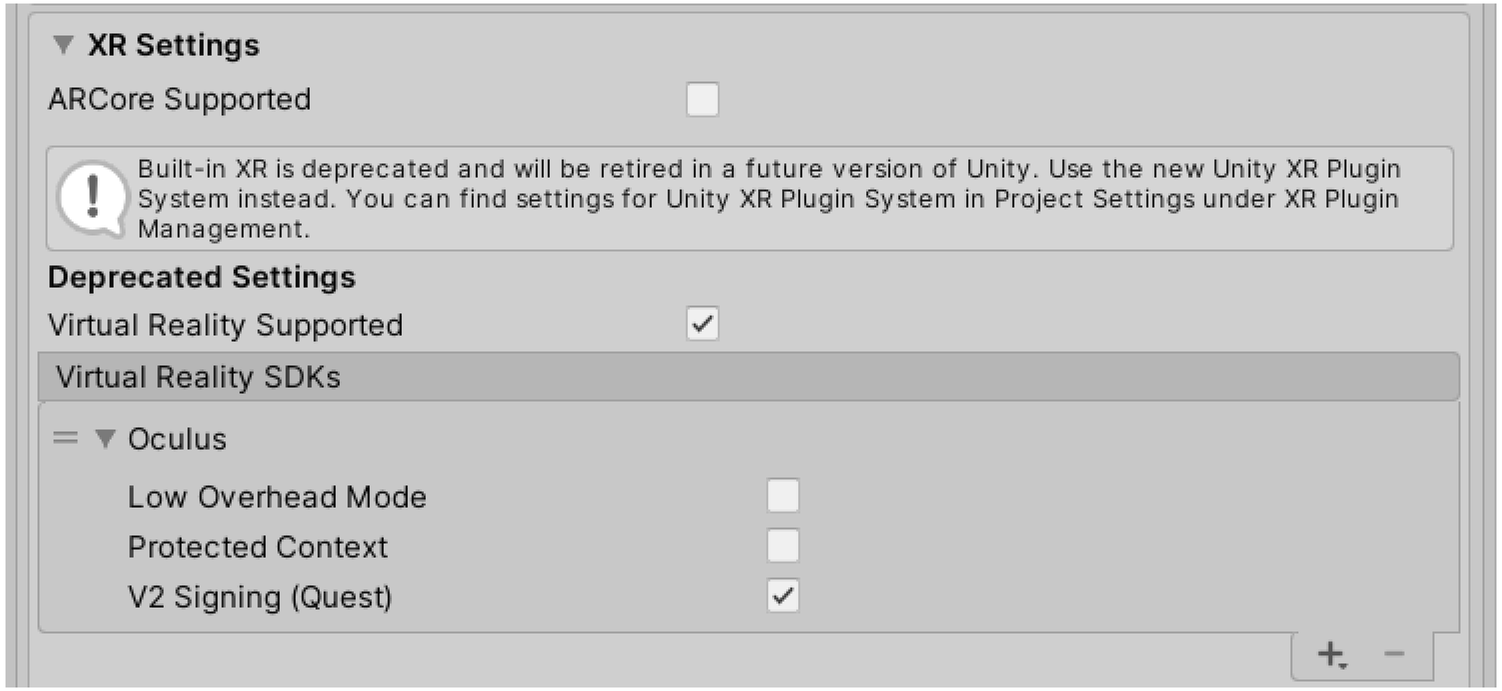
Multithreaded Rendering* ✓

Static Batching ✓

Dynamic Batching ☐

Project Settings

- Edit > Project Settings > Player
- XR Settings > check Virtual Reality Supported
- Press ‘+’ to add Oculus to the VR SDKs



XR Settings

ARCore Supported ☐

Built-in XR is deprecated and will be retired in a future version of Unity. Use the new Unity XR Plugin System instead. You can find settings for Unity XR Plugin System in Project Settings under XR Plugin Management.

Deprecated Settings

Virtual Reality Supported ✓

Virtual Reality SDKs

Oculus

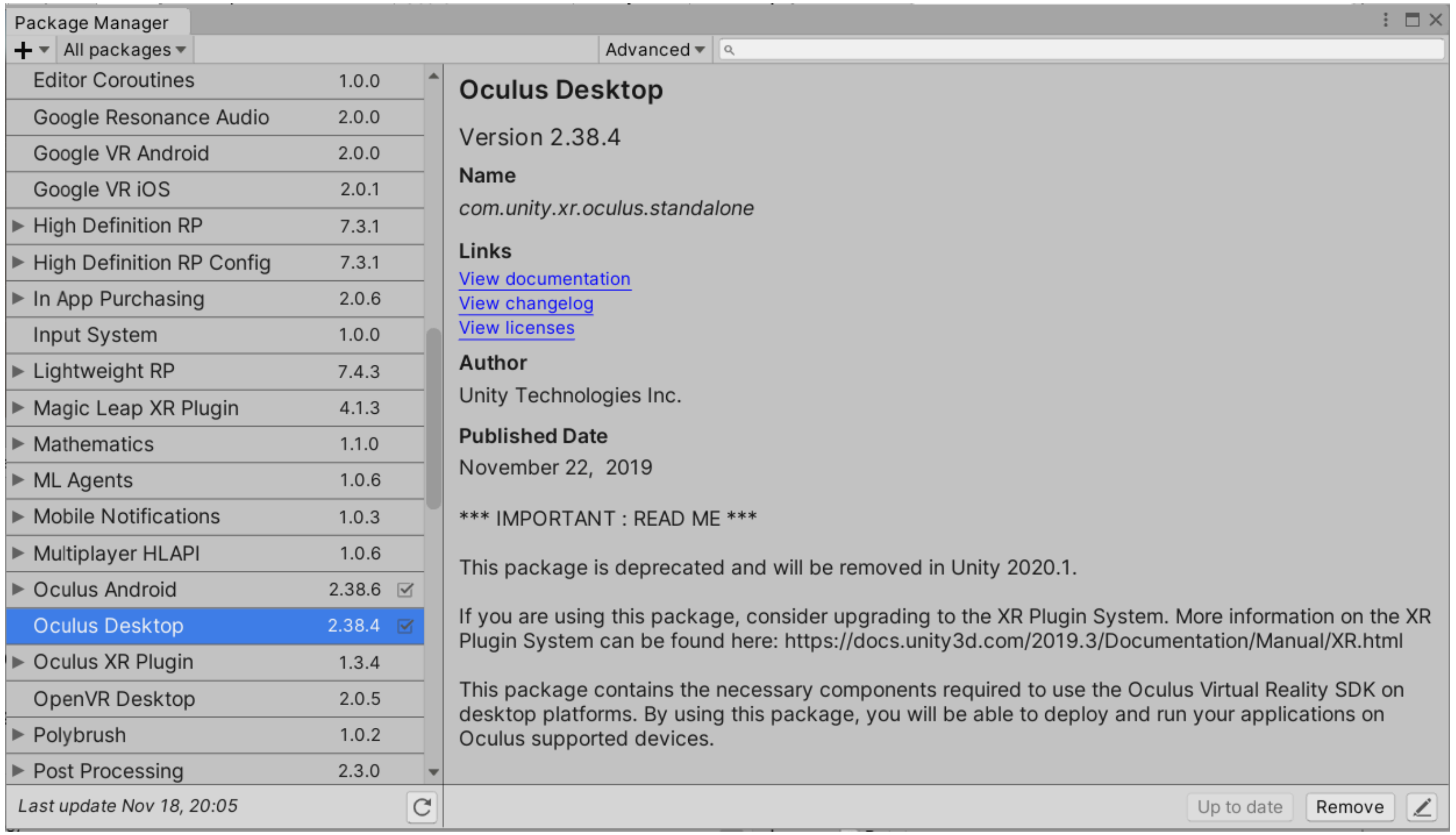
Low Overhead Mode ☐

Protected Context ☐

V2 Signing (Quest) ✓

Package Manager Window

- Install Oculus Desktop
- For Oculus Link



Editor Coroutines	1.0.0
Google Resonance Audio	2.0.0
Google VR Android	2.0.0
Google VR iOS	2.0.1
▶ High Definition RP	7.3.1
▶ High Definition RP Config	7.3.1
▶ In App Purchasing	2.0.6
Input System	1.0.0
▶ Lightweight RP	7.4.3
▶ Magic Leap XR Plugin	4.1.3
▶ Mathematics	1.1.0
▶ ML Agents	1.0.6
▶ Mobile Notifications	1.0.3
▶ Multiplayer HLAPI	1.0.6
▶ Oculus Android	2.38.6 ✓
Oculus Desktop	2.38.4 ✓
▶ Oculus XR Plugin	1.3.4
OpenVR Desktop	2.0.5
▶ Polybrush	1.0.2
▶ Post Processing	2.3.0

Last update Nov 18, 20:05

Oculus Desktop

Version 2.38.4

Name

com.unity.xr.oculus.standalone

Links

View documentation
View changelog
View licenses

Author

Unity Technologies Inc.

Published Date

November 22, 2019

*** IMPORTANT : READ ME ***

This package is deprecated and will be removed in Unity 2020.1.

If you are using this package, consider upgrading to the XR Plugin System. More information on the XR Plugin System can be found here: https://docs.unity3d.com/2019.3/Documentation/Manual/XR.html

This package contains the necessary components required to use the Oculus Virtual Reality SDK on desktop platforms. By using this package, you will be able to deploy and run your applications on Oculus supported devices.

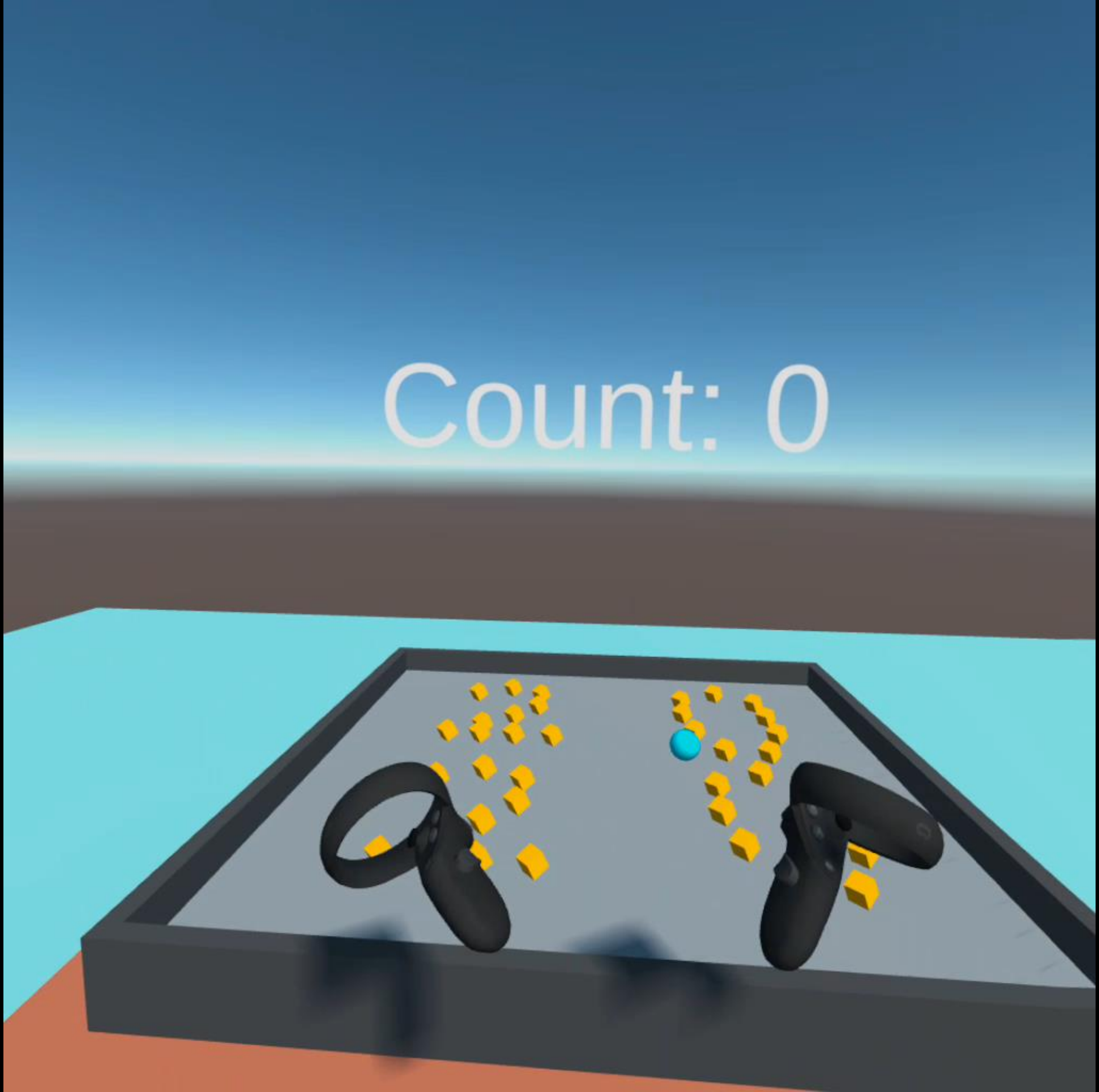
II. roll-a-ball + selection in VR

job simulator

for this lab

select with controller

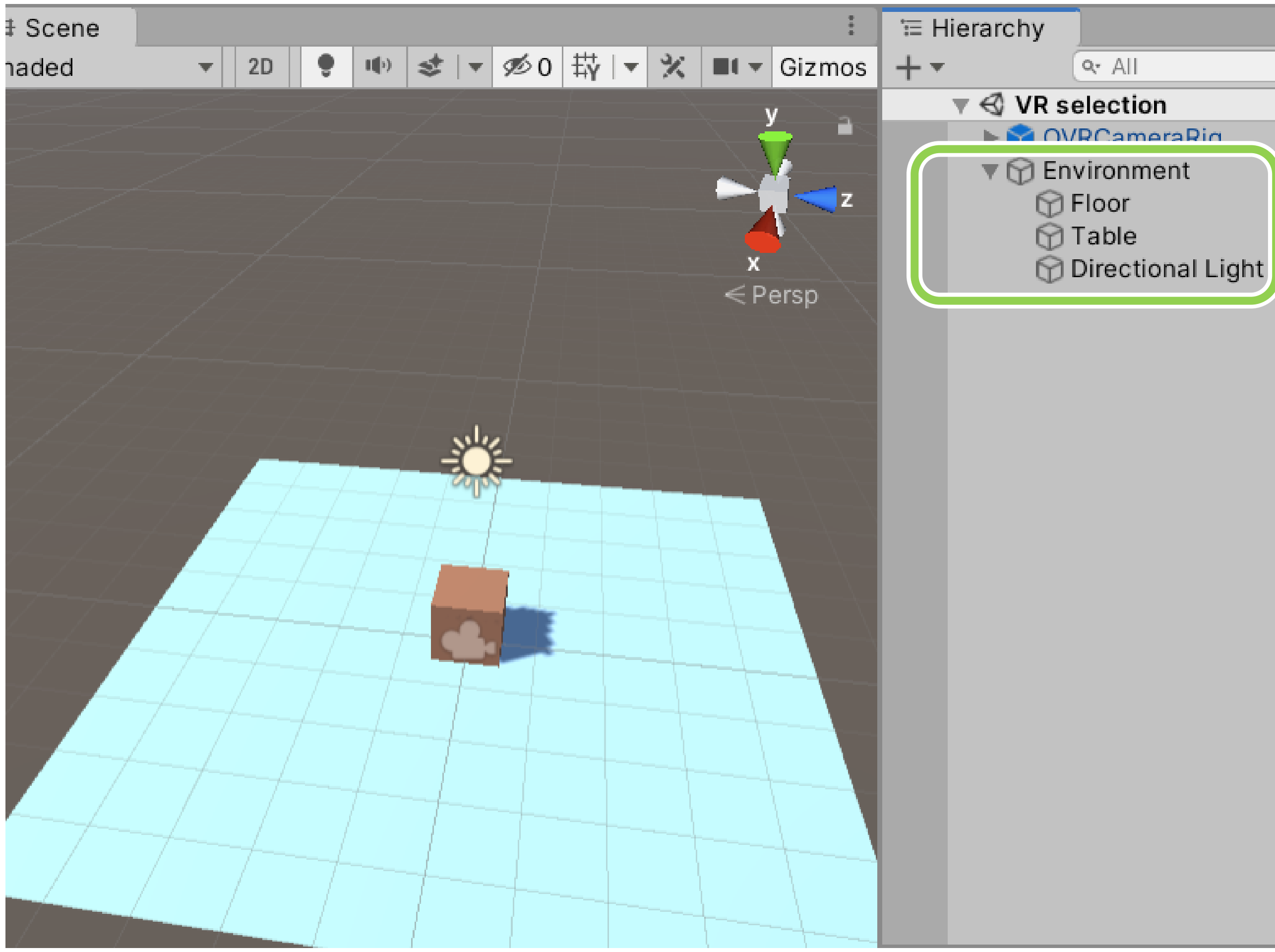
example: we select and manipulate
the board of roll-a-ball using controllers


Count: 0

scene

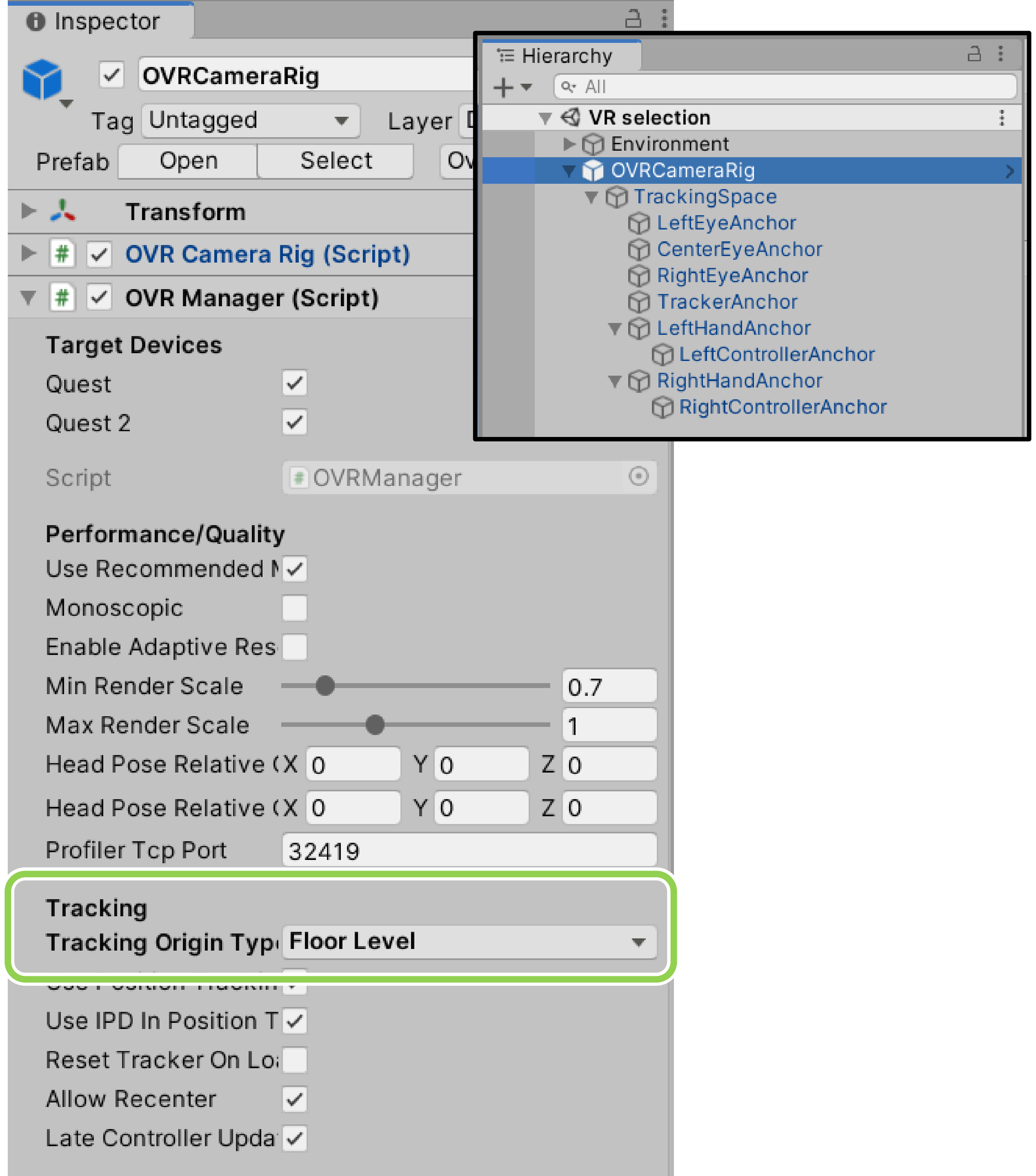
Create a new Scene

1. delete MainCamera
2. create a huge floor for VR
3. add a Cube as a table
4. Use an Empty GameObject (*Environment*) to collect non-interactable GOs



Add OVRCameraRig

- Project panel > Assets > Oculus > VR > Prefabs > OVRCameraRig
- Drag it into your scene
- Inspector > OVRManager > Tracking > select Floor Level



Inspector

OVRCameraRig

Tag Untagged Layer

Prefab Open Select

Transform

OVR Camera Rig (Script)

OVR Manager (Script)

