Mixed Reality with Unity3D and Meta-XR

Laboratorio Realtà Virtuale 2025/2026

eleonora.chitti@unimi.it

First Steps in Unity3D:

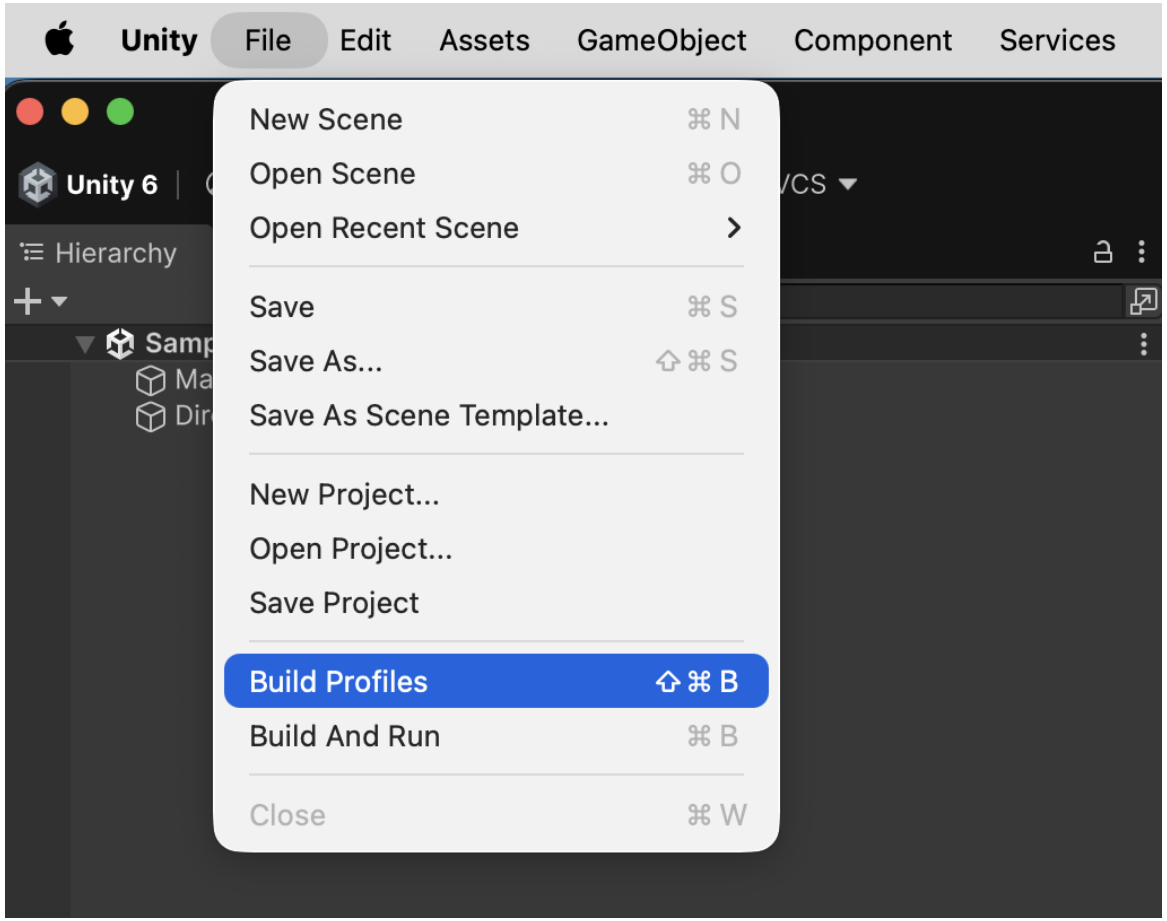
1. Create a New Local Project as 3D (Built-In Render Pipeline)