Target Devices

Quest ✓

Quest 2 ✓

Script OVRManager

Performance/Quality

Use Recommended M ✓

Monoscopic ☐

Enable Adaptive Res ☐

Min Render Scale 0.7

Max Render Scale 1

Head Pose Relative (X 0 Y 0 Z 0

Head Pose Relative (X 0 Y 0 Z 0

Profiler Tcp Port 32419

Tracking

Tracking Origin Typ Floor Level

Use IPD In Position T ✓

Reset Tracker On Lo ☐

Allow Recenter ✓

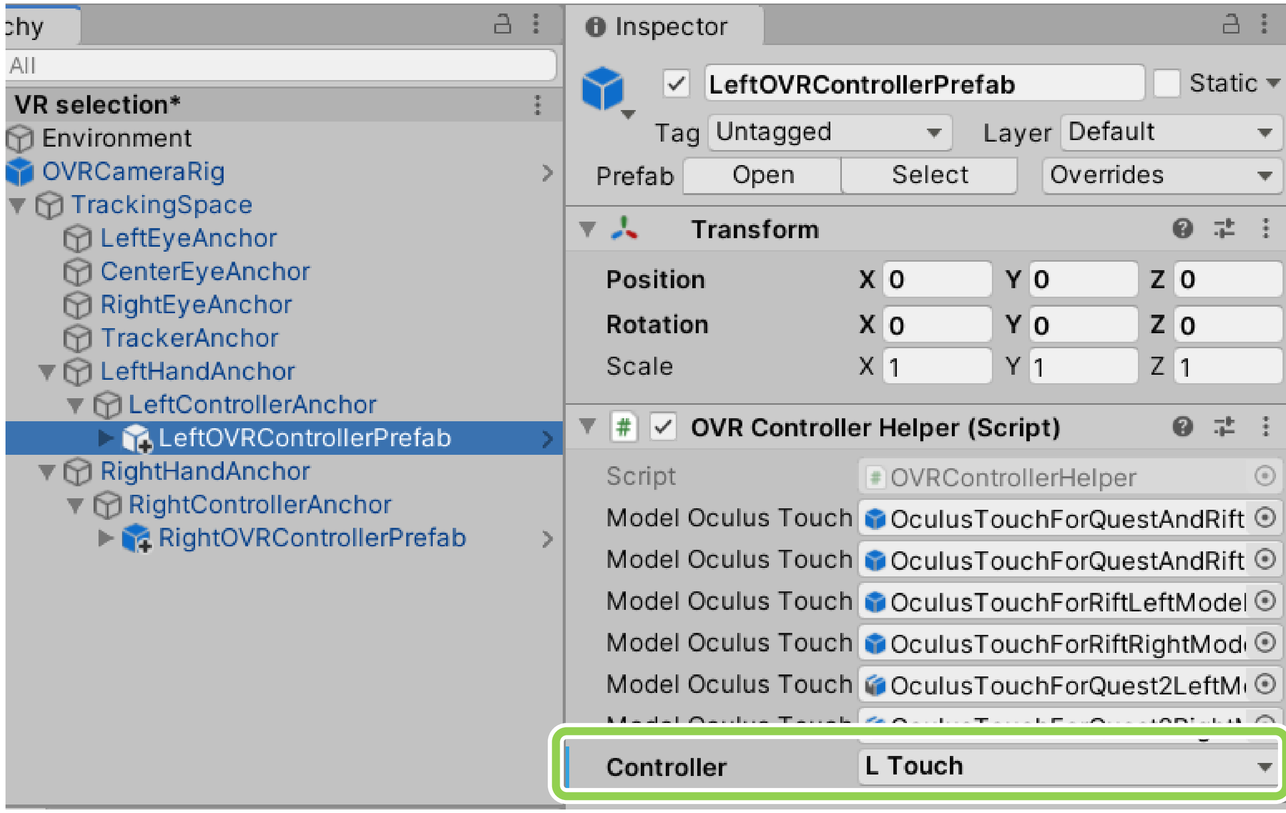
Late Controller Upda ✓

Hierarchy

- VR selection
  - Environment
  - OVRCameraRig
    - TrackingSpace
      - LeftEyeAnchor
      - CenterEyeAnchor
      - RightEyeAnchor
      - TrackerAnchor
      - LeftHandAnchor
        - LeftControllerAnchor
      - RightHandAnchor
        - RightControllerAnchor

Add OVRControllerPrefab

- Project panel > Assets > Oculus > VR > Prefabs > OVRControllerPrefab
- Drag it as a Child of LeftControllerAnchor
- Select L Touch
- Same for the Right Controller


chy

All

VR selection*

- Environment
- OVRCameraRig
  - TrackingSpace
    - LeftEyeAnchor
    - CenterEyeAnchor
    - RightEyeAnchor
    - TrackerAnchor
    - LeftHandAnchor
      - LeftControllerAnchor
        - LeftOVRControllerPrefab
    - RightHandAnchor
      - RightControllerAnchor
        - RightOVRControllerPrefab

Inspector

LeftOVRControllerPrefab — Static

Tag: Untagged — Layer: Default

Prefab: Open | Select | Overrides

Transform

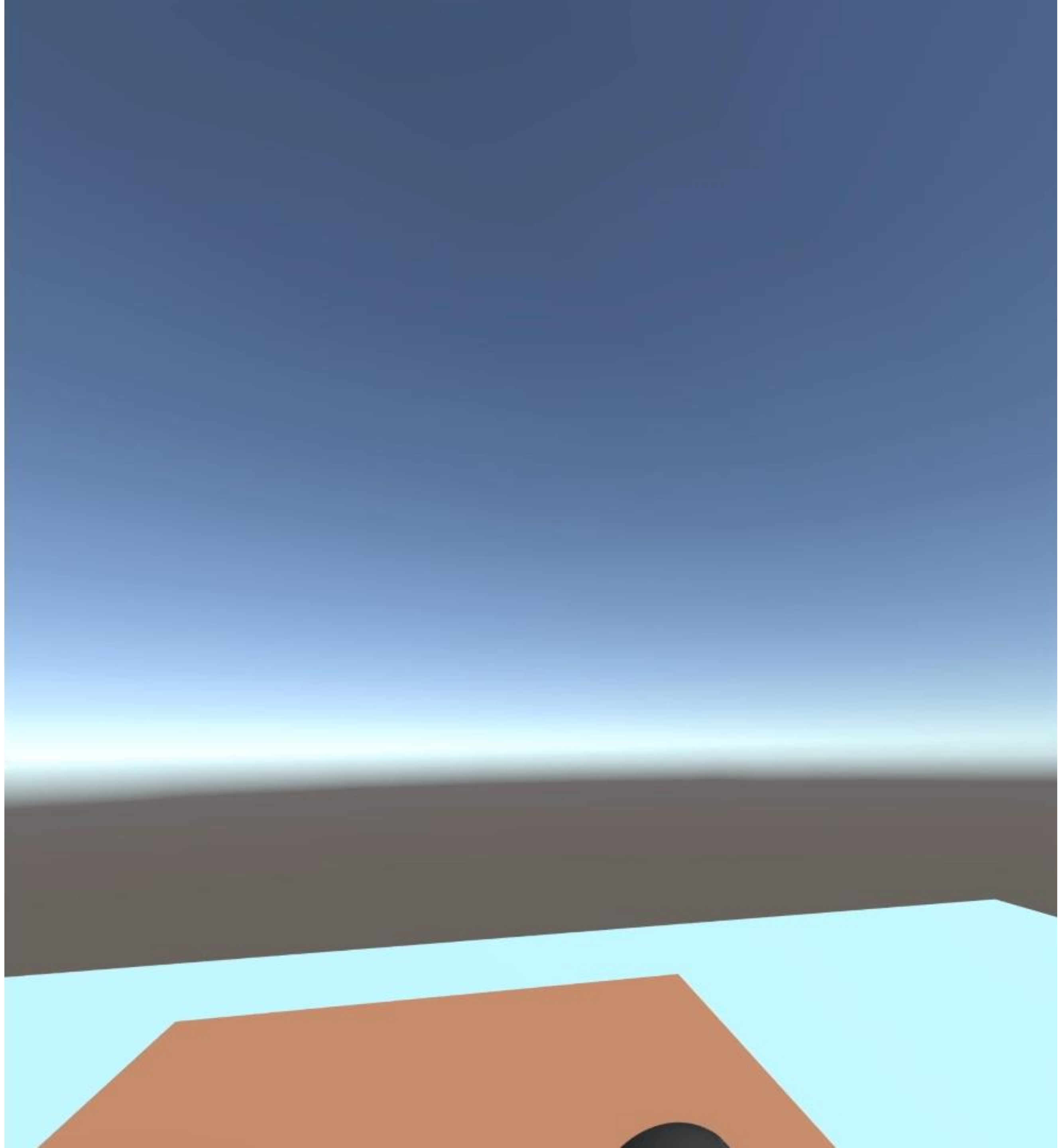
Position	X 0	Y 0	Z 0
Rotation	X 0	Y 0	Z 0
Scale	X 1	Y 1	Z 1

OVR Controller Helper (Script)

Script	OVRControllerHelper
Model Oculus Touch	OculusTouchForQuestAndRift
Model Oculus Touch	OculusTouchForQuestAndRift
Model Oculus Touch	OculusTouchForRiftLeftModel
Model Oculus Touch	OculusTouchForRiftRightMod
Model Oculus Touch	OculusTouchForQuest2LeftM
Controller	L Touch

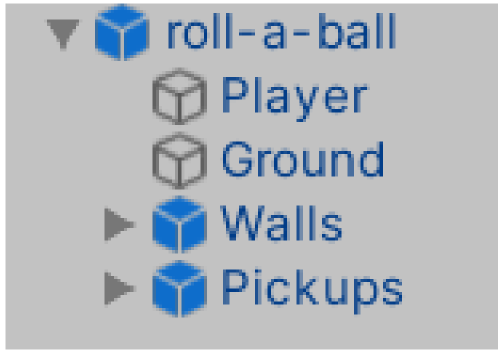
Add OVRControllerPrefab

- If you have Oculus Link, enter play mode and test the scene.
- Feel free to edit your scene.



add old stuffs from roll-a-ball

- Use an Empty GameObject (roll-a-ball) to collect
  - Player
  - Ground
  - Walls
  - Pickups

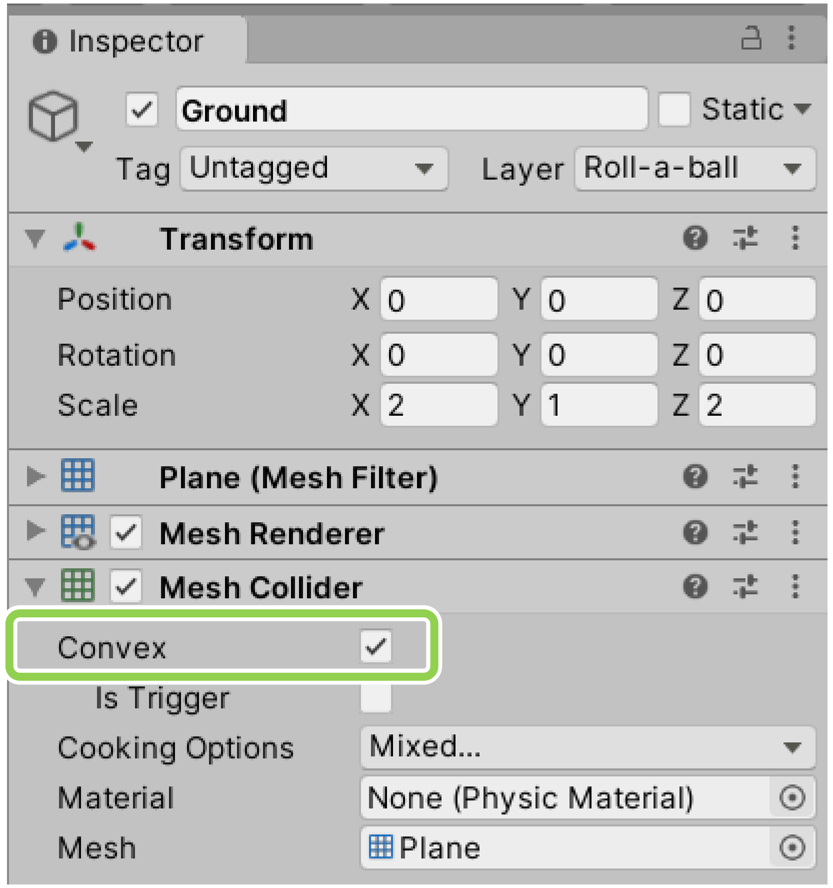


```
▼ roll-a-ball
    Player
    Ground
  ▶ Walls
  ▶ Pickups
```

- They are at the same ‘Child’ hierarchy.
- Scale down to a size you like (check and edit with Oculus Link)

Ground

- select Convex in Mesh Collider



Inspector

Ground ✓ | Static

Tag: Untagged | Layer: Roll-a-ball

Transform

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

Plane (Mesh Filter)

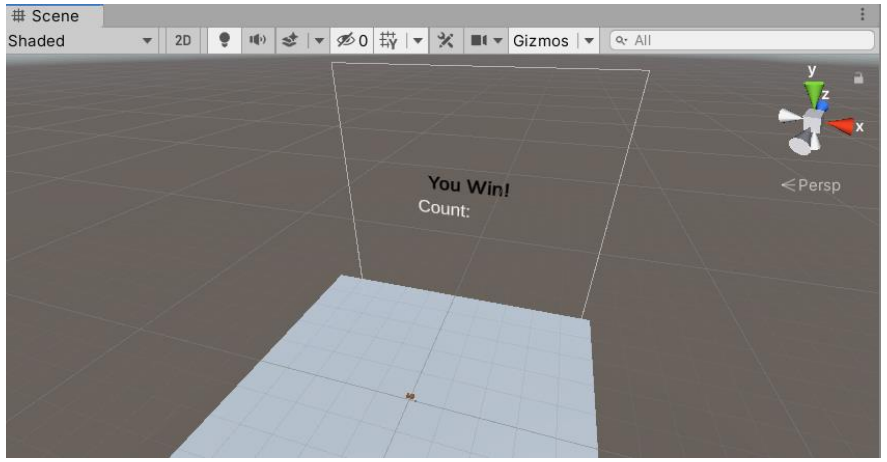
Mesh Renderer ✓

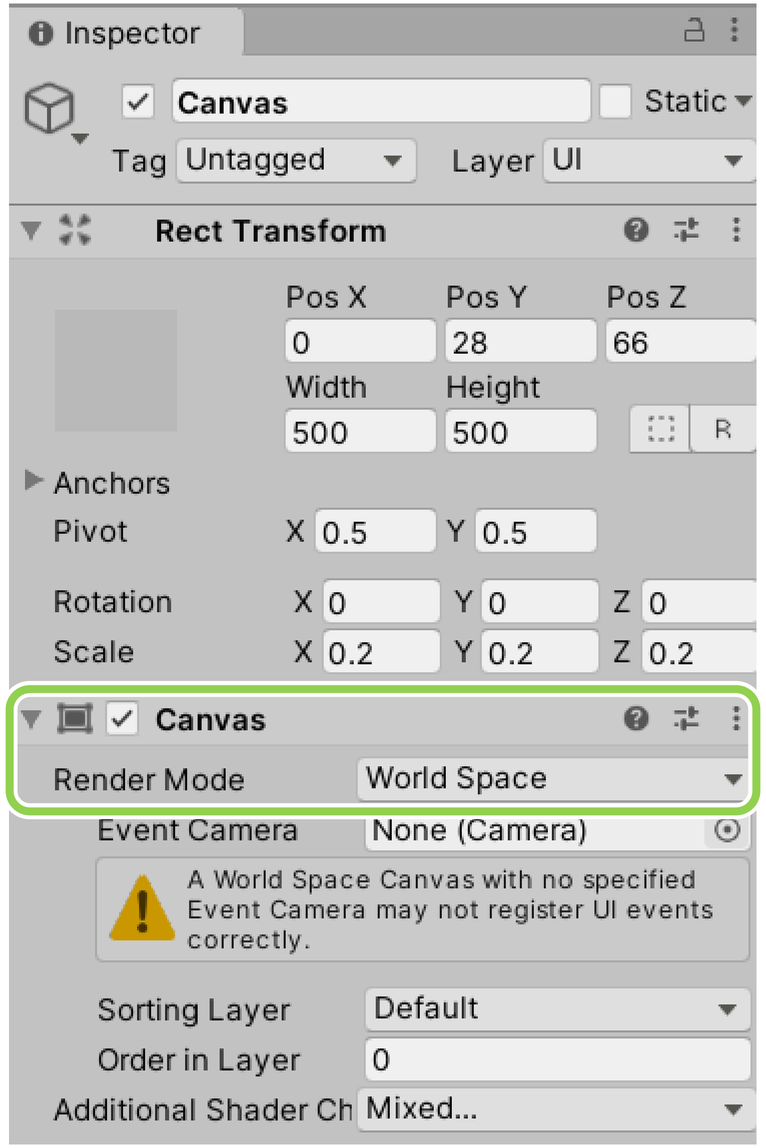
Mesh Collider ✓

Convex	✓
Is Trigger	
Cooking Options	Mixed...
Material	None (Physic Material)
Mesh	Plane

UI text

- GameObject > UI > Text – TextMeshPro
  - Add two TMP, one for Count, one for Win.
- In the inspector of Canvas > Render Mode > **select World Space**
- The Text would be like a 3D object in the scene.




Inspector

Canvas
Static
Tag Untagged
Layer UI

Rect Transform

Pos X	Pos Y	Pos Z
0	28	66
Width	Height	
500	500	

Anchors

Pivot	X 0.5	Y 0.5			
Rotation	X 0	Y 0	Z 0		
Scale	X 0.2	Y 0.2	Z 0.2		

Canvas

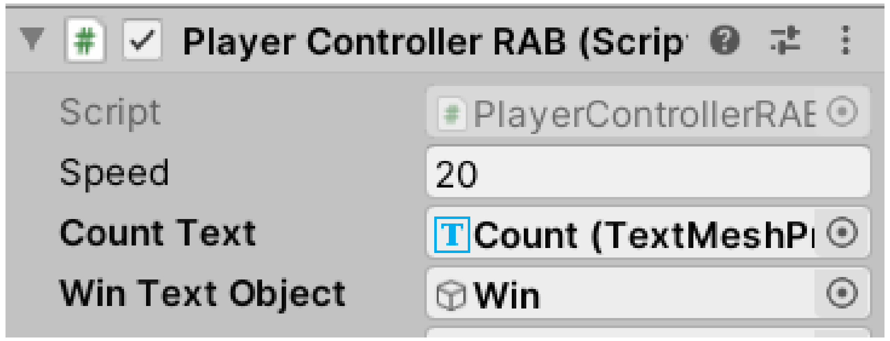
Render Mode	World Space
Event Camera	None (Camera)

A World Space Canvas with no specified Event Camera may not register UI events correctly.

Sorting Layer	Default
Order in Layer	0
Additional Shader Ch	Mixed...

UI text

- Remember to set reference back to our PlayerController script of roll-a-ball.



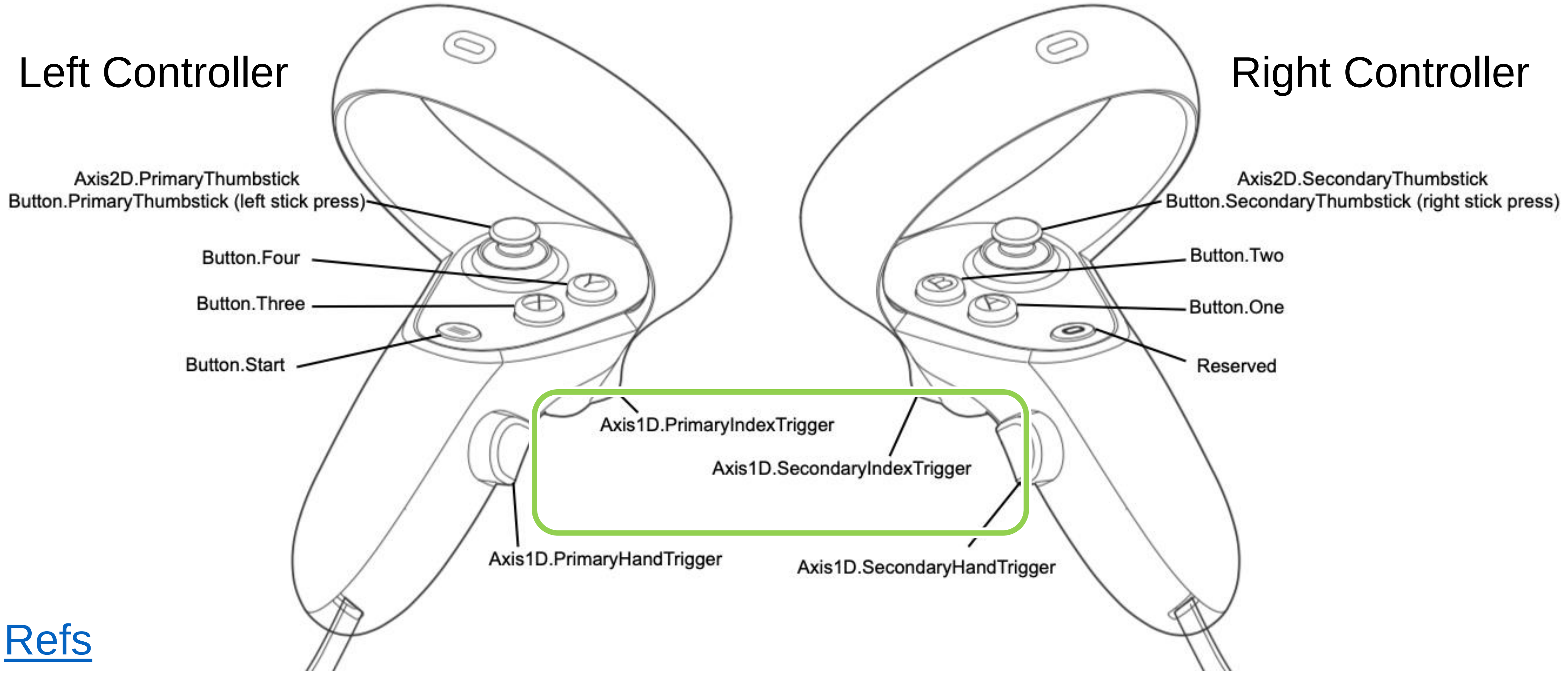
Player Controller RAB (Scrip

Script	PlayerControllerRAE
Speed	20
Count Text	Count (TextMeshP
Win Text Object	Win

interaction

```
if (controller is in the collider of roll-a-ball)
    if (not selected and pull the trigger)
        selects roll-a-ball
    else if (selected and release the trigger)
        releases roll-a-ball
```

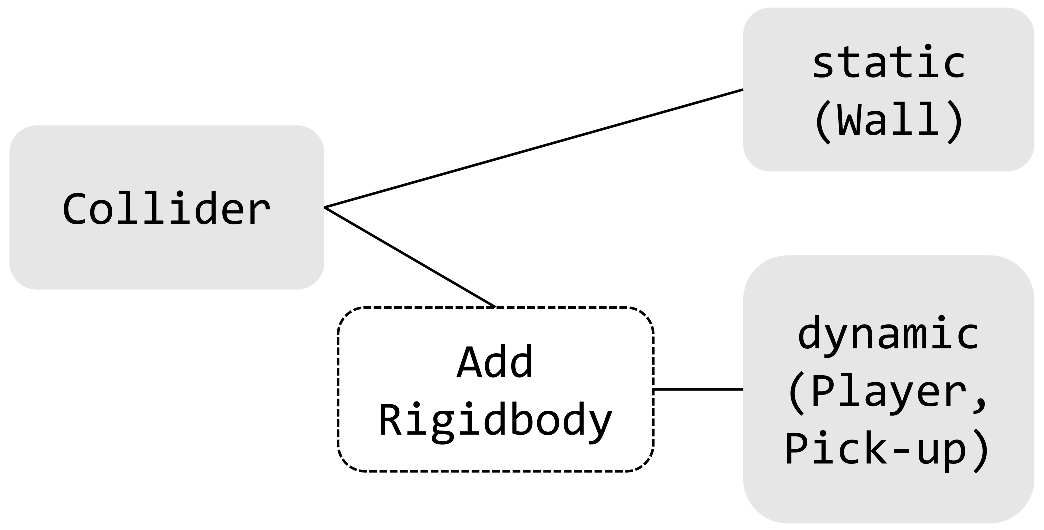
Use IndexTrigger as input


Left Controller
Right Controller
Axis2D.PrimaryThumbstick
Button.PrimaryThumbstick (left stick press)
Button.Four
Button.Three
Button.Start
Axis2D.SecondaryThumbstick
Button.SecondaryThumbstick (right stick press)
Button.Two
Button.One
Reserved
Axis1D.PrimaryIndexTrigger
Axis1D.SecondaryIndexTrigger
Axis1D.PrimaryHandTrigger
Axis1D.SecondaryHandTrigger

Refs

Let's have a look in our game

- Unity Colliders



detect collision:

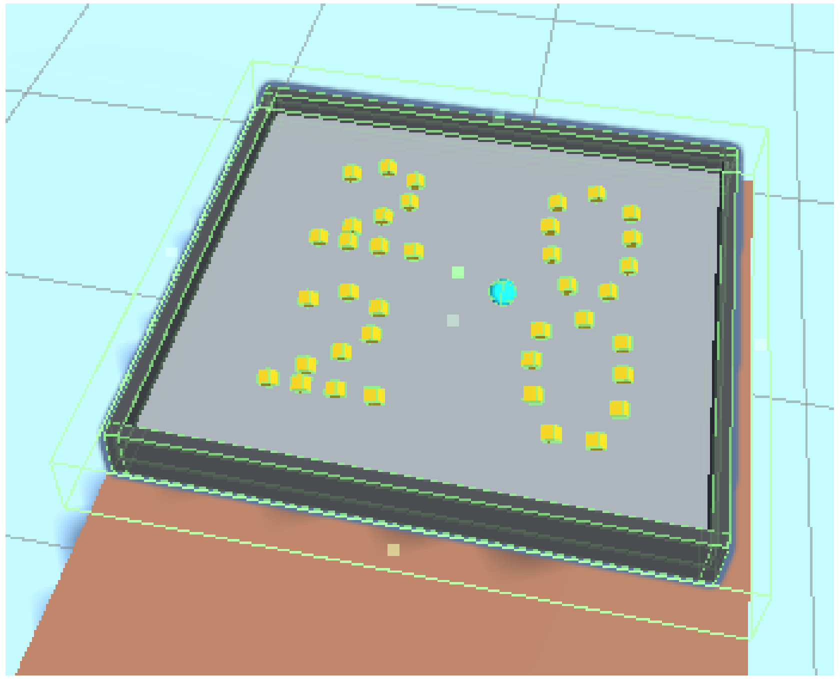
- OnCollisionEnter()
- OnTriggerEnter()

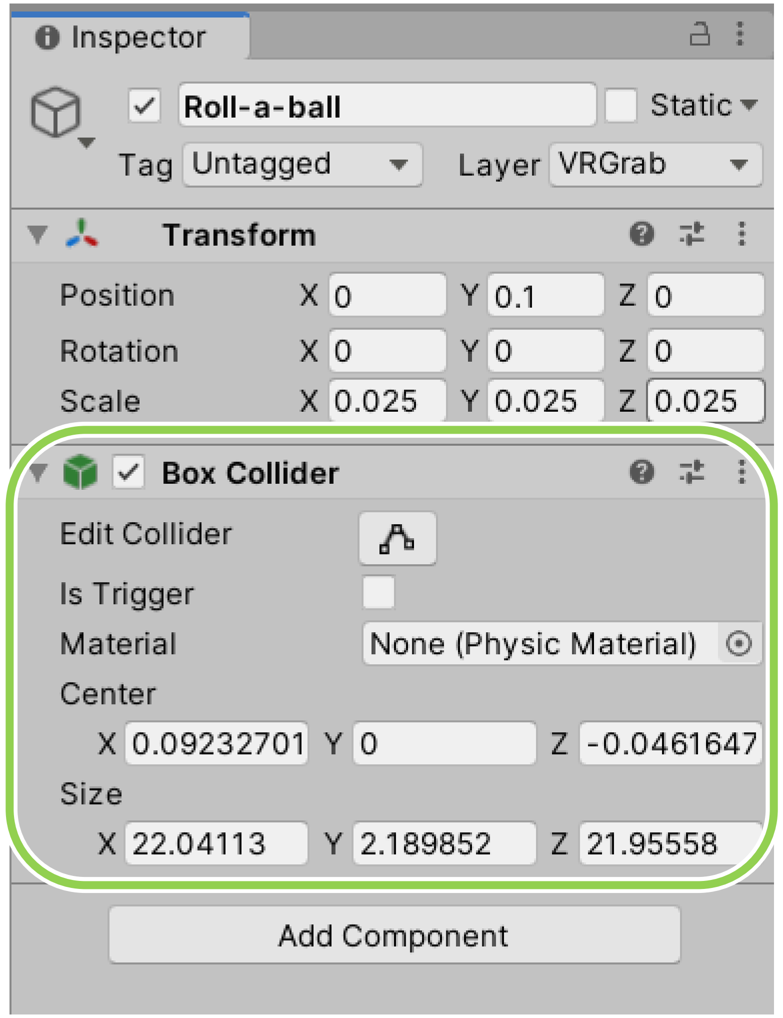
  detect when one collider enters the space of another without creating a collision

  In this example:
  Controller has OnTriggerEnter
  Roll-a-ball is triggered

Roll-a-ball > add Box Collider

- Use Edit Collider to modify the boundary to fit the size of Ground.





Inspector

Roll-a-ball
Static
Tag Untagged
Layer VRGrab

Transform

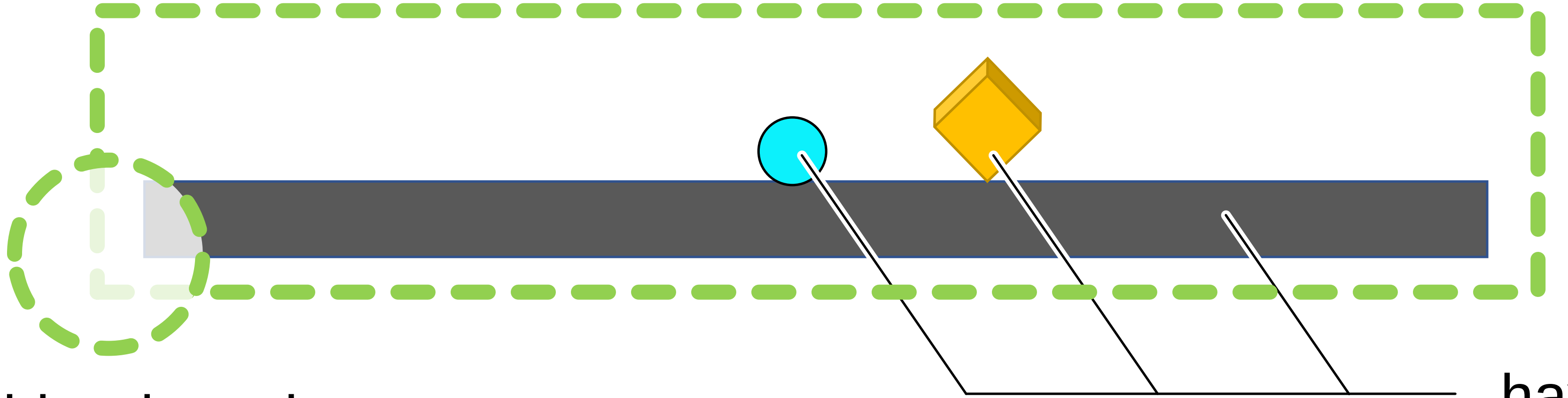
Position	X	0	Y	0.1	Z	0
Rotation	X	0	Y	0	Z	0
Scale	X	0.025	Y	0.025	Z	0.025

Box Collider

Edit Collider
Is Trigger
Material None (Physic Material)
Center
X 0.09232701 Y 0 Z -0.0461647
Size
X 22.04113 Y 2.189852 Z 21.95558

Add Component

One problem about Colliders

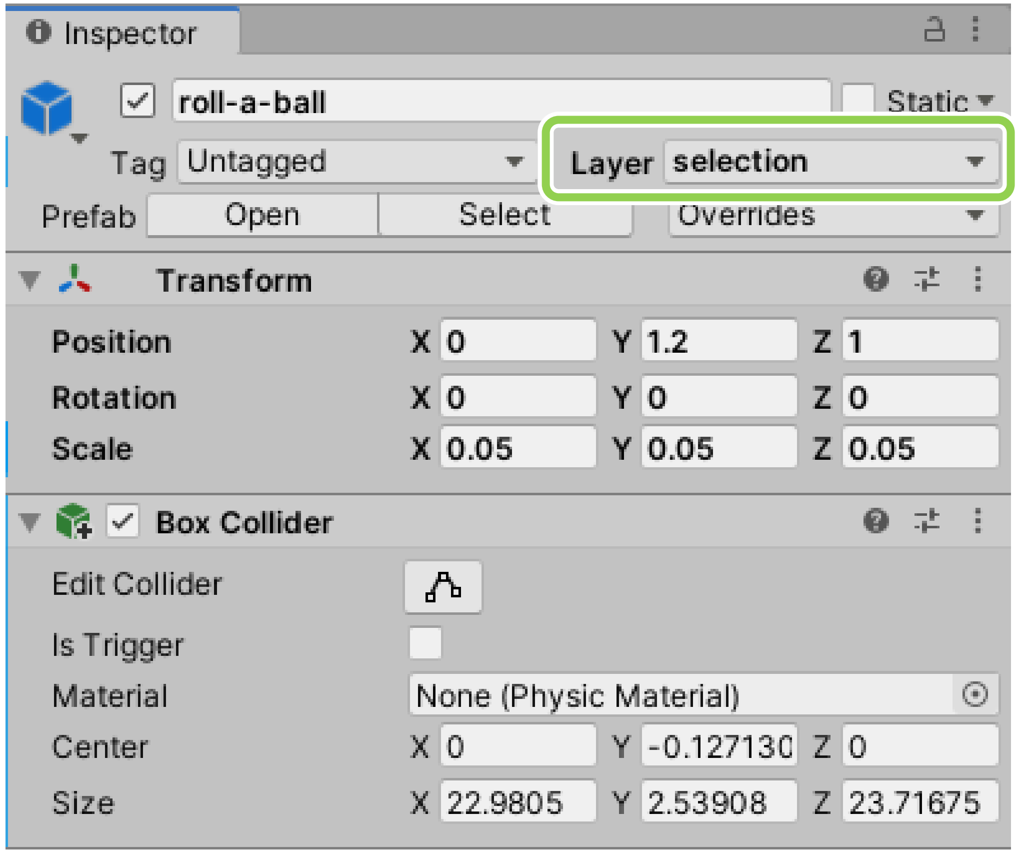


which collider does the controller trigger?

have their own colliders

Layer

- We create different layers so that the colliders of roll-a-ball and colliders of selection won't affect each other.



Inspector

roll-a-ball Static

Tag Untagged Layer selection

Prefab Open Select Overrides

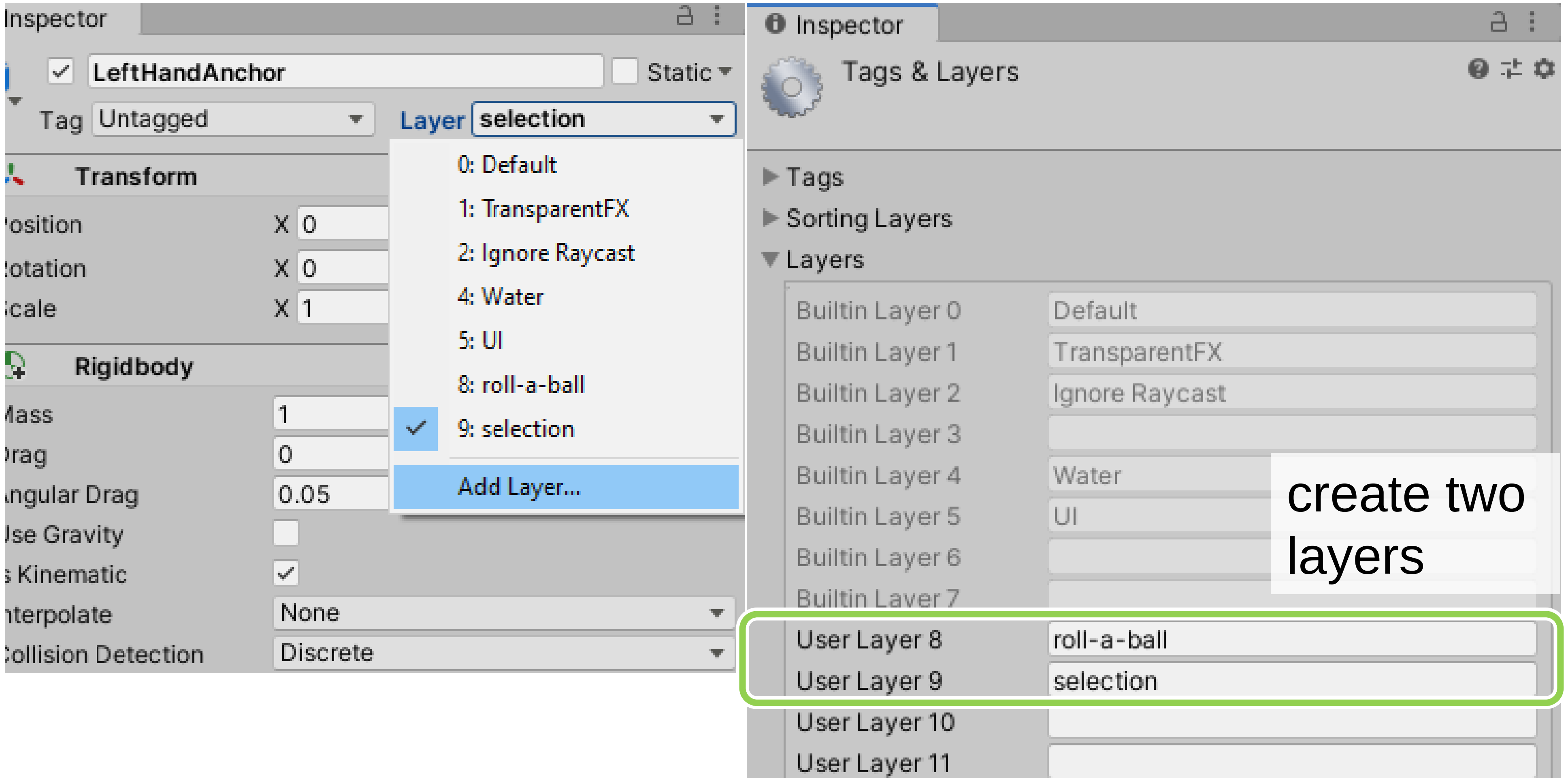
Transform

Position	X	0	Y	1.2	Z	1
Rotation	X	0	Y	0	Z	0
Scale	X	0.05	Y	0.05	Z	0.05

Box Collider

Edit Collider						
Is Trigger						
Material	None (Physic Material)					
Center	X	0	Y	-0.127130	Z	0
Size	X	22.9805	Y	2.53908	Z	23.71675

Add Layer



Inspector

✓ LeftHandAnchor Static

Tag Untagged Layer selection

Transform

Position X 0

Rotation X 0

Scale X 1

Rigidbody

Mass 1

Drag 0

Angular Drag 0.05

Use Gravity

Is Kinematic ✓

Interpolate None

Collision Detection Discrete

0: Default
1: TransparentFX
2: Ignore Raycast
4: Water
5: UI
8: roll-a-ball
✓ 9: selection
Add Layer...

Inspector

Tags & Layers

Tags

Sorting Layers

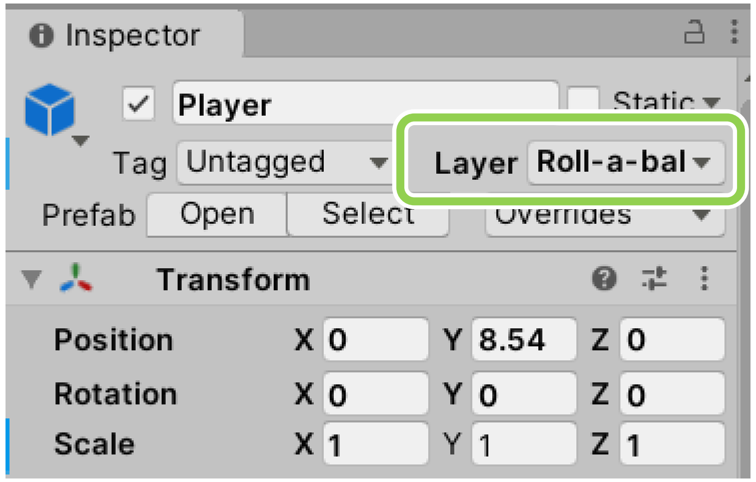
Layers

Builtin Layer 0	Default
Builtin Layer 1	TransparentFX
Builtin Layer 2	Ignore Raycast
Builtin Layer 3	
Builtin Layer 4	Water
Builtin Layer 5	UI
Builtin Layer 6	
Builtin Layer 7	
User Layer 8	roll-a-ball
User Layer 9	selection
User Layer 10	
User Layer 11	

create two layers

roll-a-ball layer

- Player
- Pickups
- Walls
- Ground


Inspector

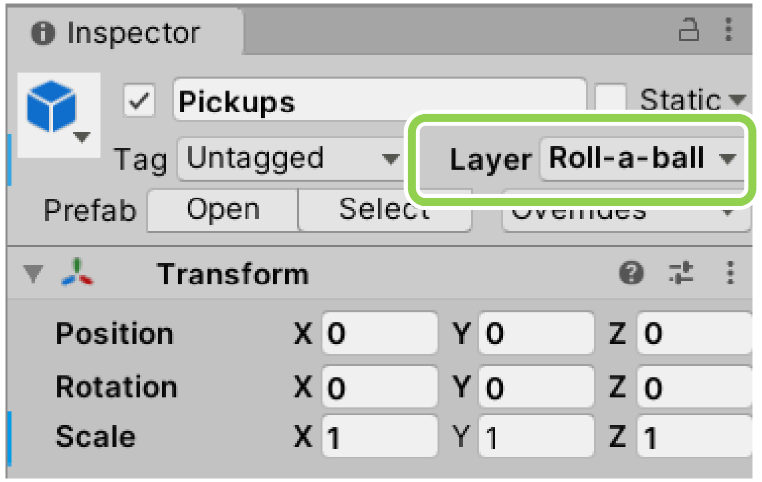
Player

Tag Untagged | Layer Roll-a-bal

Prefab Open Select Overrides

Transform

Position	X 0	Y 8.54	Z 0
Rotation	X 0	Y 0	Z 0
Scale	X 1	Y 1	Z 1


Inspector

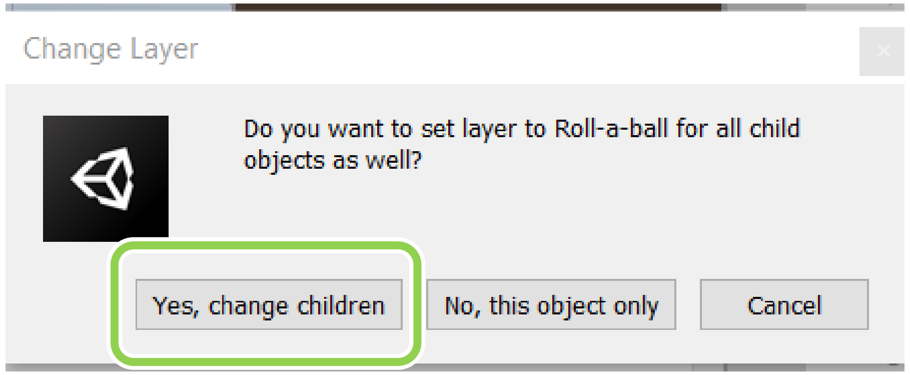
Pickups

Tag Untagged | Layer Roll-a-ball

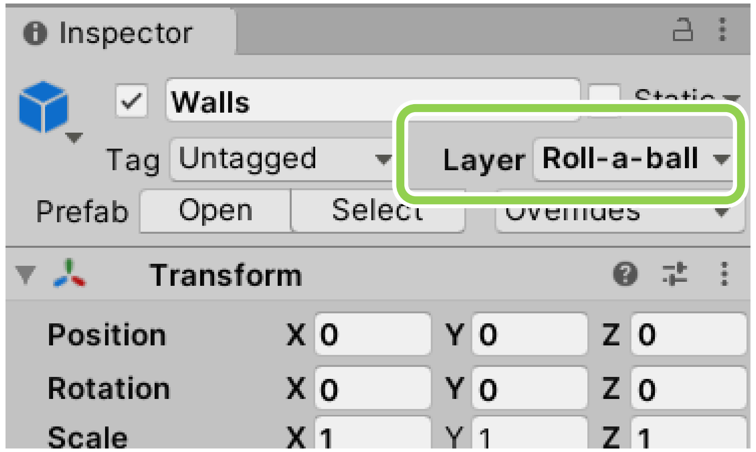
Prefab Open Select Overrides

Transform

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


Change Layer

Do you want to set layer to Roll-a-ball for all child objects as well?