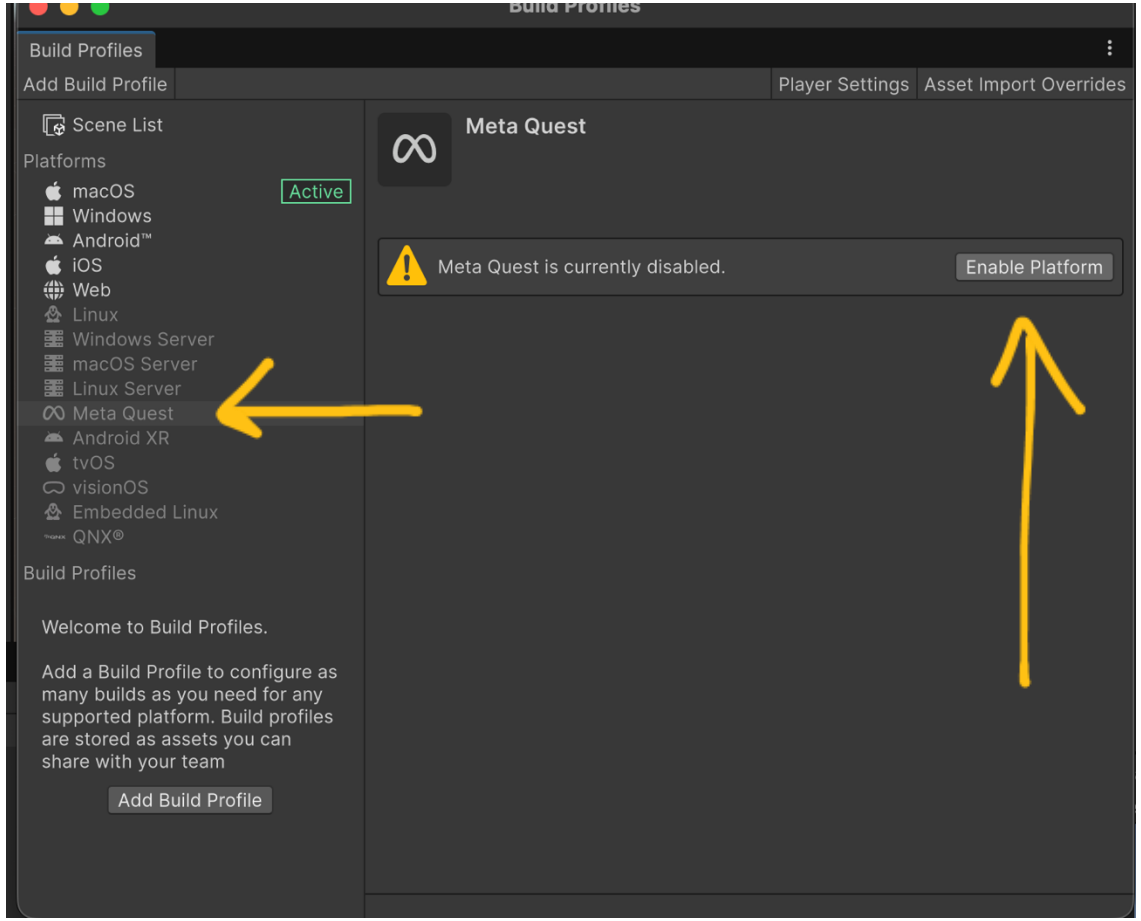
2. Go to File → Build Profiles and choose Meta Quest, then click on “Enable Platform”

3. Click again on Meta Quest and click on “Switch Platform”

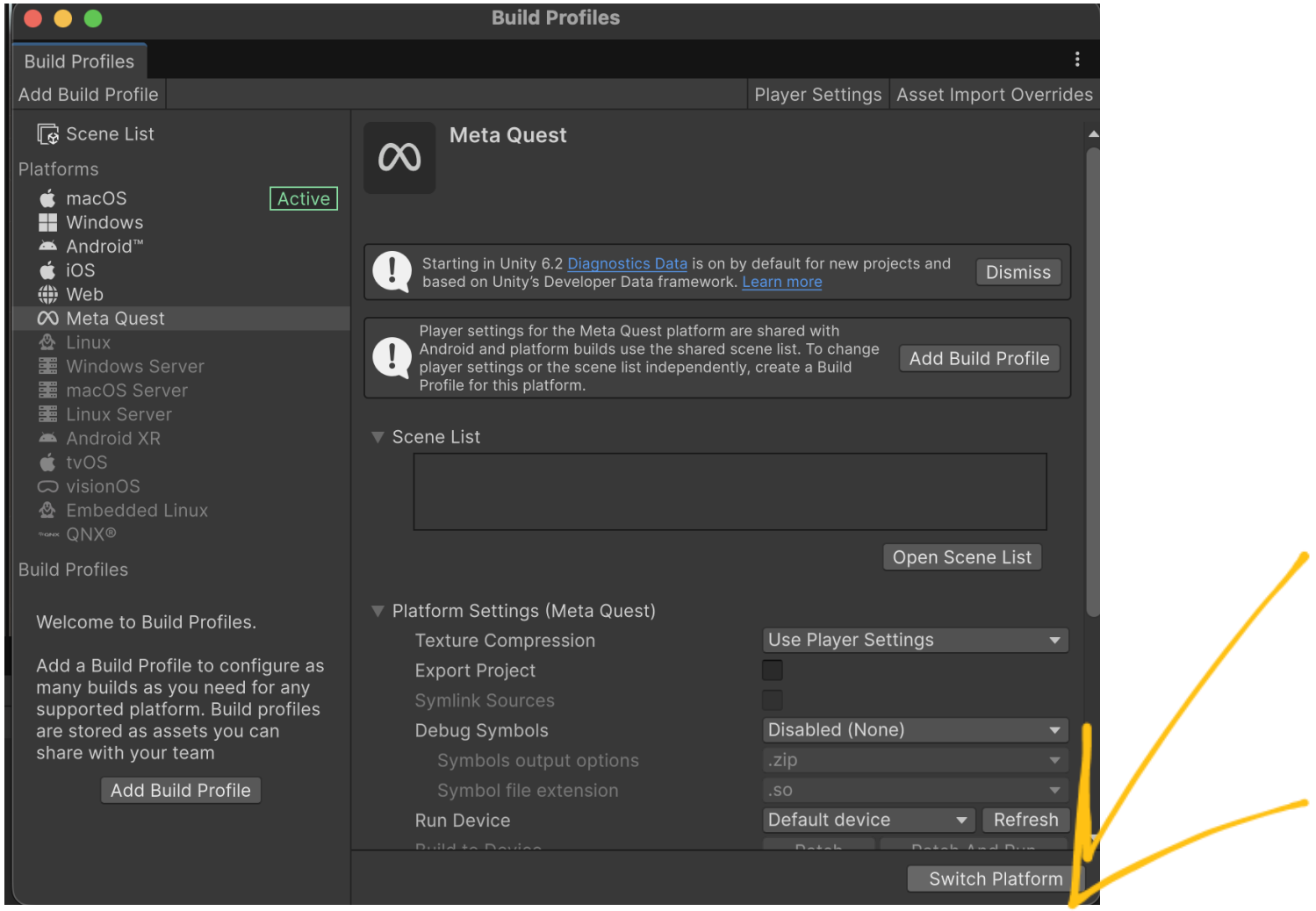
Full Unity+Meta procedure documented here:
https://developers.meta.com/horizon/documentation/unity/unity-project-setup/