Inspector

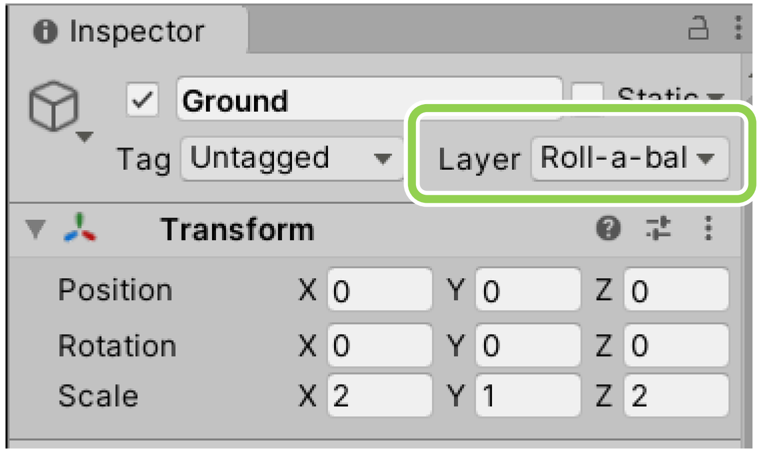
Walls

Tag Untagged | Layer Roll-a-ball

Prefab Open Select Overrides

Transform

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


Inspector

Ground

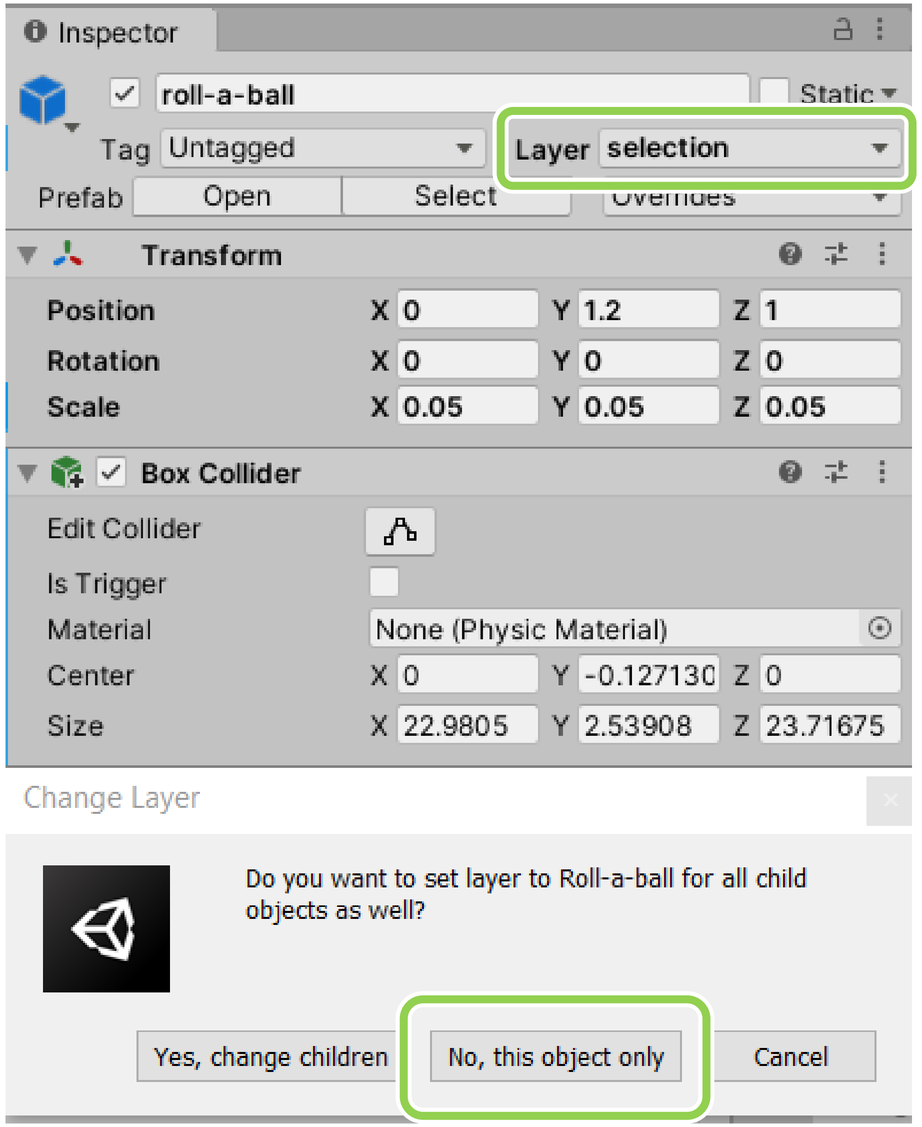
Tag Untagged | Layer Roll-a-bal

Transform

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

selection layer

- Empty GameObject roll-a-ball



Inspector

roll-a-ball   Static

Tag Untagged   Layer selection

Prefab Open Select Overrides

Transform

Position	X 0	Y 1.2	Z 1
Rotation	X 0	Y 0	Z 0
Scale	X 0.05	Y 0.05	Z 0.05

Box Collider

Edit Collider			
Is Trigger			
Material	None (Physic Material)		
Center	X 0	Y -0.127130	Z 0
Size	X 22.9805	Y 2.53908	Z 23.71675

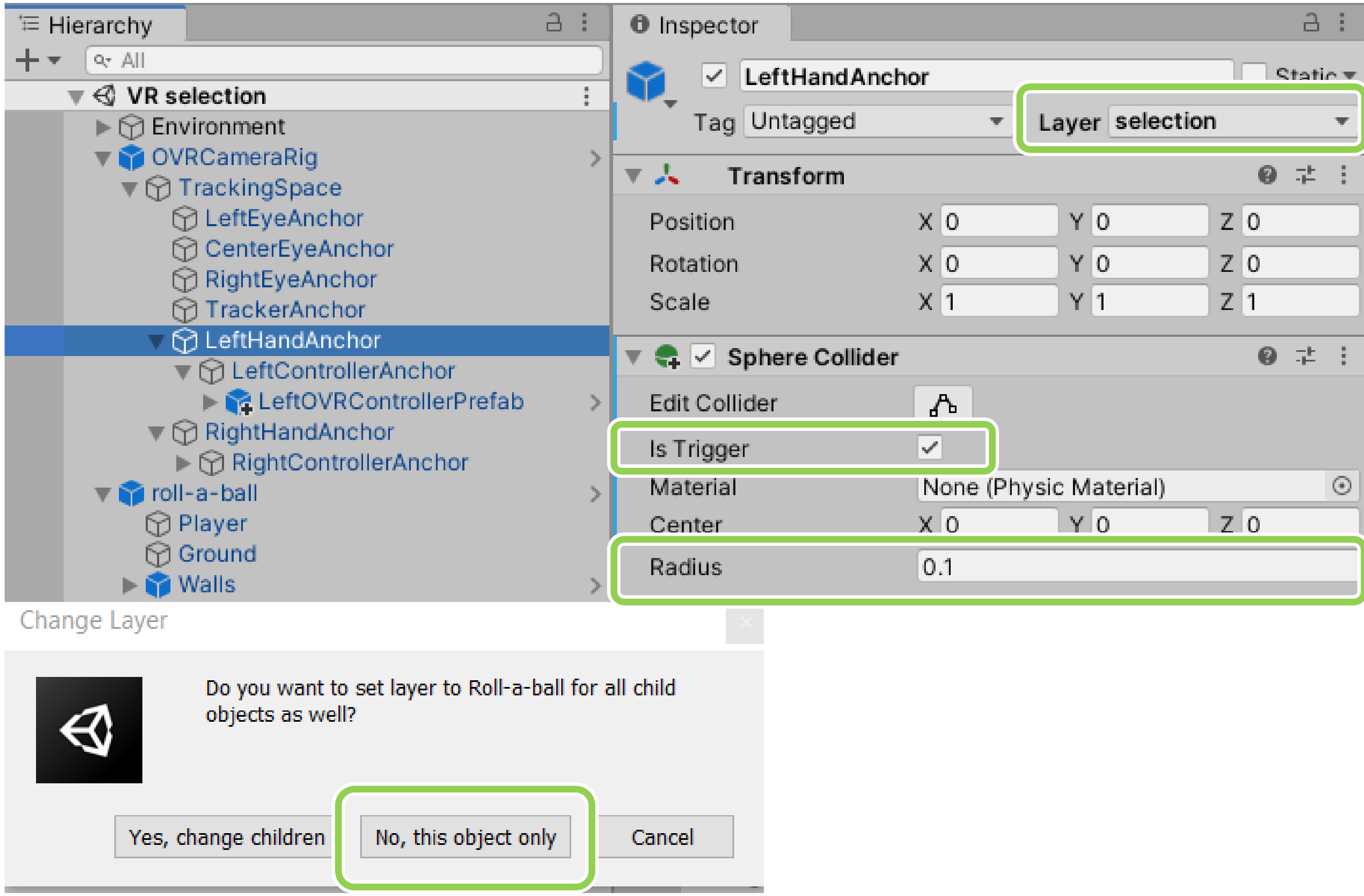
Change Layer

Do you want to set layer to Roll-a-ball for all child objects as well?

Yes, change children   No, this object only   Cancel

selection layer

- LeftHandAnchor
- RightHandAnchor
- **Add Collider**
  - **isTrigger**
  - **Adjust collider size**



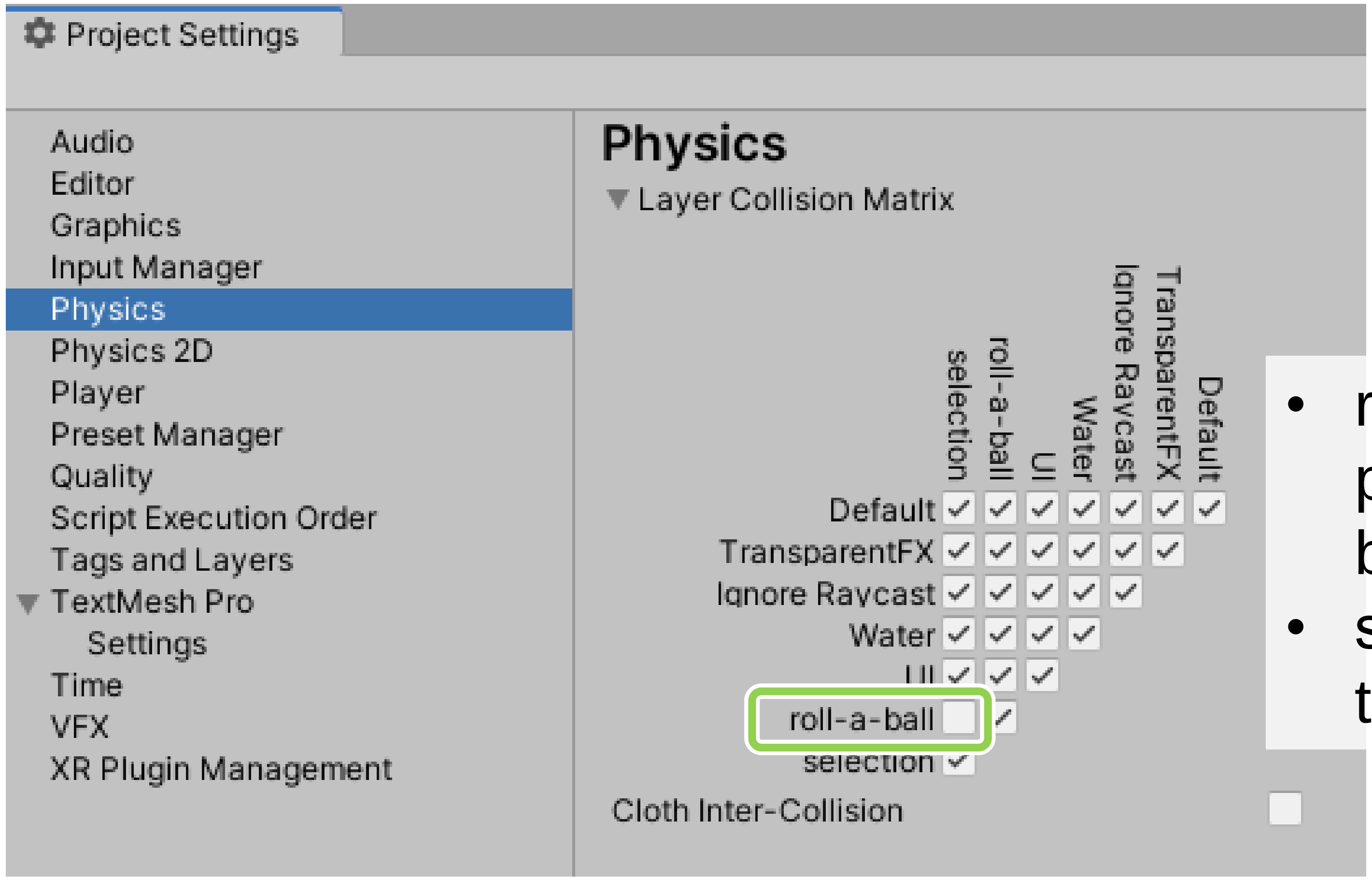
LeftHandAnchor
Tag Untagged
Layer selection

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

Is Trigger ✓
Material None (Physic Material)
Center X 0 Y 0 Z 0
Radius 0.1

Do you want to set layer to Roll-a-ball for all child objects as well?

Edit > Project Settings > Physics > layer collision matrix



Project Settings

- Audio
- Editor
- Graphics
- Input Manager
- Physics
- Physics 2D
- Player
- Preset Manager
- Quality
- Script Execution Order
- Tags and Layers
- TextMesh Pro
  - Settings
- Time
- VFX
- XR Plugin Management

Physics

Layer Collision Matrix

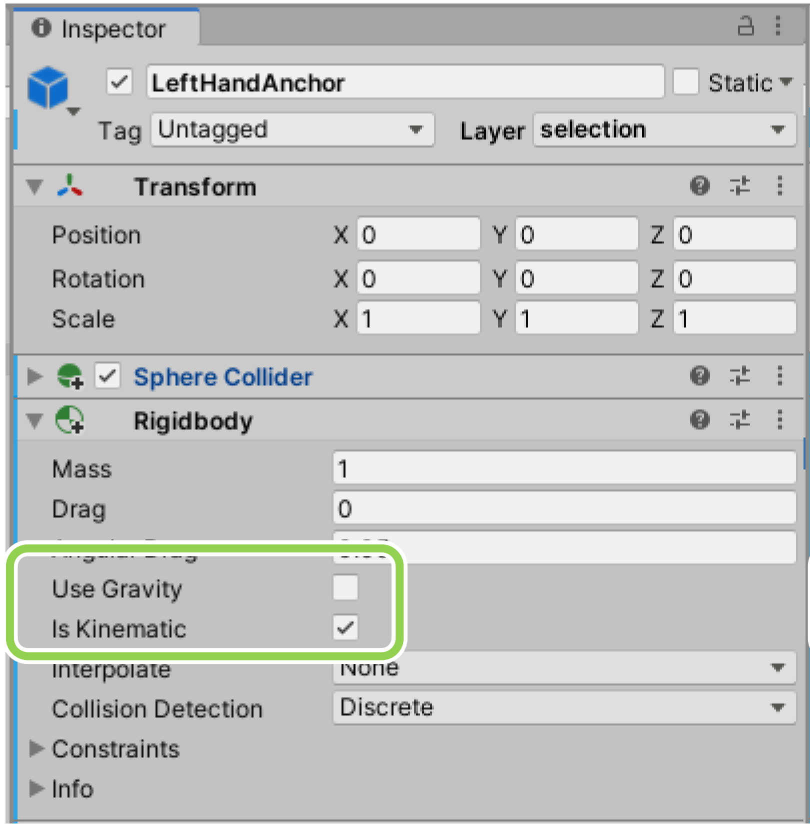
	selection	roll-a-ball	UI	Water	Ignore Raycast	TransparentFX	Default
Default	✓	✓	✓	✓	✓	✓	✓
TransparentFX	✓	✓	✓	✓	✓	✓	
Ignore Raycast	✓	✓	✓	✓	✓		
Water	✓	✓	✓	✓			
UI	✓	✓	✓				
roll-a-ball	☐	✓					
selection	✓						

Cloth Inter-Collision ☐

- roll-a-ball objects have physics within roll-a-ball objects.
- selection objects won’t trigger roll-a-ball

Add Rigidbody on

LeftHandAnchor



Inspector

LeftHandAnchor — Static

Tag: Untagged — Layer: selection

Transform

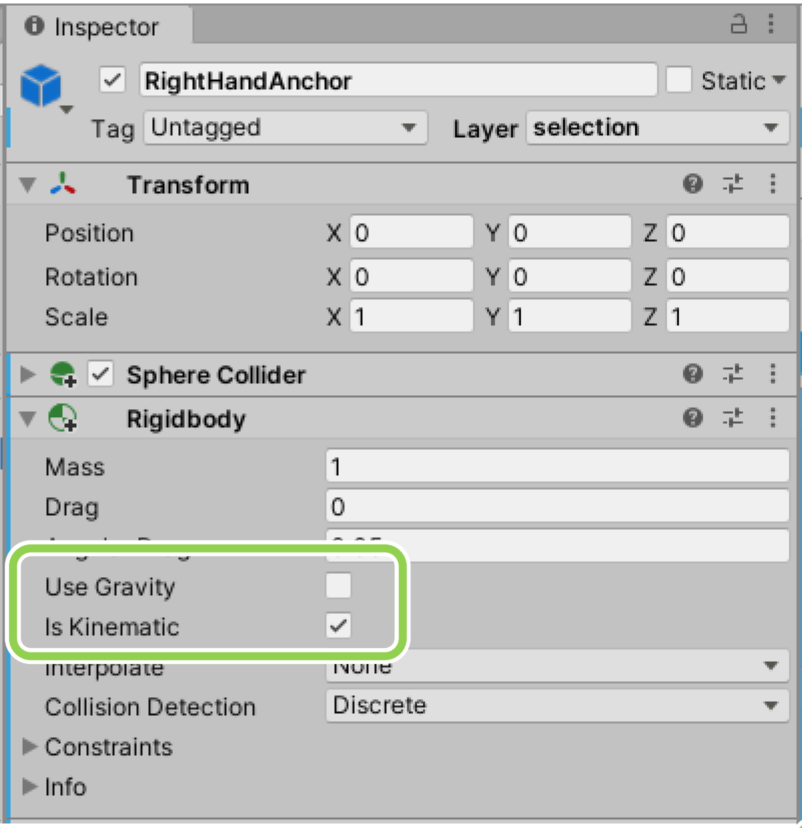
- Position: X 0, Y 0, Z 0
- Rotation: X 0, Y 0, Z 0
- Scale: X 1, Y 1, Z 1

Sphere Collider

Rigidbody

- Mass: 1
- Drag: 0
- Angular Drag: 0.05
- Use Gravity: ☐
- Is Kinematic: ✓
- Interpolate: None
- Collision Detection: Discrete
- Constraints
- Info

RightHandAnchor



Inspector

RightHandAnchor — Static

Tag: Untagged — Layer: selection

Transform

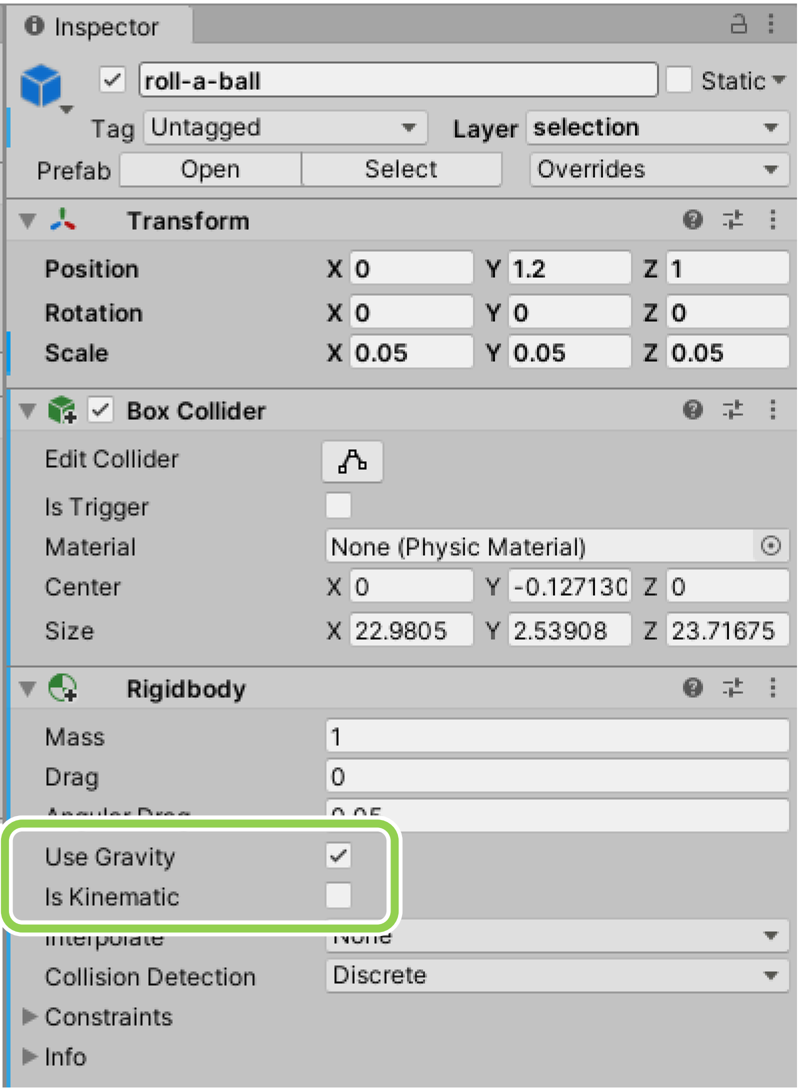
- Position: X 0, Y 0, Z 0
- Rotation: X 0, Y 0, Z 0
- Scale: X 1, Y 1, Z 1

Sphere Collider

Rigidbody

- Mass: 1
- Drag: 0
- Angular Drag: 0.05
- Use Gravity: ☐
- Is Kinematic: ✓
- Interpolate: None
- Collision Detection: Discrete
- Constraints
- Info

Roll-a-ball



Inspector

roll-a-ball — Static

Tag: Untagged — Layer: selection

Prefab: Open — Select — Overrides

Transform

- Position: X 0, Y 1.2, Z 1
- Rotation: X 0, Y 0, Z 0
- Scale: X 0.05, Y 0.05, Z 0.05

Box Collider

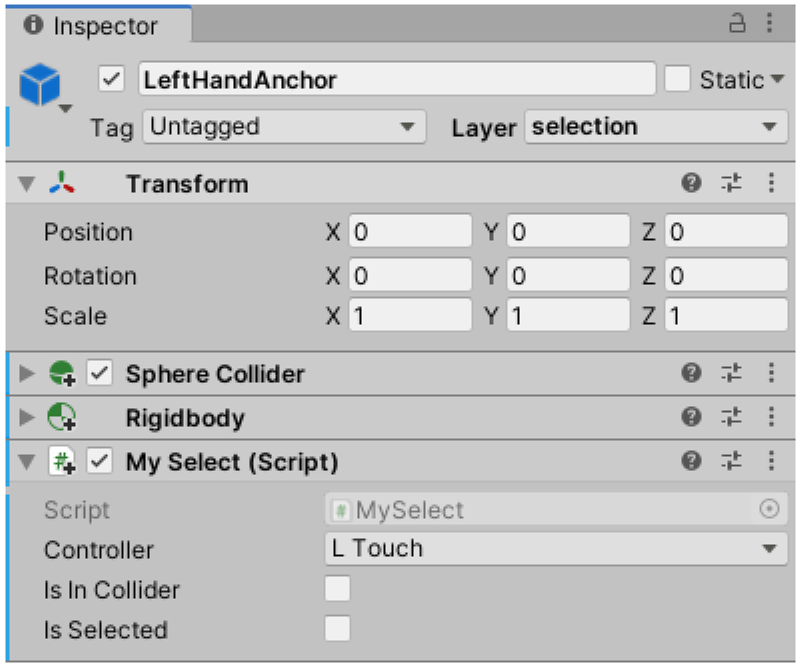
- Edit Collider
- Is Trigger: ☐
- Material: None (Physic Material)
- Center: X 0, Y -0.127130, Z 0
- Size: X 22.9805, Y 2.53908, Z 23.71675

Rigidbody

- Mass: 1
- Drag: 0
- Angular Drag: 0.05
- Use Gravity: ✓
- Is Kinematic: ☐
- Interpolate: None
- Collision Detection: Discrete
- Constraints
- Info

Add a new script ‘MySelect.cs’ on

LeftHandAnchor



Inspector

LeftHandAnchor — Static

Tag: Untagged — Layer: selection

Transform

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

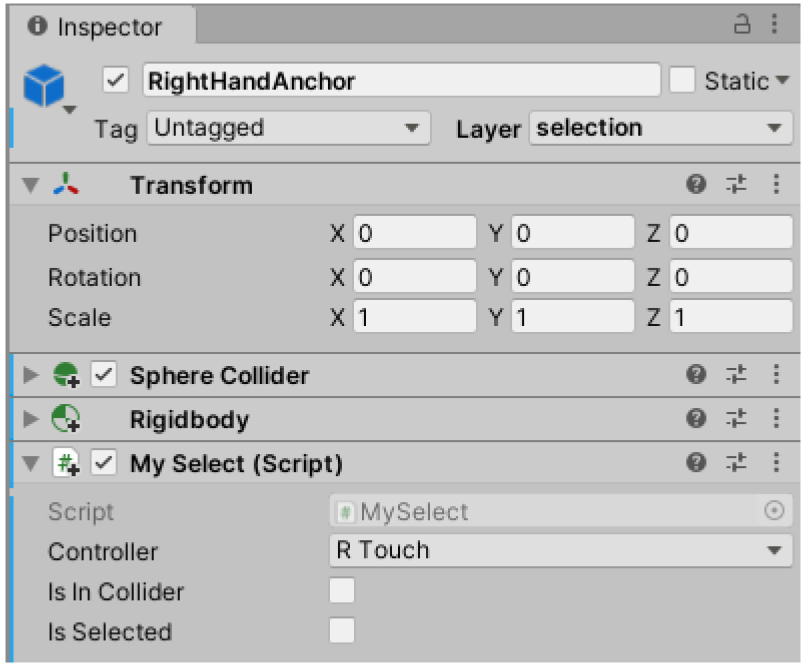
Sphere Collider

Rigidbody

My Select (Script)

Script: MySelect
Controller: L Touch
Is In Collider: ☐
Is Selected: ☐

RightHandAnchor



Inspector

RightHandAnchor — Static

Tag: Untagged — Layer: selection

Transform

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

Sphere Collider

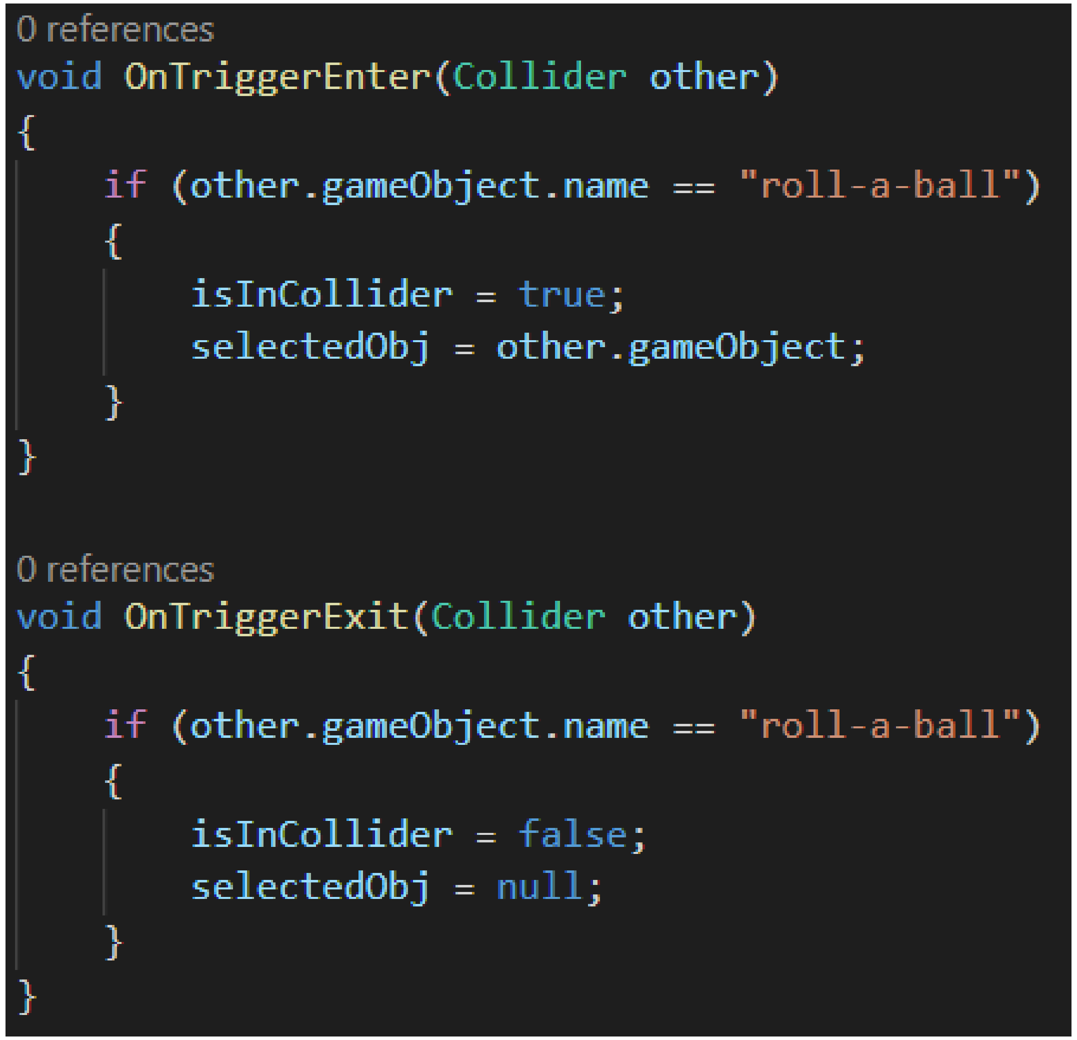
Rigidbody

My Select (Script)

Script: MySelect
Controller: R Touch
Is In Collider: ☐
Is Selected: ☐

In MySelect.cs

- Detecting whether controller is in the collider of roll-a-ball

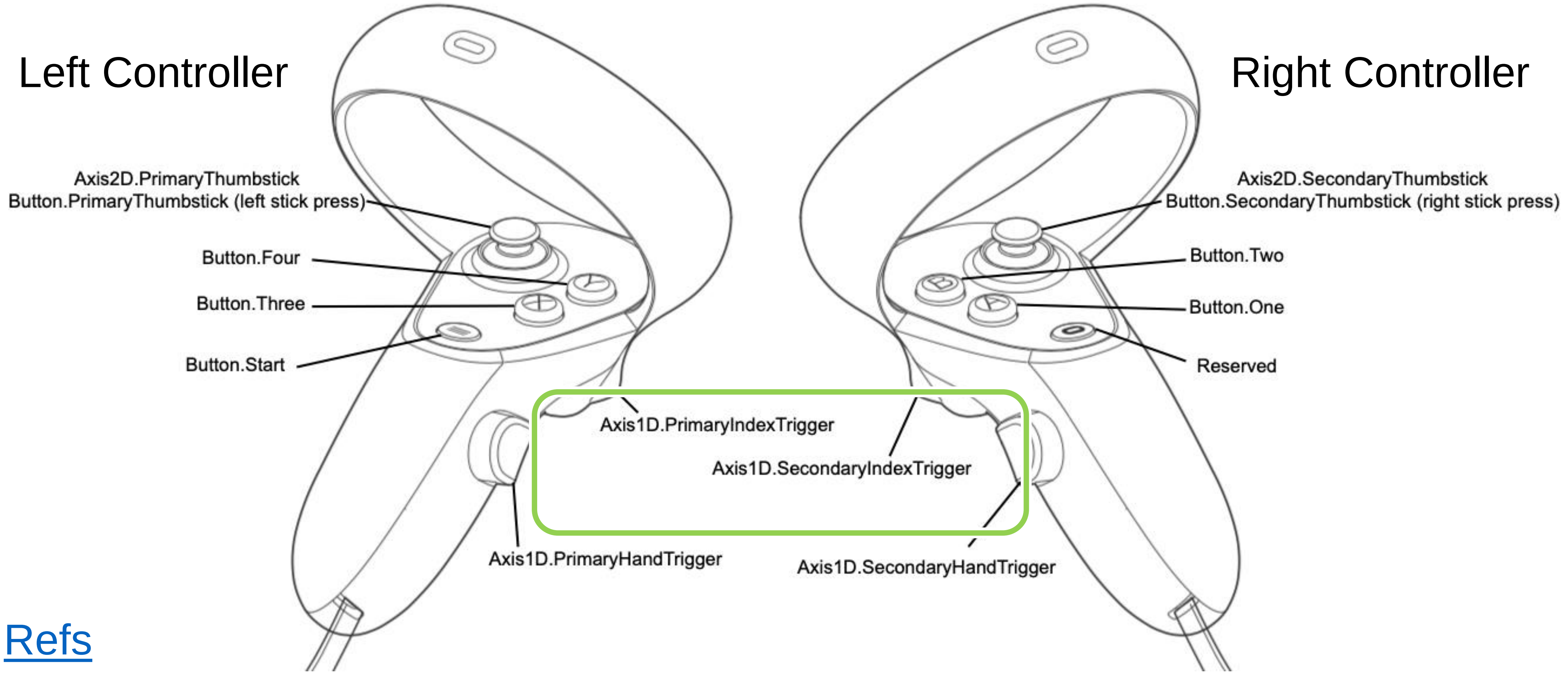


```
0 references
void OnTriggerEnter(Collider other)
{
    if (other.gameObject.name == "roll-a-ball")
    {
        isInCollider = true;
        selectedObj = other.gameObject;
    }
}

0 references
void OnTriggerExit(Collider other)
{
    if (other.gameObject.name == "roll-a-ball")
    {
        isInCollider = false;
        selectedObj = null;
    }
}
```

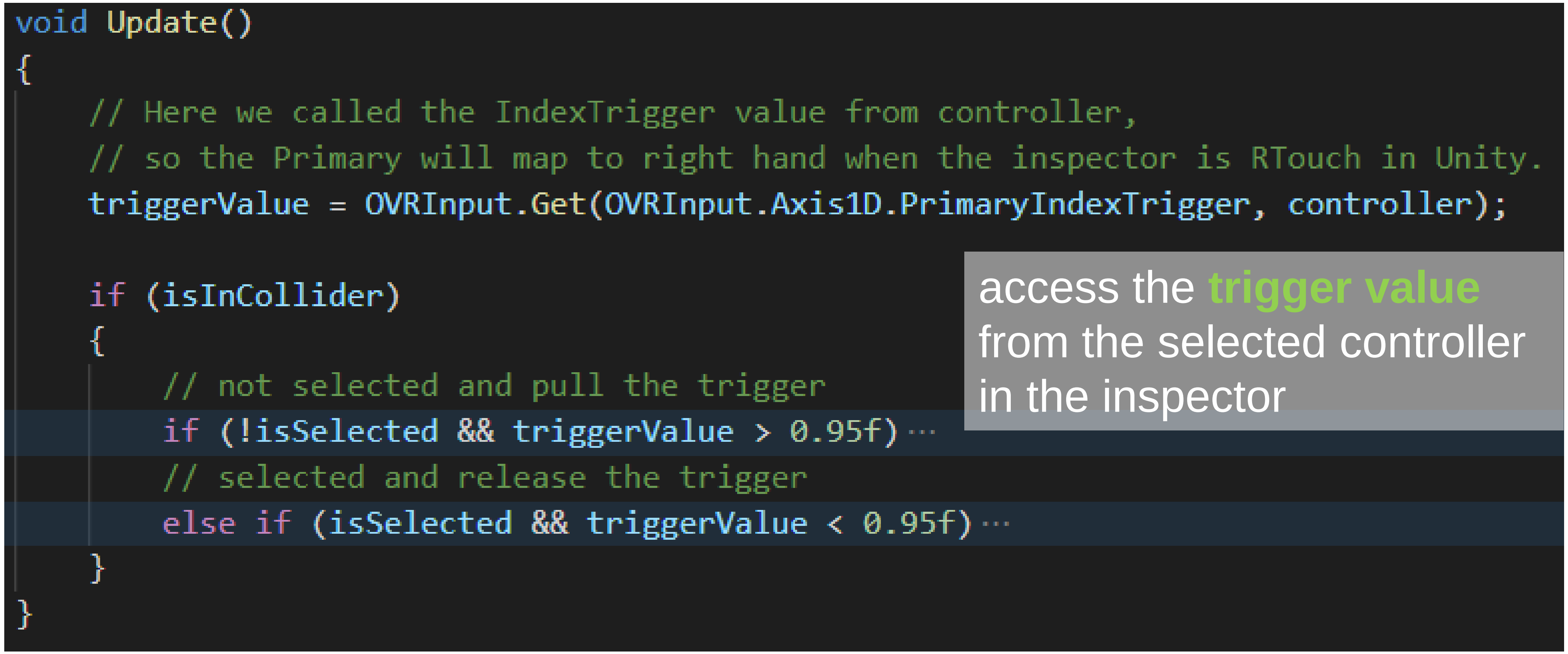
```
if (controller is in the collider of roll-a-ball)
    if (not selected and pull the trigger)
        selects roll-a-ball
    else if (selected and release the trigger)
        releases roll-a-ball
```

Use IndexTrigger as input


Left Controller
Right Controller
Axis2D.PrimaryThumbstick
Button.PrimaryThumbstick (left stick press)
Button.Four
Button.Three
Button.Start
Axis2D.SecondaryThumbstick
Button.SecondaryThumbstick (right stick press)
Button.Two
Button.One
Reserved
Axis1D.PrimaryIndexTrigger
Axis1D.SecondaryIndexTrigger
Axis1D.PrimaryHandTrigger
Axis1D.SecondaryHandTrigger