Step 2

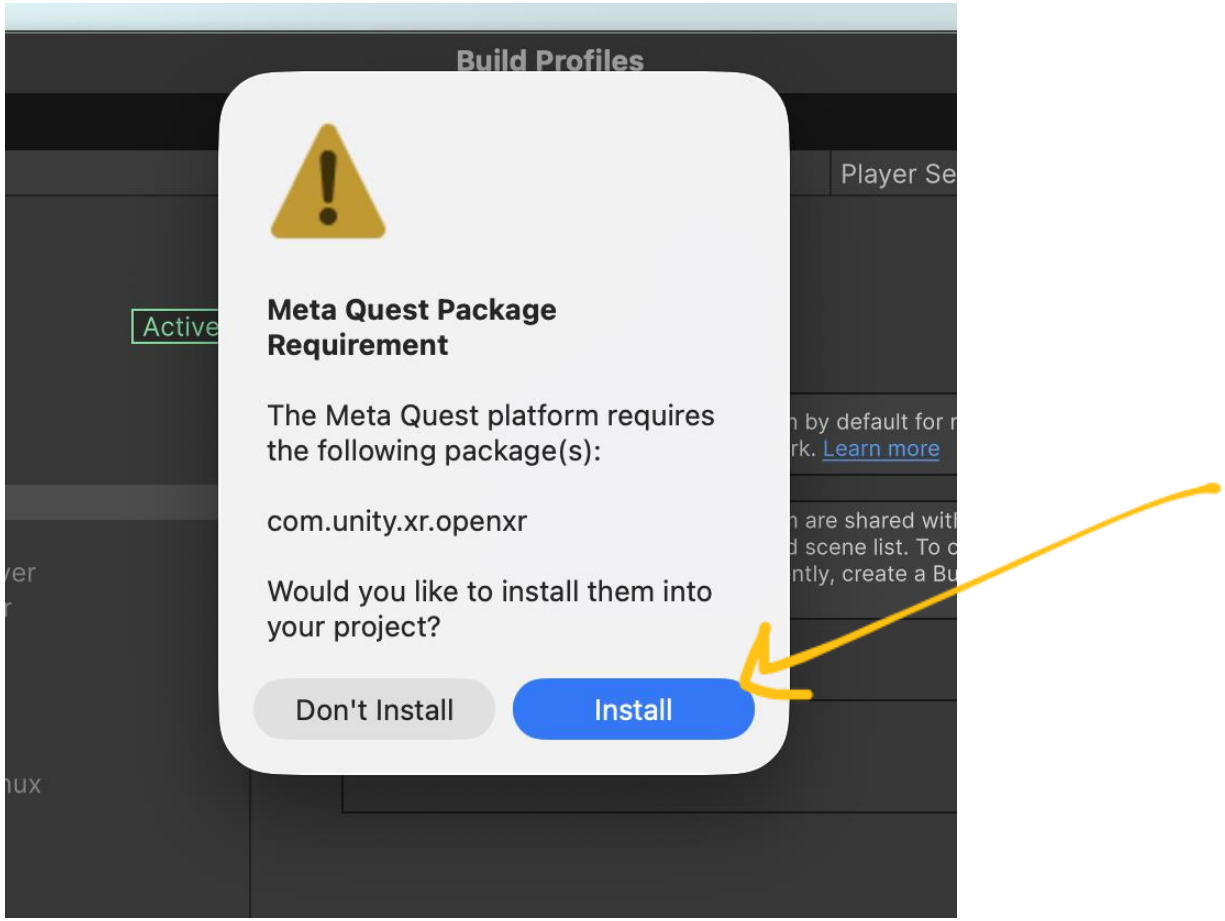

Unity
File
Edit
Assets
GameObject
Component
Services
New Scene ⌘ N
Open Scene ⌘ O
Open Recent Scene
Save ⌘ S
Save As... ⇧⌘ S
Save As Scene Template...
New Project...
Open Project...
Save Project
Build Profiles ⇧⌘ B
Build And Run ⌘ B
Close ⌘ W
Unity 6
Hierarchy


Build Profiles
Add Build Profile
Player Settings
Asset Import Overrides
Scene List
Platforms
macOS
Active
Windows
Android™
iOS
Web
Linux
Windows Server
macOS Server
Linux Server
Meta Quest
Android XR
tvOS
visionOS
Embedded Linux
QNX®
Build Profiles
Welcome to Build Profiles.
Add a Build Profile to configure as many builds as you need for any supported platform. Build profiles are stored as assets you can share with your team
Add Build Profile
Meta Quest
Meta Quest is currently disabled.
Enable Platform