Refs

In MySelect.cs



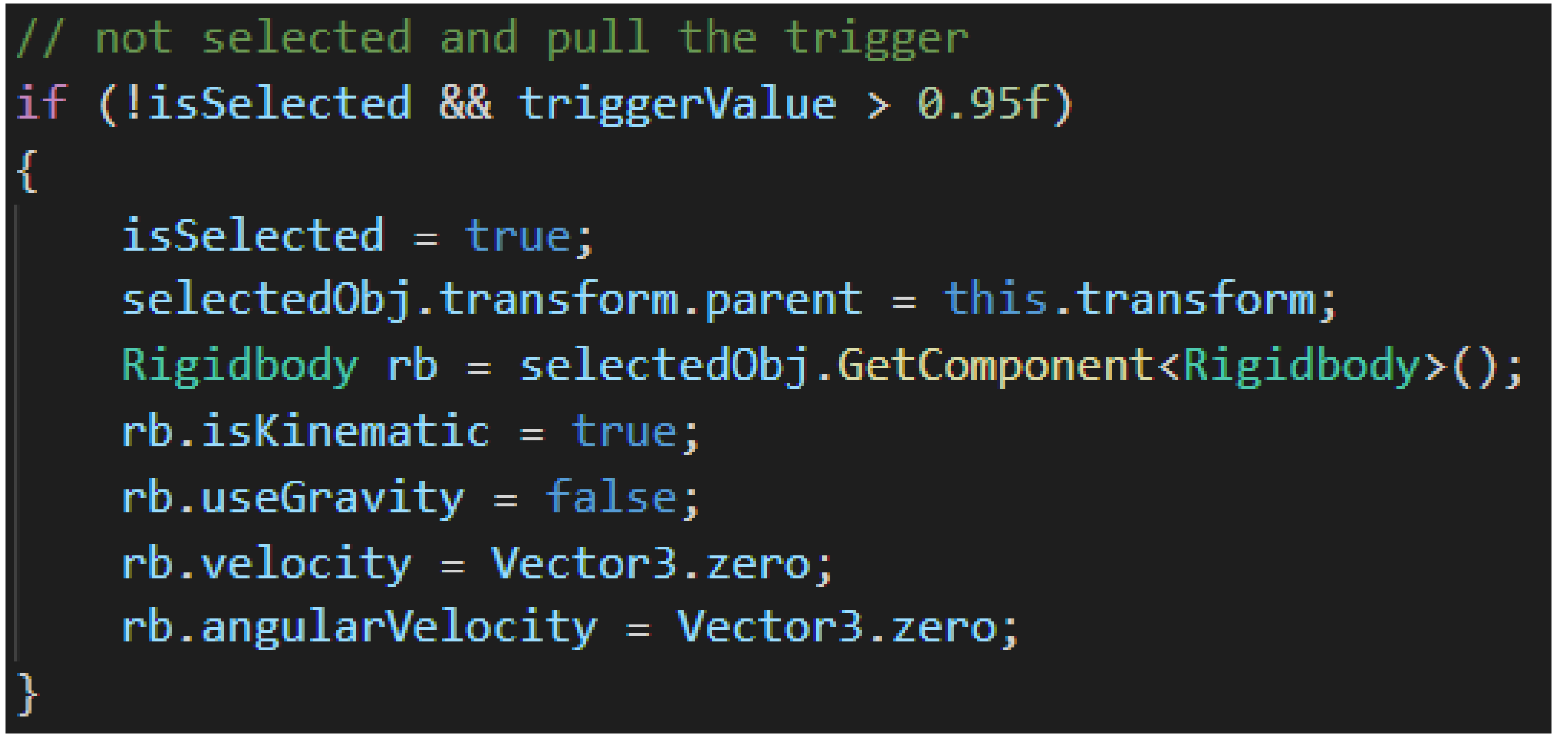
```
void Update()
{
    // Here we called the IndexTrigger value from controller,
    // so the Primary will map to right hand when the inspector is RTouch in Unity.
    triggerValue = OVRInput.Get(OVRInput.Axis1D.PrimaryIndexTrigger, controller);

    if (isInCollider)
    {
        // not selected and pull the trigger
        if (!isSelected && triggerValue > 0.95f)···
        // selected and release the trigger
        else if (isSelected && triggerValue < 0.95f)···
    }
}
```

access the **trigger value** from the selected controller in the inspector

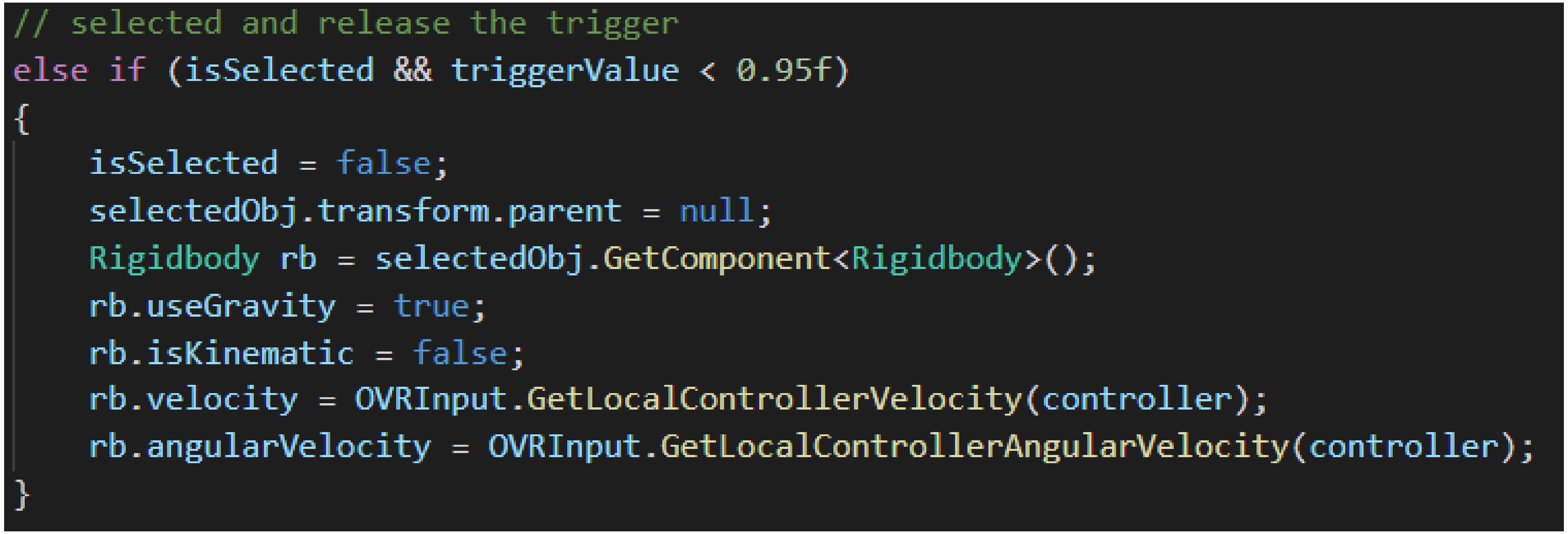
select

make roll-a-ball as the Child of HandAnchor



```
// not selected and pull the trigger
if (!isSelected && triggerValue > 0.95f)
{
    isSelected = true;
    selectedObj.transform.parent = this.transform;
    Rigidbody rb = selectedObj.GetComponent<Rigidbody>();
    rb.isKinematic = true;
    rb.useGravity = false;
    rb.velocity = Vector3.zero;
    rb.angularVelocity = Vector3.zero;
}
```

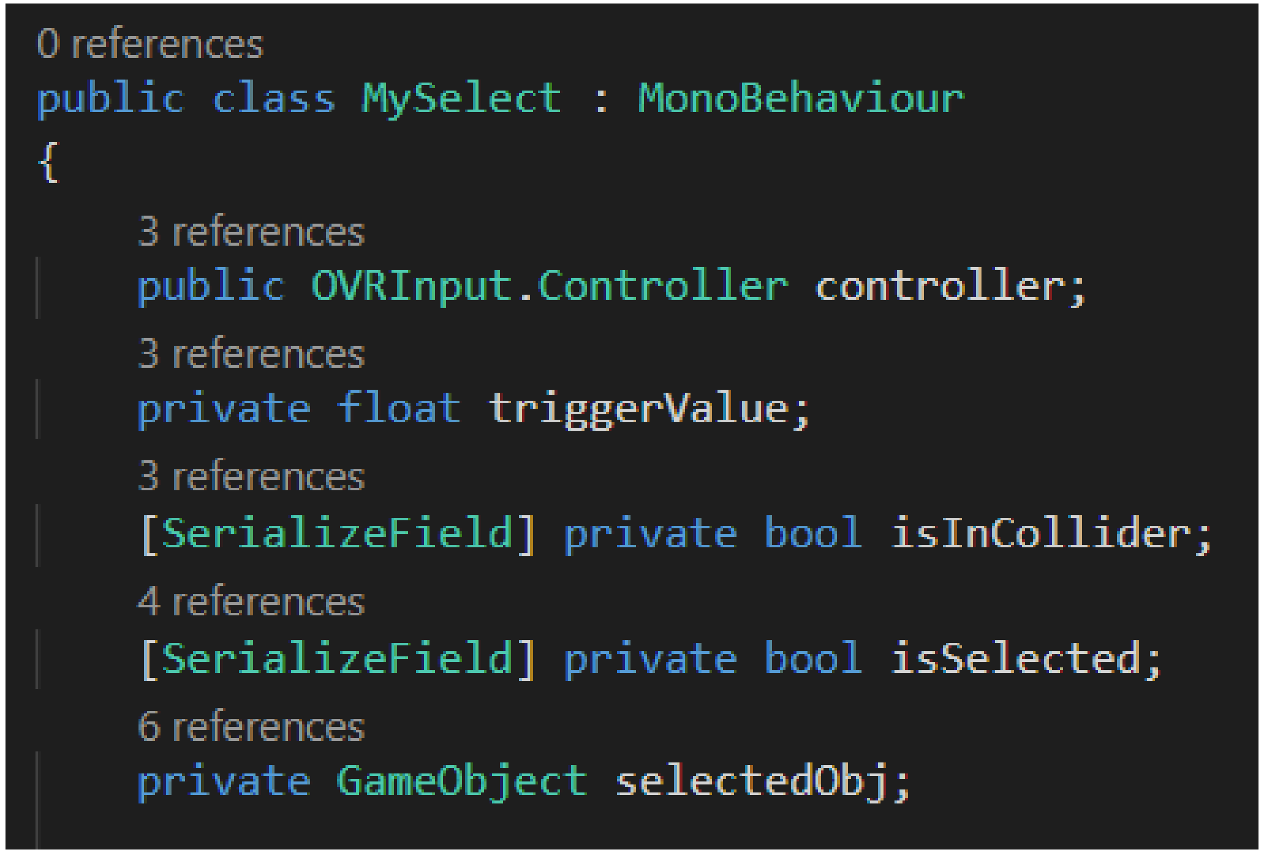
release



```
// selected and release the trigger
else if (isSelected && triggerValue < 0.95f)
{
    isSelected = false;
    selectedObj.transform.parent = null;
    Rigidbody rb = selectedObj.GetComponent<Rigidbody>();
    rb.useGravity = true;
    rb.isKinematic = false;
    rb.velocity = OVRInput.GetLocalControllerVelocity(controller);
    rb.angularVelocity = OVRInput.GetLocalControllerAngularVelocity(controller);
}
```

- remove Parent
- adjust all the physics back
- velocity and angular velocity have to use the tracked value from OVRInput

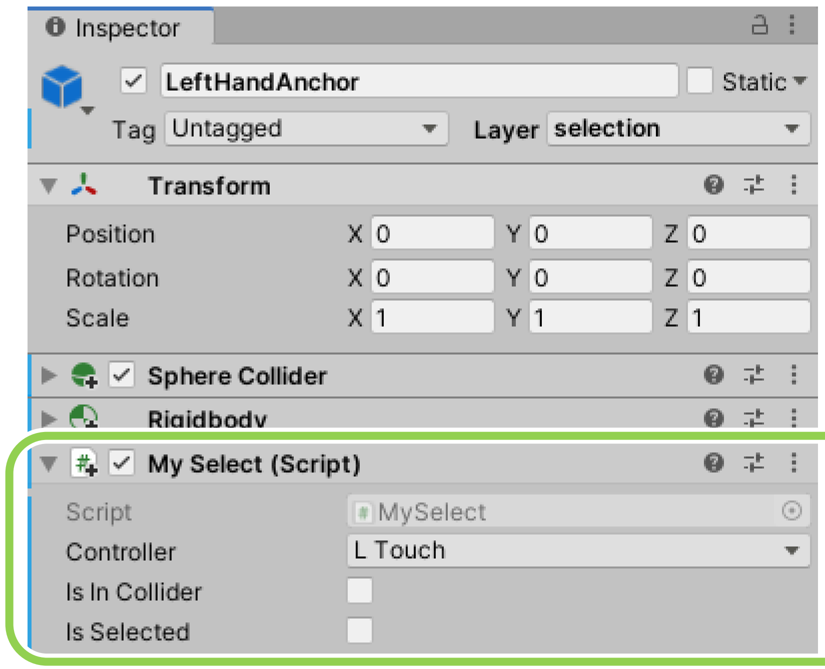
variables



```
0 references
public class MySelect : MonoBehaviour
{
        3 references
        public OVRInput.Controller controller;
        3 references
        private float triggerValue;
        3 references
        [SerializeField] private bool isInCollider;
        4 references
        [SerializeField] private bool isSelected;
        6 references
        private GameObject selectedObj;
```

Select L & R Touch in the inspector

LeftHandAnchor



Inspector

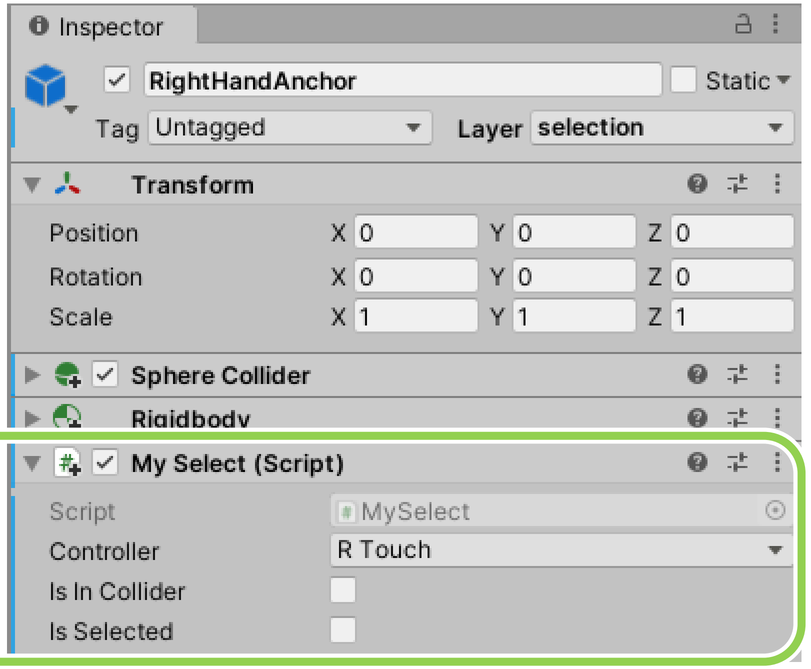
LeftHandAnchor ✓ Static
Tag Untagged Layer selection

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

Sphere Collider ✓
Rigidbody

My Select (Script) ✓
Script MySelect
Controller L Touch
Is In Collider
Is Selected

RightHandAnchor



Inspector

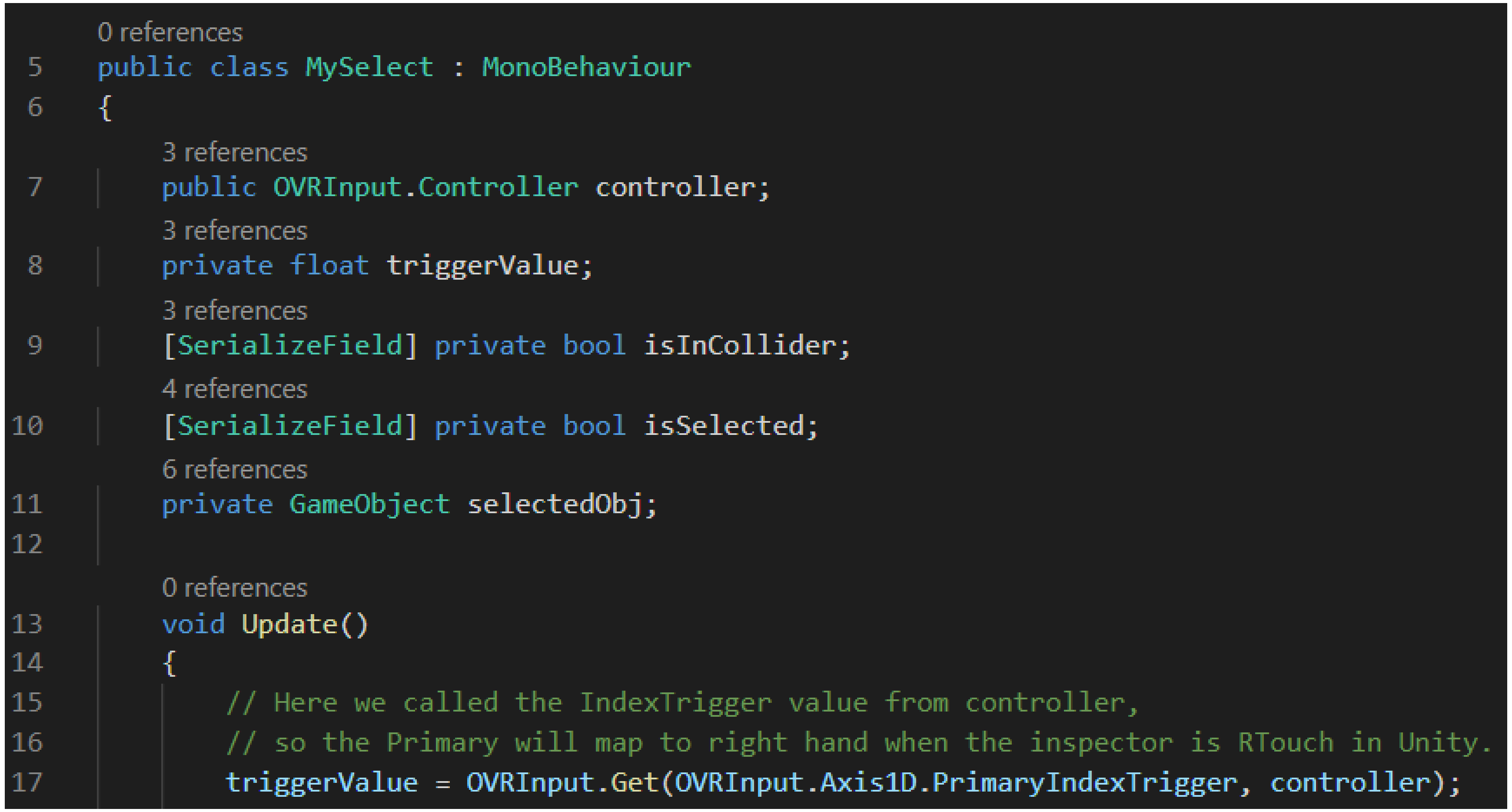
RightHandAnchor ✓ Static
Tag Untagged Layer selection

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

Sphere Collider ✓
Rigidbody

My Select (Script) ✓
Script MySelect
Controller R Touch
Is In Collider
Is Selected

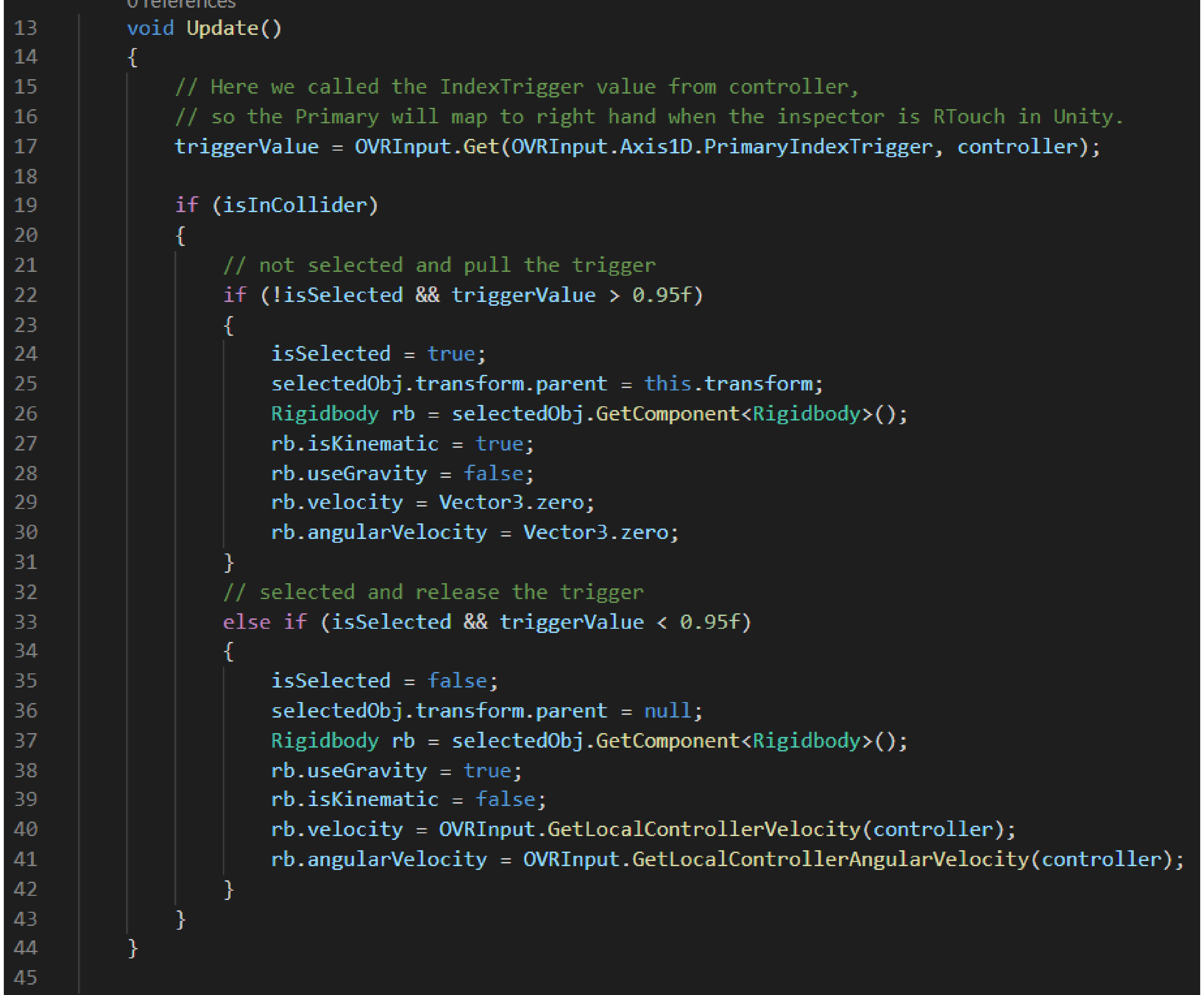
code 1/3



```
0 references
public class MySelect : MonoBehaviour
{
    3 references
    public OVRInput.Controller controller;
    3 references
    private float triggerValue;
    3 references
    [SerializeField] private bool isInCollider;
    4 references
    [SerializeField] private bool isSelected;
    6 references
    private GameObject selectedObj;

    0 references
    void Update()
    {
        // Here we called the IndexTrigger value from controller,
        // so the Primary will map to right hand when the inspector is RTouch in Unity.
        triggerValue = OVRInput.Get(OVRInput.Axis1D.PrimaryIndexTrigger, controller);
```

code 2/3

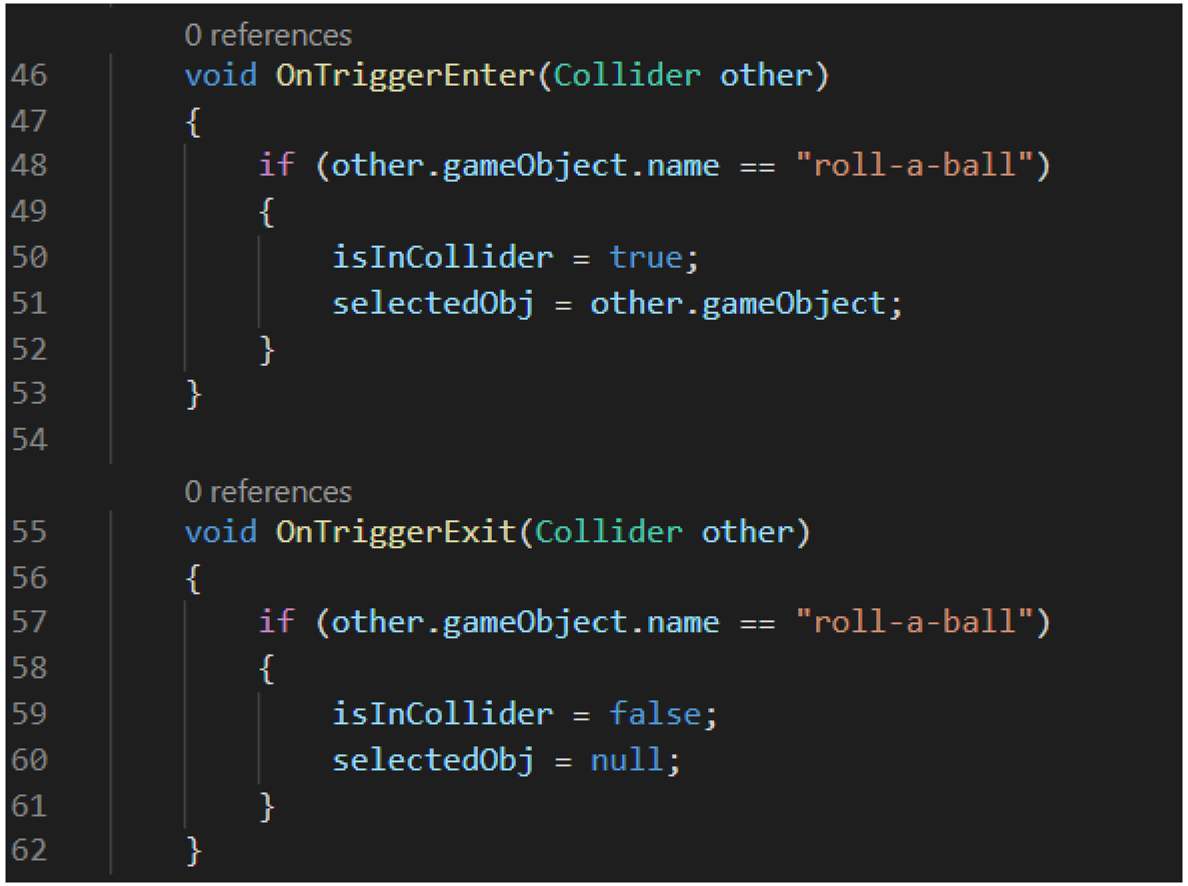


```
void Update()
{
    // Here we called the IndexTrigger value from controller,
    // so the Primary will map to right hand when the inspector is RTouch in Unity.
    triggerValue = OVRInput.Get(OVRInput.Axis1D.PrimaryIndexTrigger, controller);

    if (isInCollider)
    {
        // not selected and pull the trigger
        if (!isSelected && triggerValue > 0.95f)
        {
            isSelected = true;
            selectedObj.transform.parent = this.transform;
            Rigidbody rb = selectedObj.GetComponent<Rigidbody>();
            rb.isKinematic = true;
            rb.useGravity = false;
            rb.velocity = Vector3.zero;
            rb.angularVelocity = Vector3.zero;
        }
        // selected and release the trigger
        else if (isSelected && triggerValue < 0.95f)
        {
            isSelected = false;
            selectedObj.transform.parent = null;
            Rigidbody rb = selectedObj.GetComponent<Rigidbody>();
            rb.useGravity = true;
            rb.isKinematic = false;
            rb.velocity = OVRInput.GetLocalControllerVelocity(controller);
            rb.angularVelocity = OVRInput.GetLocalControllerAngularVelocity(controller);
        }
    }
}

```

code 3/3



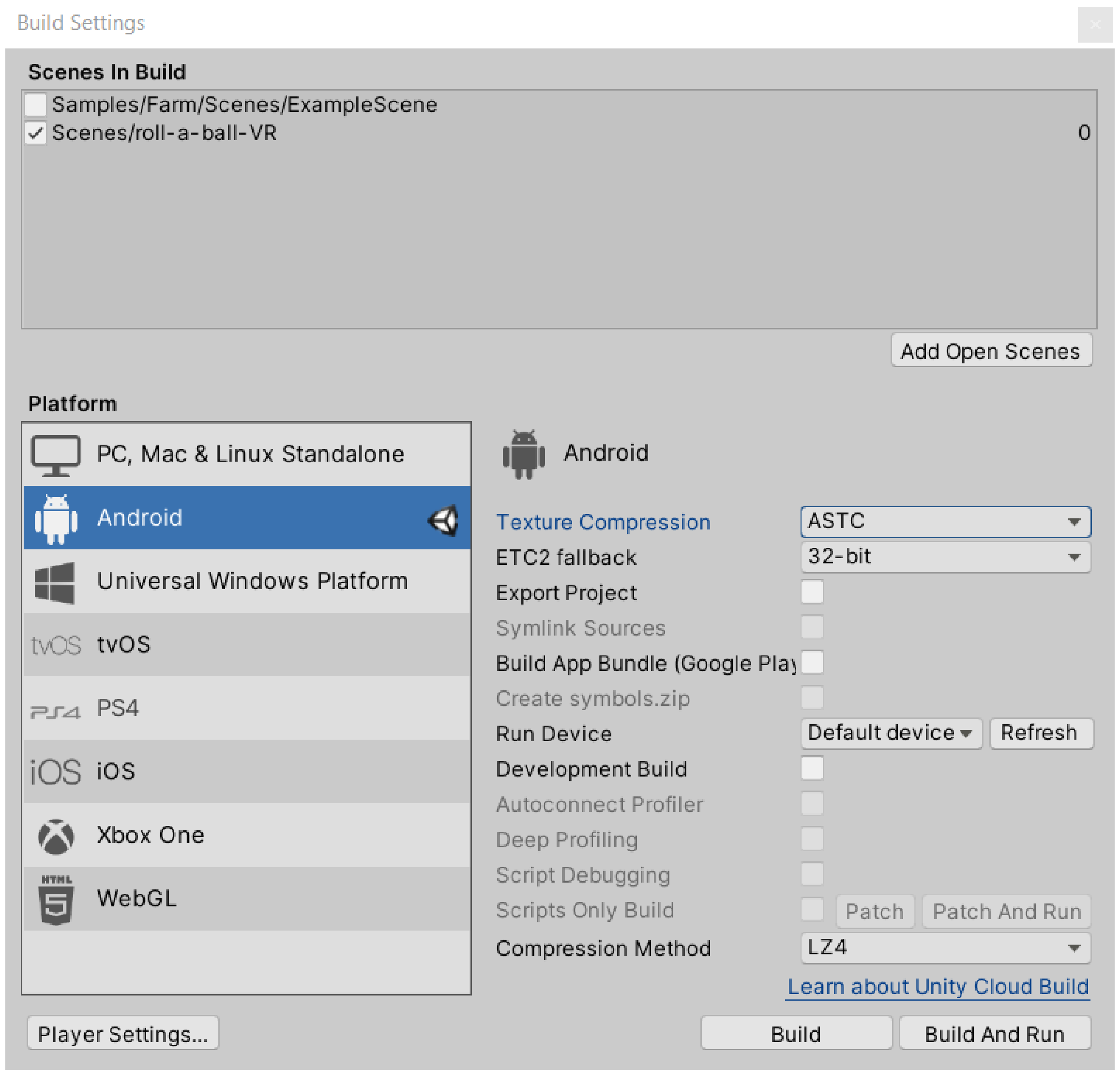
```
0 references
void OnTriggerEnter(Collider other)
{
    if (other.gameObject.name == "roll-a-ball")
    {
        isInCollider = true;
        selectedObj = other.gameObject;
    }
}

0 references
void OnTriggerExit(Collider other)
{
    if (other.gameObject.name == "roll-a-ball")
    {
        isInCollider = false;
        selectedObj = null;
    }
}
```

deploy

File > Build Setting > **Build And Run**

It takes a while to build project



Build Settings

Scenes In Build

☐ Samples/Farm/Scenes/ExampleScene
✓ Scenes/roll-a-ball-VR 0

Add Open Scenes

Platform

- PC, Mac & Linux Standalone
- Android
- Universal Windows Platform
- tvOS
- PS4
- iOS
- Xbox One
- WebGL

Android

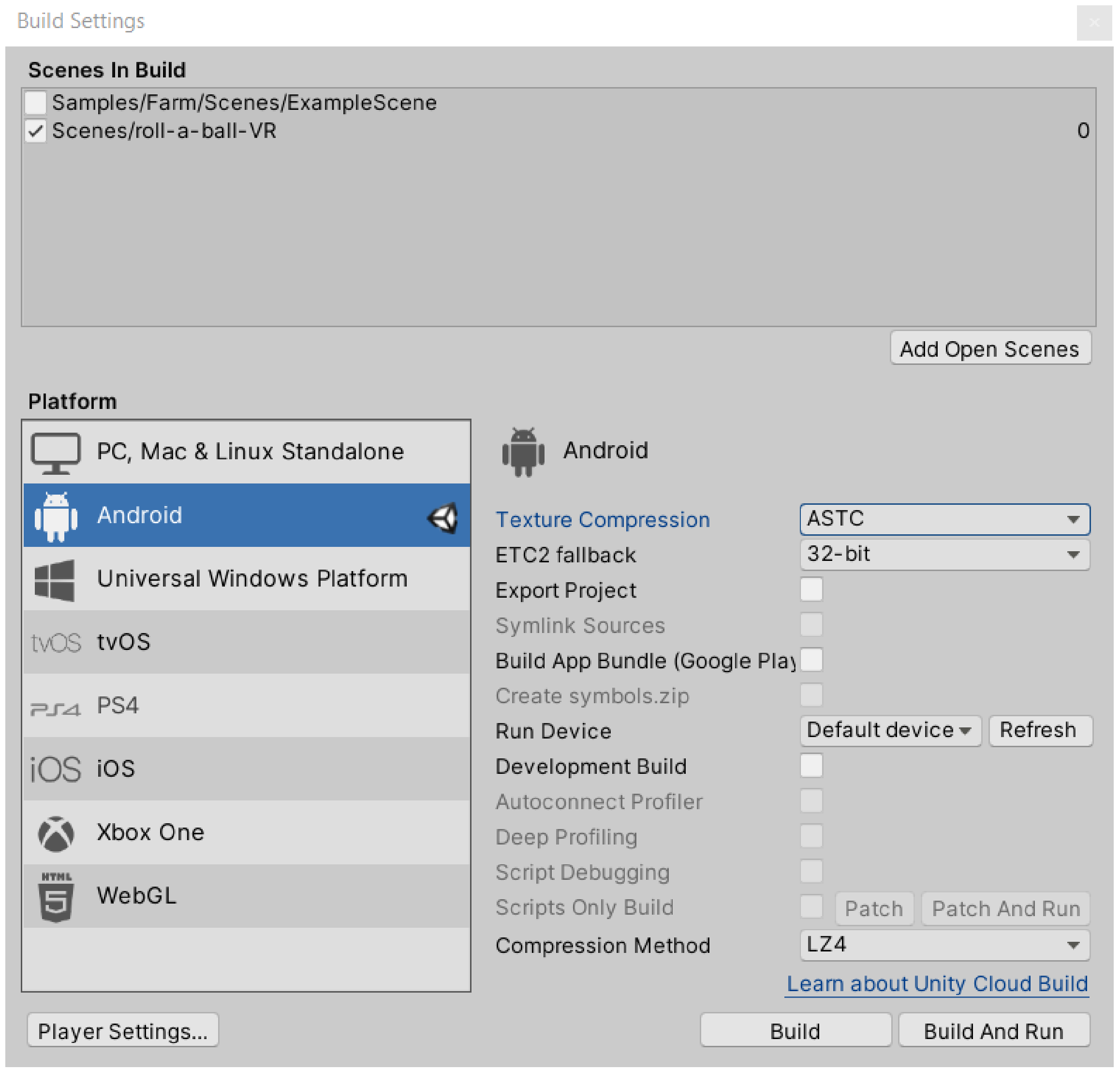
Texture Compression	ASTC
ETC2 fallback	32-bit
Export Project	☐
Symlink Sources	☐
Build App Bundle (Google Play	☐
Create symbols.zip	☐
Run Device	Default device; Refresh
Development Build	☐
Autoconnect Profiler	☐
Deep Profiling	☐
Script Debugging	☐
Scripts Only Build	☐ Patch; Patch And Run
Compression Method	LZ4

Learn about Unity Cloud Build

Player Settings... Build Build And Run

File > Build Setting > **Build**

It takes a while to build project


Build Settings

Scenes In Build

- [ ] Samples/Farm/Scenes/ExampleScene
- [✓] Scenes/roll-a-ball-VR 0

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Script Debugging	☐
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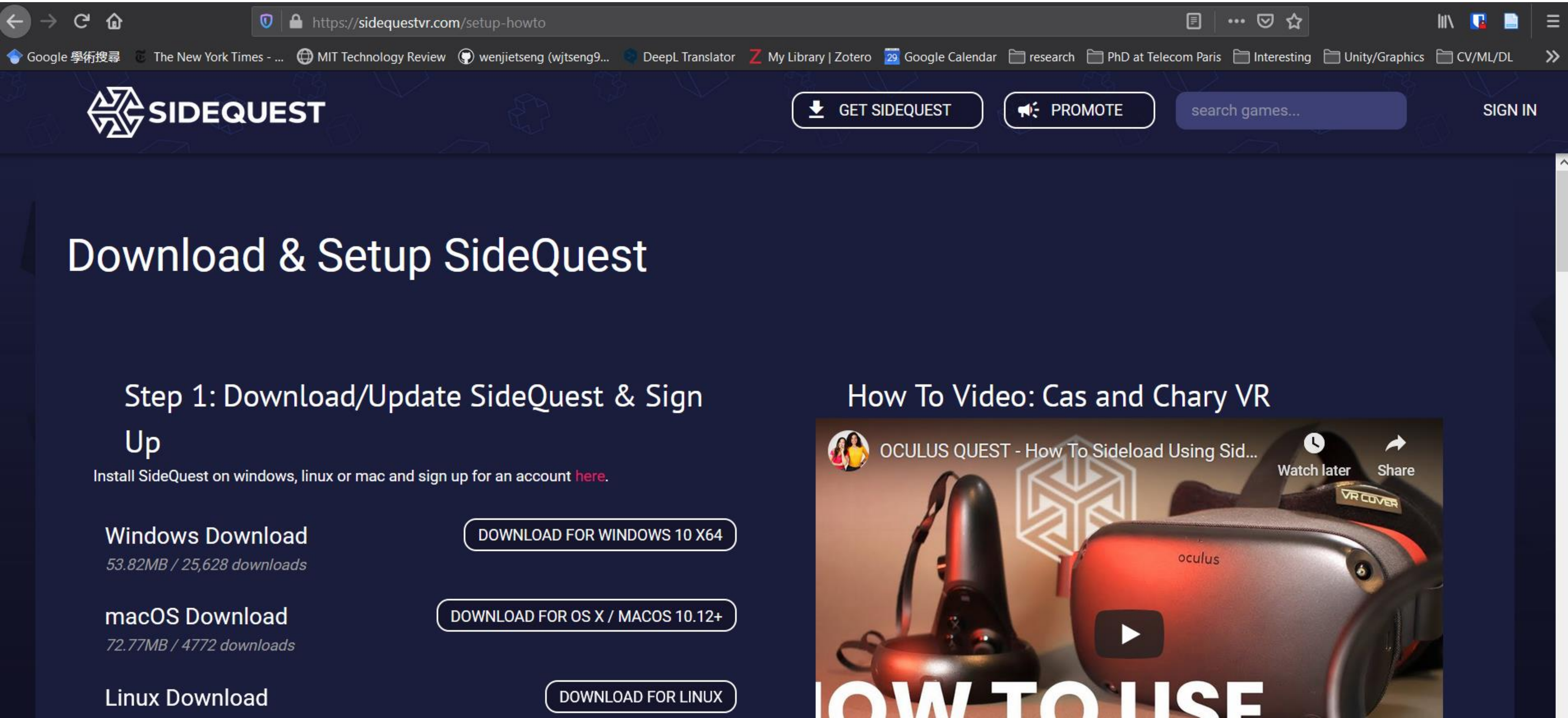
Learn about Unity Cloud Build

Player Settings... Build Build And Run

SideQuest (link to download)



https://sidequestvr.com/setup-howto

Google 學術搜尋 · The New York Times - ... · MIT Technology Review · wenjietseng (wjtseng9... · DeepL Translator · My Library | Zotero · Google Calendar · research · PhD at Telecom Paris · Interesting · Unity/Graphics · CV/ML/DL

SIDEQUEST · GET SIDEQUEST · PROMOTE · search games... · SIGN IN

Download & Setup SideQuest

Step 1: Download/Update SideQuest & Sign Up

Install SideQuest on windows, linux or mac and sign up for an account here.