Step 3

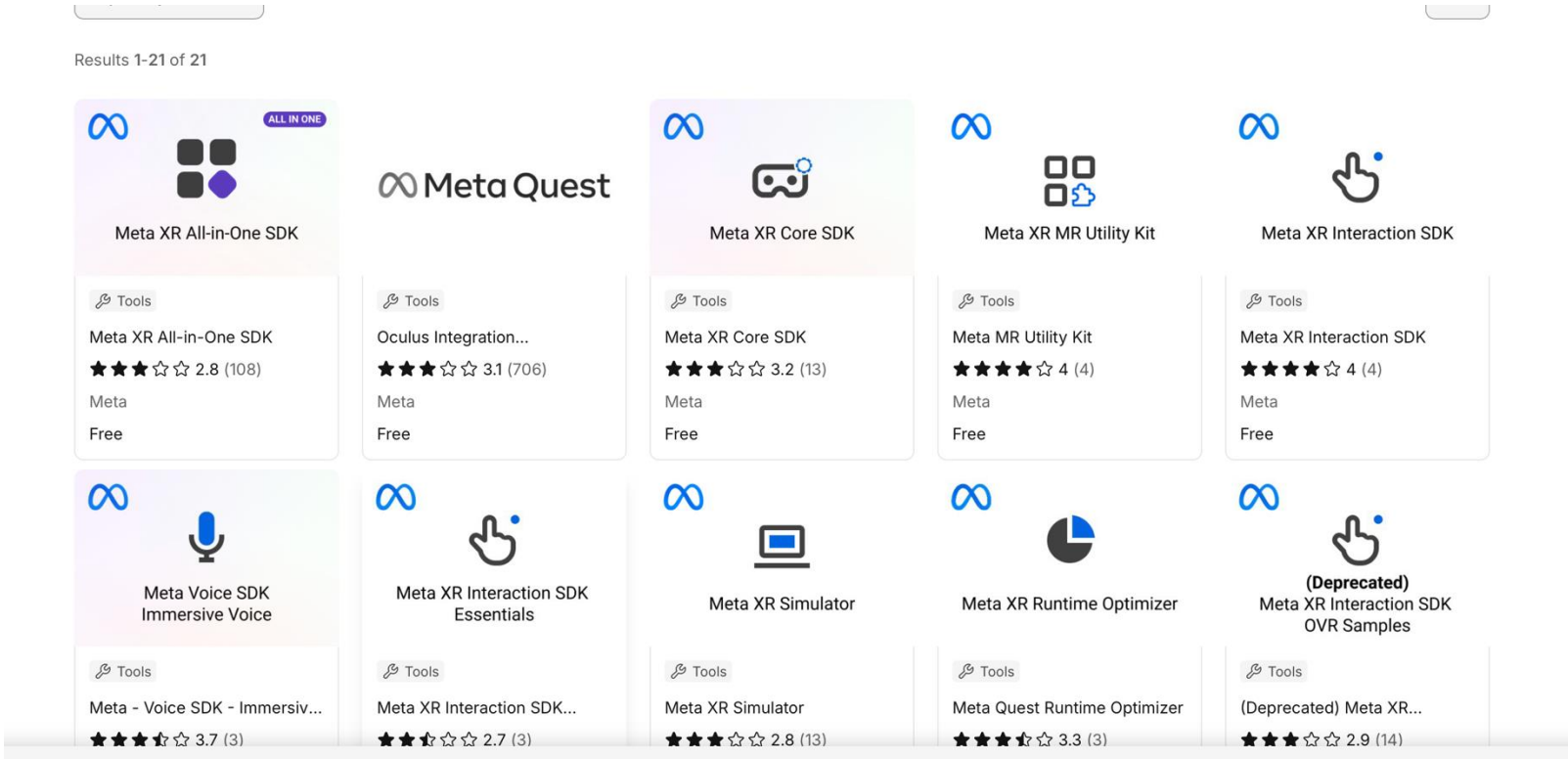

Build Profiles
Build Profiles
Add Build Profile
Player Settings
Asset Import Overrides
Scene List
Platforms
macOS
Active
Windows
Android™
iOS
Web
Meta Quest
Linux
Windows Server
macOS Server
Linux Server
Android XR
tvOS
visionOS
Embedded Linux
QNX®
Build Profiles
Welcome to Build Profiles.
Add a Build Profile to configure as many builds as you need for any supported platform. Build profiles are stored as assets you can share with your team
Add Build Profile
Meta Quest
Starting in Unity 6.2 Diagnostics Data is on by default for new projects and based on Unity's Developer Data framework. Learn more
Dismiss
Player settings for the Meta Quest platform are shared with Android and platform builds use the shared scene list. To change player settings or the scene list independently, create a Build Profile for this platform.
Add Build Profile
Scene List
Open Scene List
Platform Settings (Meta Quest)
Texture Compression
Use Player Settings
Export Project
Symlink Sources
Debug Symbols
Disabled (None)
Symbols output options
.zip
Symbol file extension
.so
Run Device
Default device
Refresh
Switch Platform