Windows Download — DOWNLOAD FOR WINDOWS 10 X64
53.82MB / 25,628 downloads

macOS Download — DOWNLOAD FOR OS X / MACOS 10.12+
72.77MB / 4772 downloads

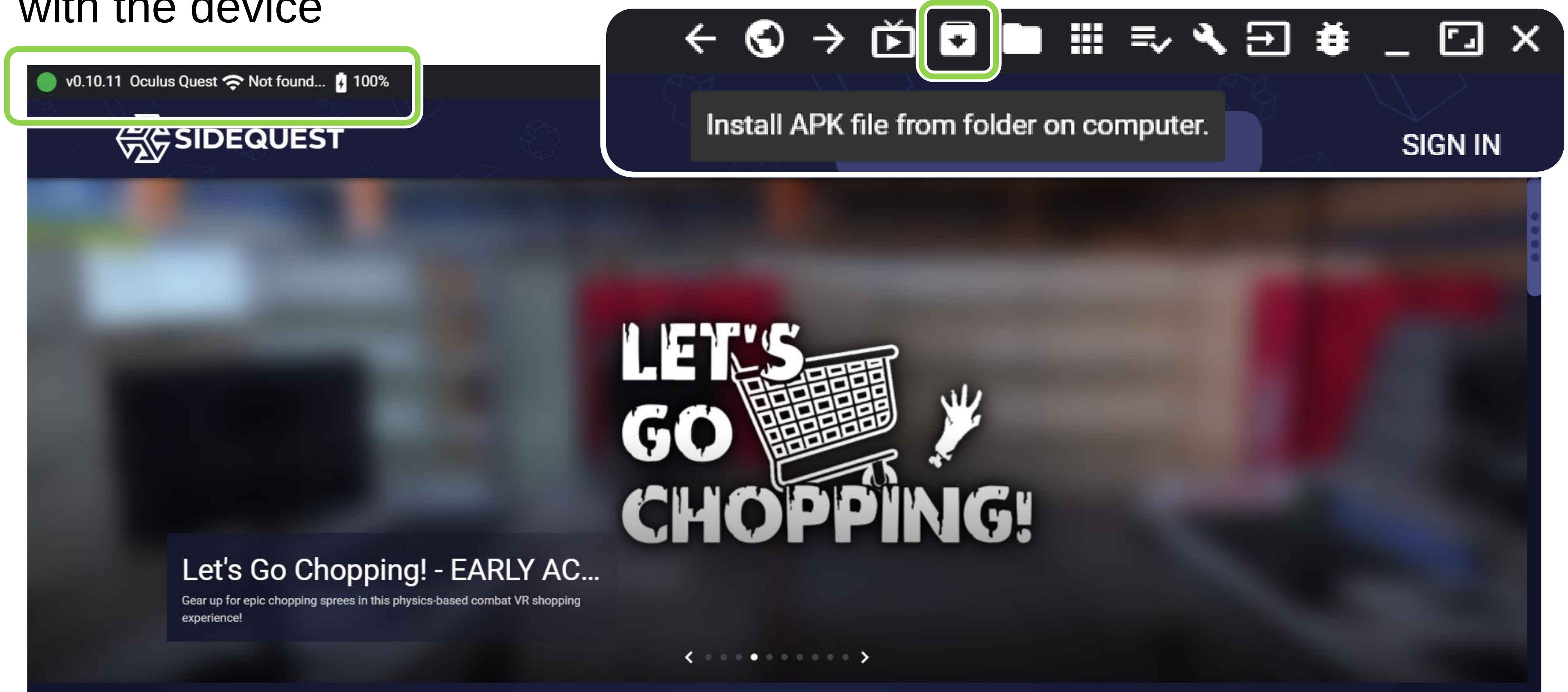
Linux Download — DOWNLOAD FOR LINUX

How To Video: Cas and Chary VR

SideQuest > see toolbar

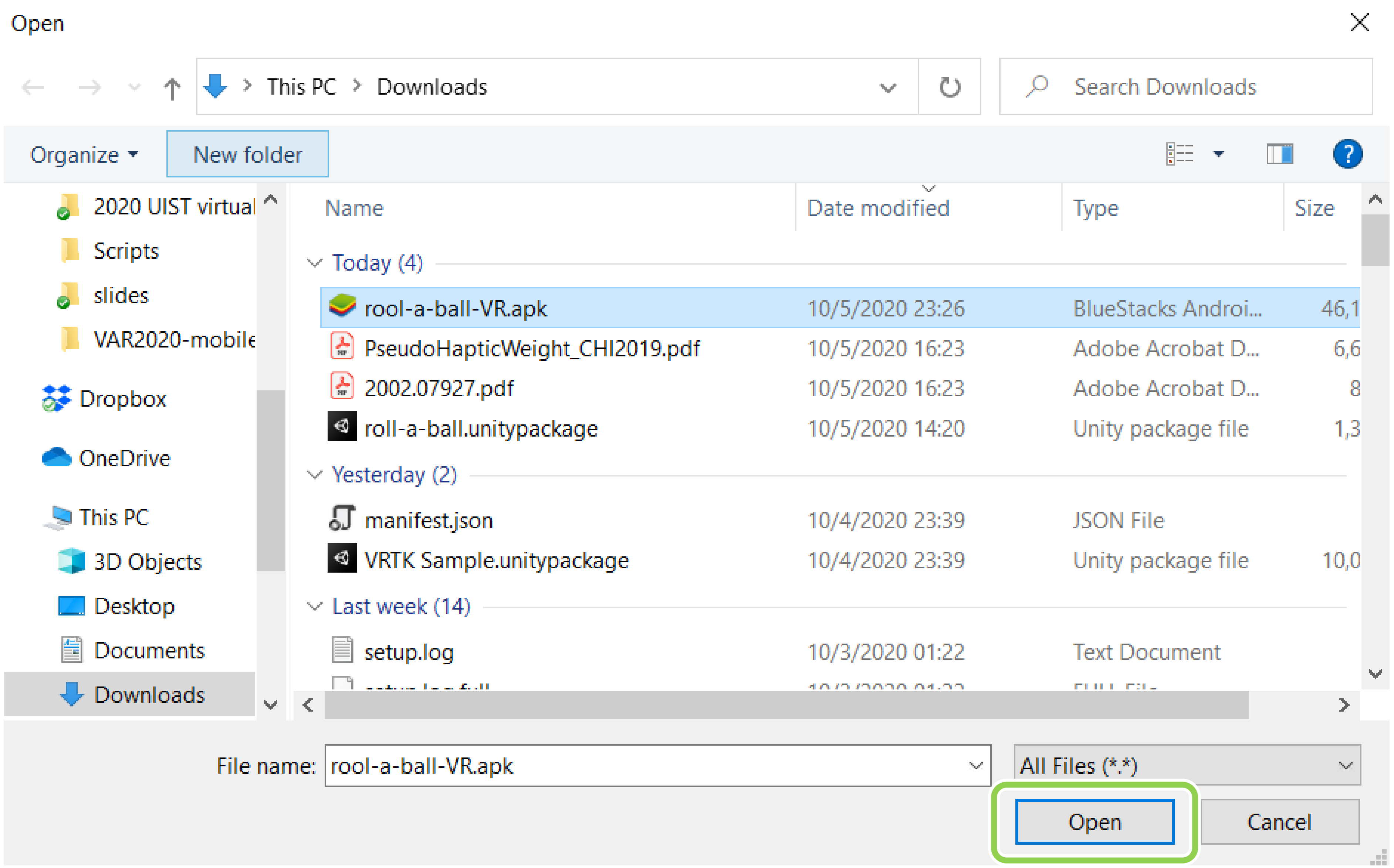
shows connected
with the device

press this icon
to install


v0.10.11 Oculus Quest Not found... 100%
SIDEQUEST
Install APK file from folder on computer.
SIGN IN
LET'S GO CHOPPING!

Let's Go Chopping! - EARLY AC...

Gear up for epic chopping sprees in this physics-based combat VR shopping experience!


Open

This PC > Downloads

Search Downloads

Organize ▾ New folder

Name	Date modified	Type	Size
Today (4)			
rool-a-ball-VR.apk	10/5/2020 23:26	BlueStacks Androi...	46,1
PseudoHapticWeight_CHI2019.pdf	10/5/2020 16:23	Adobe Acrobat D...	6,6
2002.07927.pdf	10/5/2020 16:23	Adobe Acrobat D...	8
roll-a-ball.unitypackage	10/5/2020 14:20	Unity package file	1,3
Yesterday (2)			
manifest.json	10/4/2020 23:39	JSON File	
VRTK Sample.unitypackage	10/4/2020 23:39	Unity package file	10,0
Last week (14)			
setup.log	10/3/2020 01:22	Text Document	

2020 UIST virtual
Scripts
slides
VAR2020-mobile
Dropbox
OneDrive
This PC
3D Objects
Desktop
Documents
Downloads

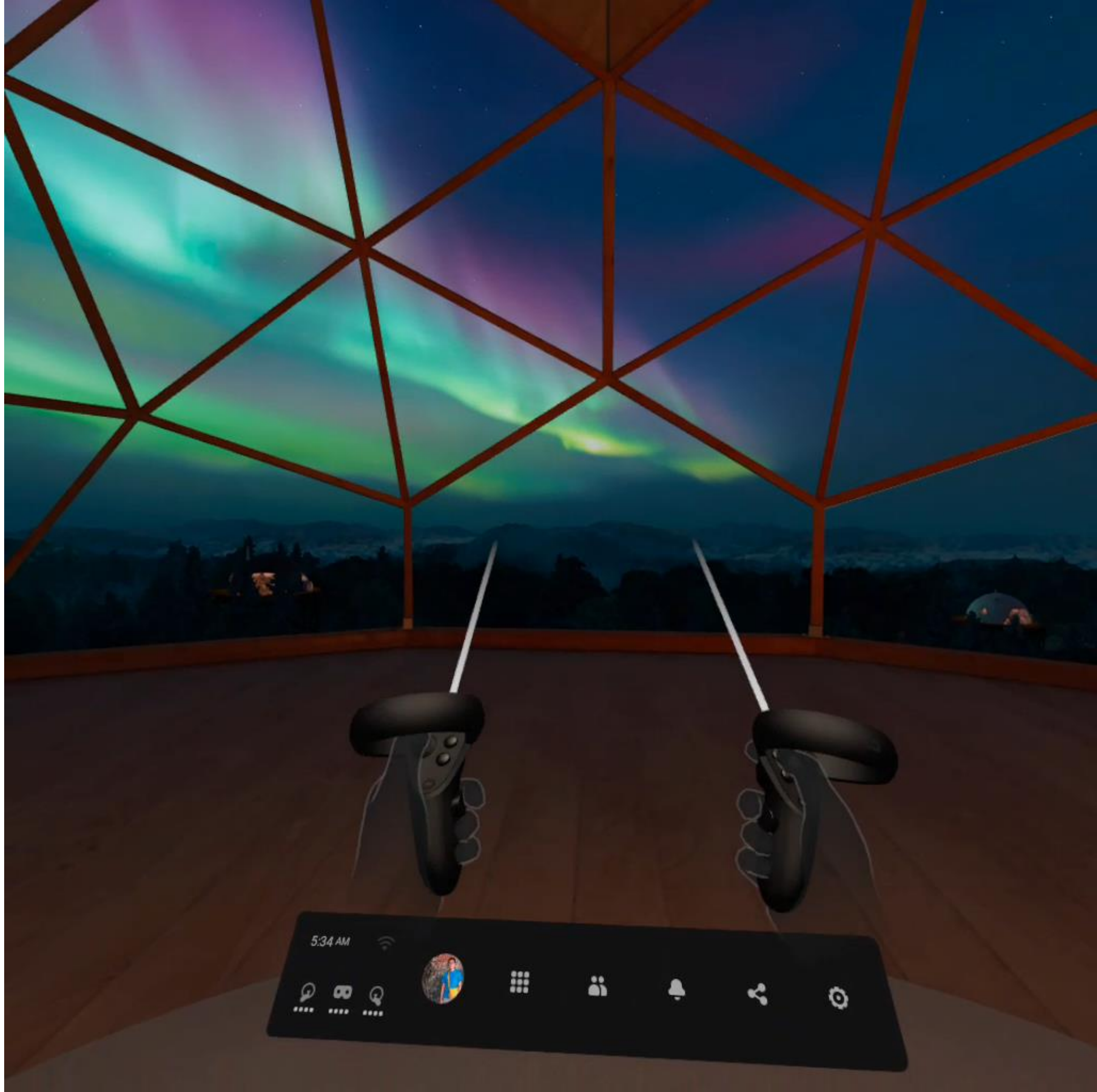
File name: rool-a-ball-VR.apk

All Files (*.*)

Open Cancel

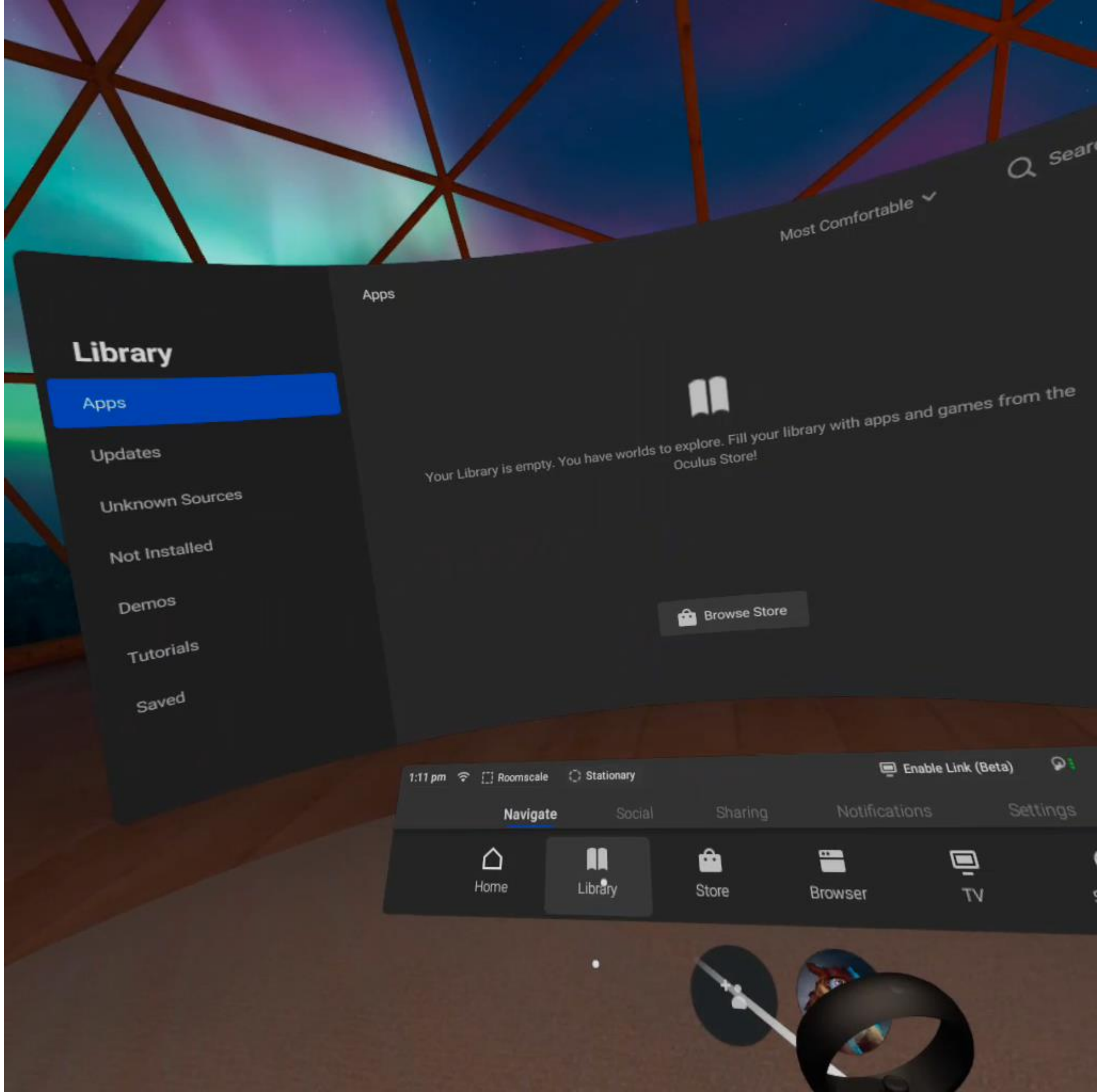
Where is the apk on the Quest?

- 3 x 3 grid
- top-right tab
- unknown sources
- scroll down and find your project (or select most recent)



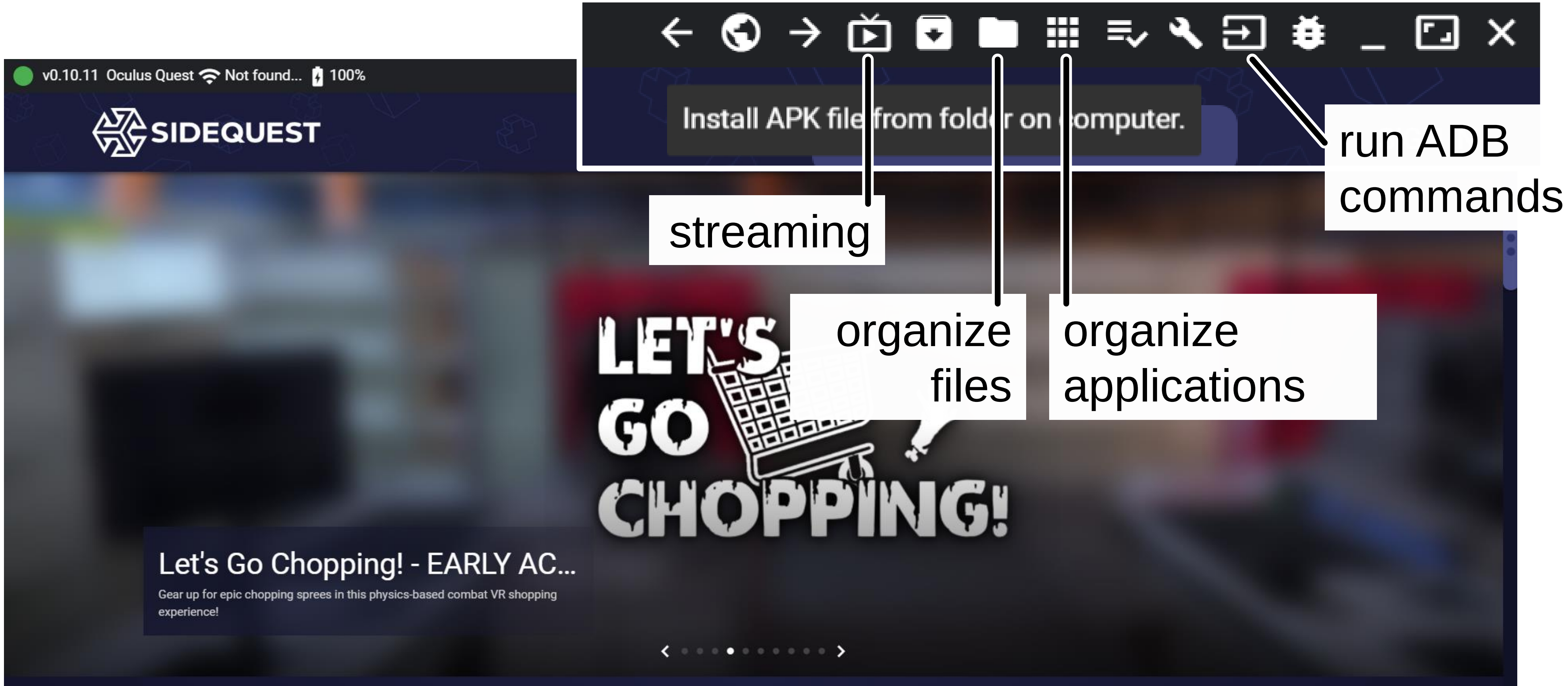
The old interface on the Quest

- navigate
- library
- unknown sources
- scroll down and find your project



Your Library is empty. You have worlds to explore. Fill your library with apps and games from the Oculus Store!

SideQuest also has other tools!


v0.10.11 Oculus Quest Not found... 100%
SIDEQUEST
Install APK file from folder on computer.
streaming
organize files
organize applications
run ADB commands
LET'S GO CHOPPING!
Let's Go Chopping! - EARLY AC...
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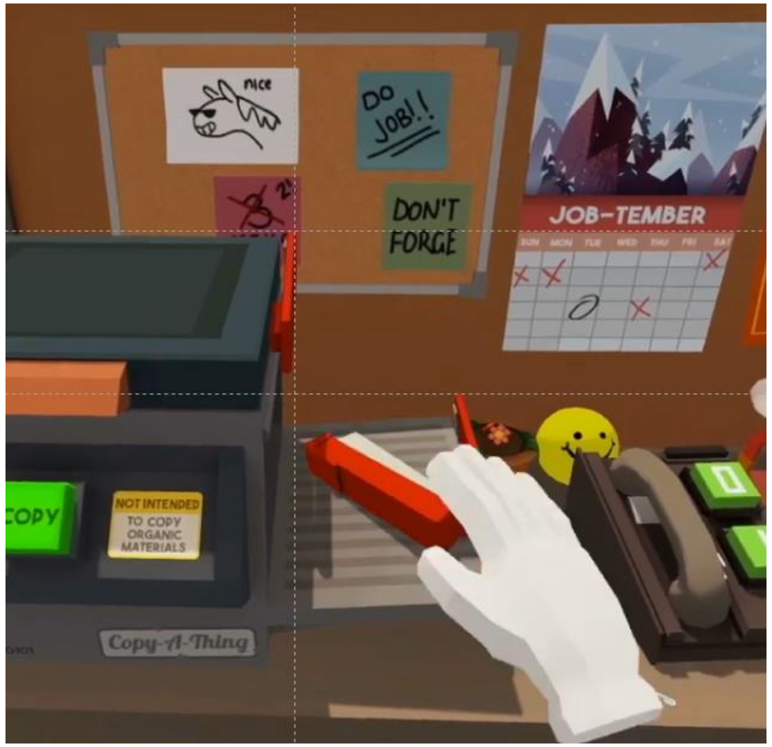
selection in VR

What else selection techniques are there in VR?

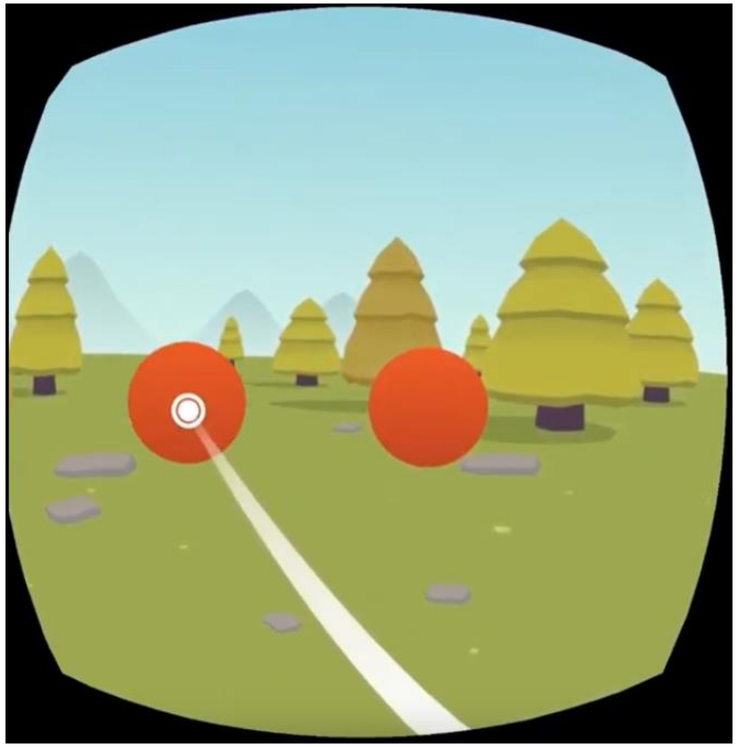
grasping

simple virtual hand


nice
DO JOB!!
DON'T FORGE
JOB-TEMBER
SUN MON TUE WED THU FRI SAT
COPY
NOT INTENDED TO COPY ORGANIC MATERIALS
Copy-A-Thing

pointing

ray-casting



	grasping	pointing
benefits		
limitations		

	grasping	pointing
benefits	• a direct way to manipulate • full degree of freedom (DoF)	• select things that are far away • fast
limitations	• the range is your arm length • lack of tactile feedback	• lack of DoF (e.g., depth) • what if the targets are small and close to each other?

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application dependent: choose the interaction that suits your application best

3D manipulation tasks

selection

Acquiring or identifying a particular object or subset of objects from the entire set of objects available.

rotation

Changing the orientation of an object. E.g., what we just did in the roll-a-ball example.

positioning

Changing the 3D position of an object. E.g., moving an object from A to B.

scaling

Changing the size of an object. E.g., resize a GUI on a laptop.

The end of today

- Adapt the roll-a-ball (or your selected game) into the VR version.
- **optional**
  - If you choose the other application, please adapt it into a VR version.
  - different selection (e.g., ray-casting)
  - hand tracking as the input (how to select? Plain version could be trigger + pinch, feel free to explore other possibilities)

references

Starting a VR project with different APIs

- Oculus Integration
- Unity XR Input
- VRTK 4

Interesting applications on YouTube

- Controller:
    - Climbing (using unity XR input)
    - Climbing [part 1] [part 2] (using Oculus Integration)
    - BeatSaber in 10 min (using Oculus Integration)
- Hand Tracking:
    - basics
    - grab
    - detect gesture

IGD301
MR & HCI

Questions?