Now it will ask to download OpenXR, say yes

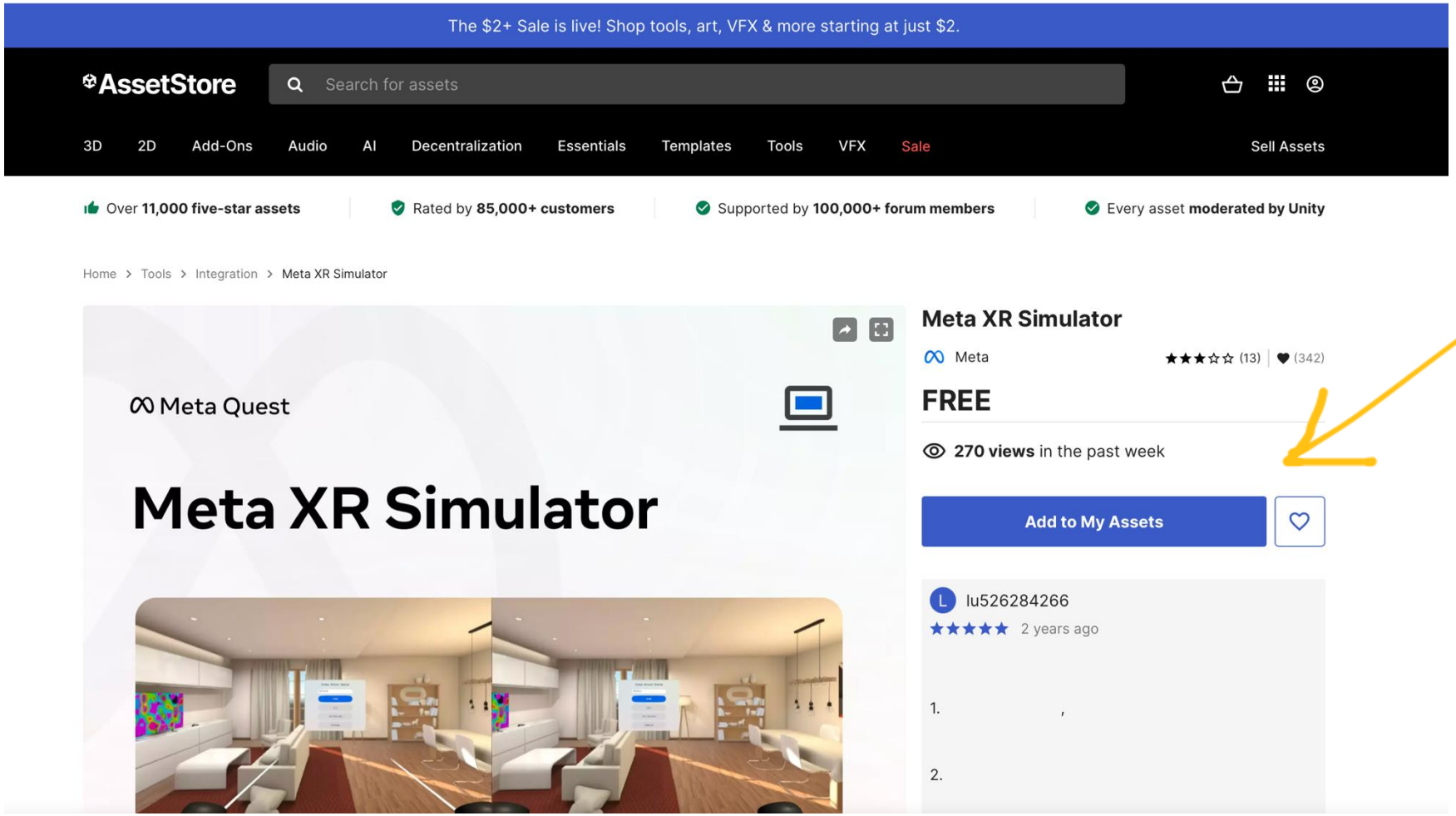


Setup Meta XR

- Go to the Unity Asset Store https://assetstore.unity.com/publishers/25353
- At least you should add to your assets:
  - Meta XR Core SDK
  - Meta XR Interaction SDK
  - Meta XR Simulator

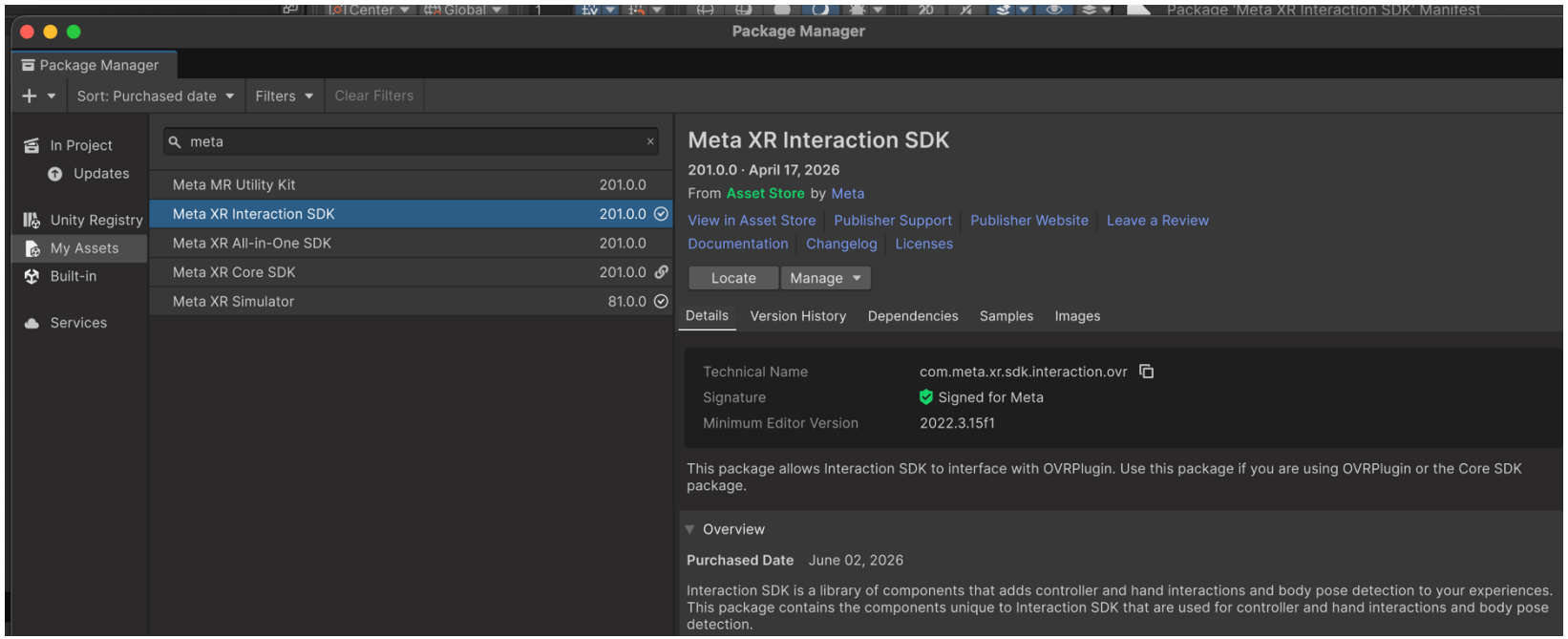


How to add to your assets:

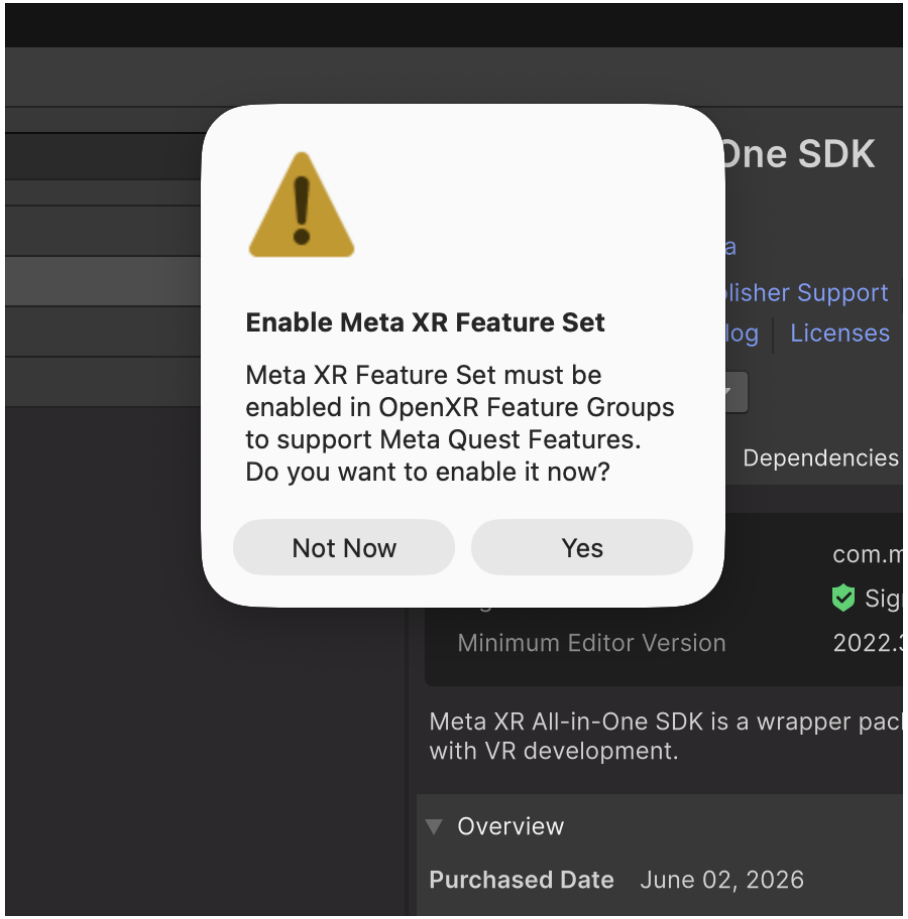


Go Back to the Unity Project

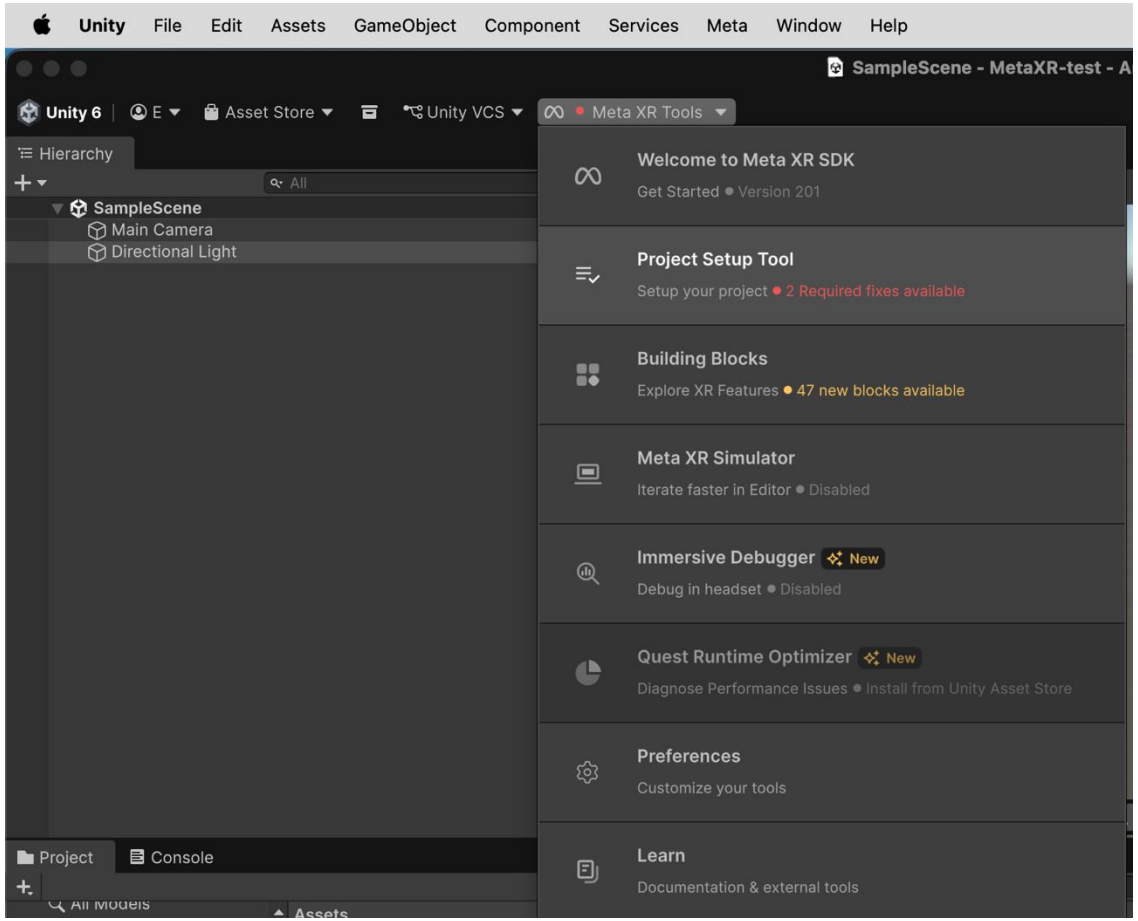
- Go to Window → Package Management → Package Manager
- Click on “My Assets”
- Install Meta Packages:
  - Interaction SDK
  - Meta XR Core SDK
  - Meta XR Simulator



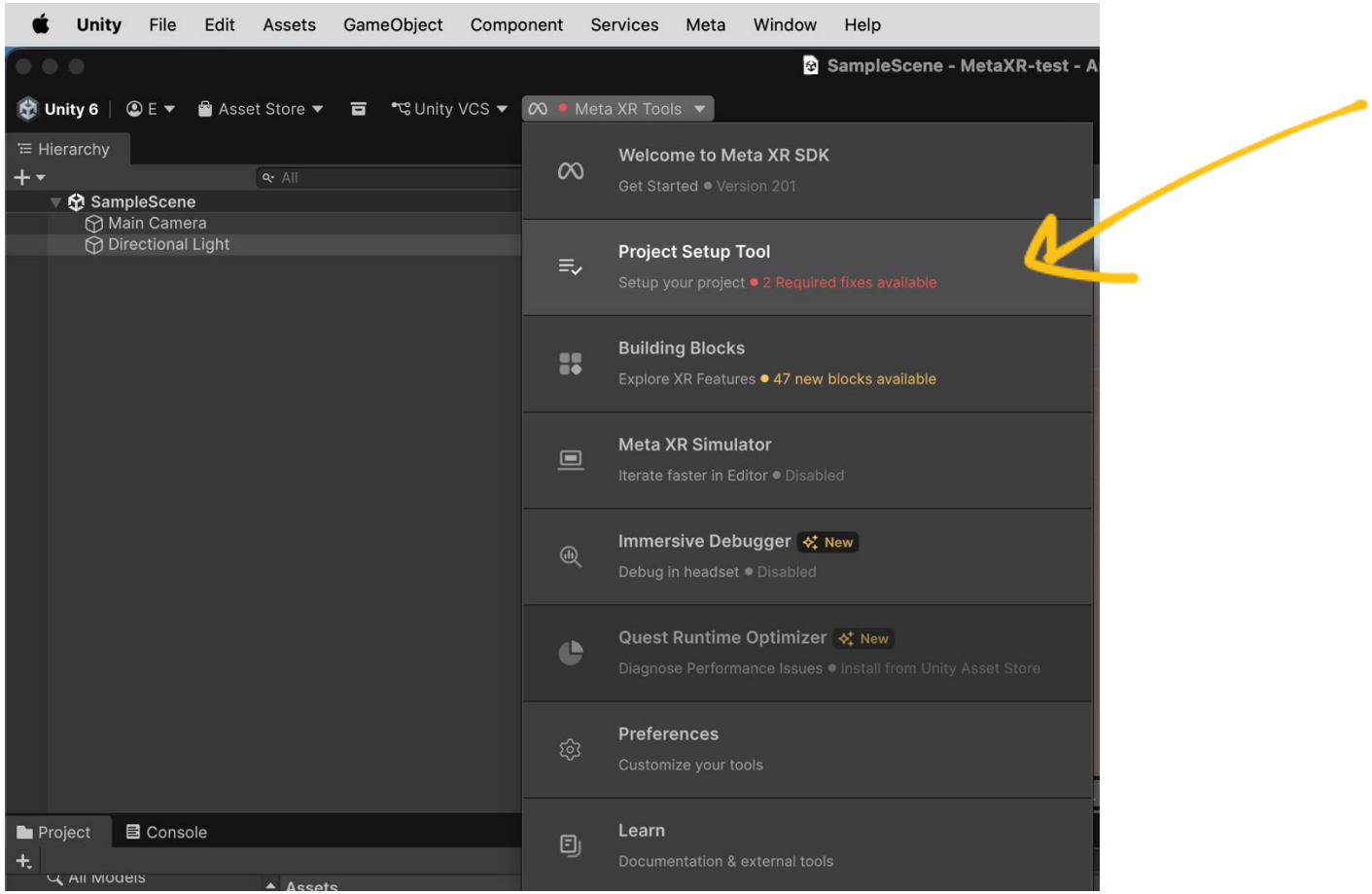
Say yes to popups



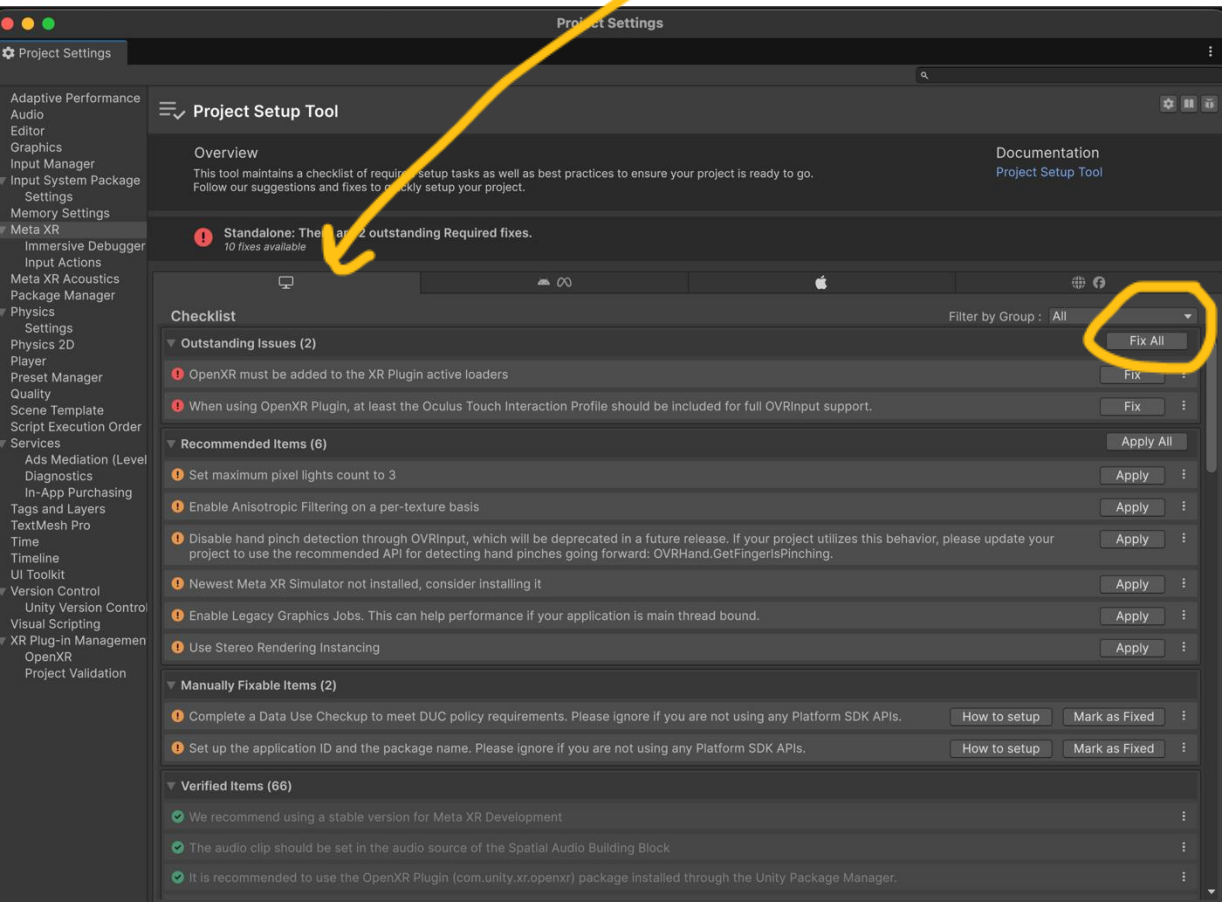
Now a Meta XR Tools menu appears

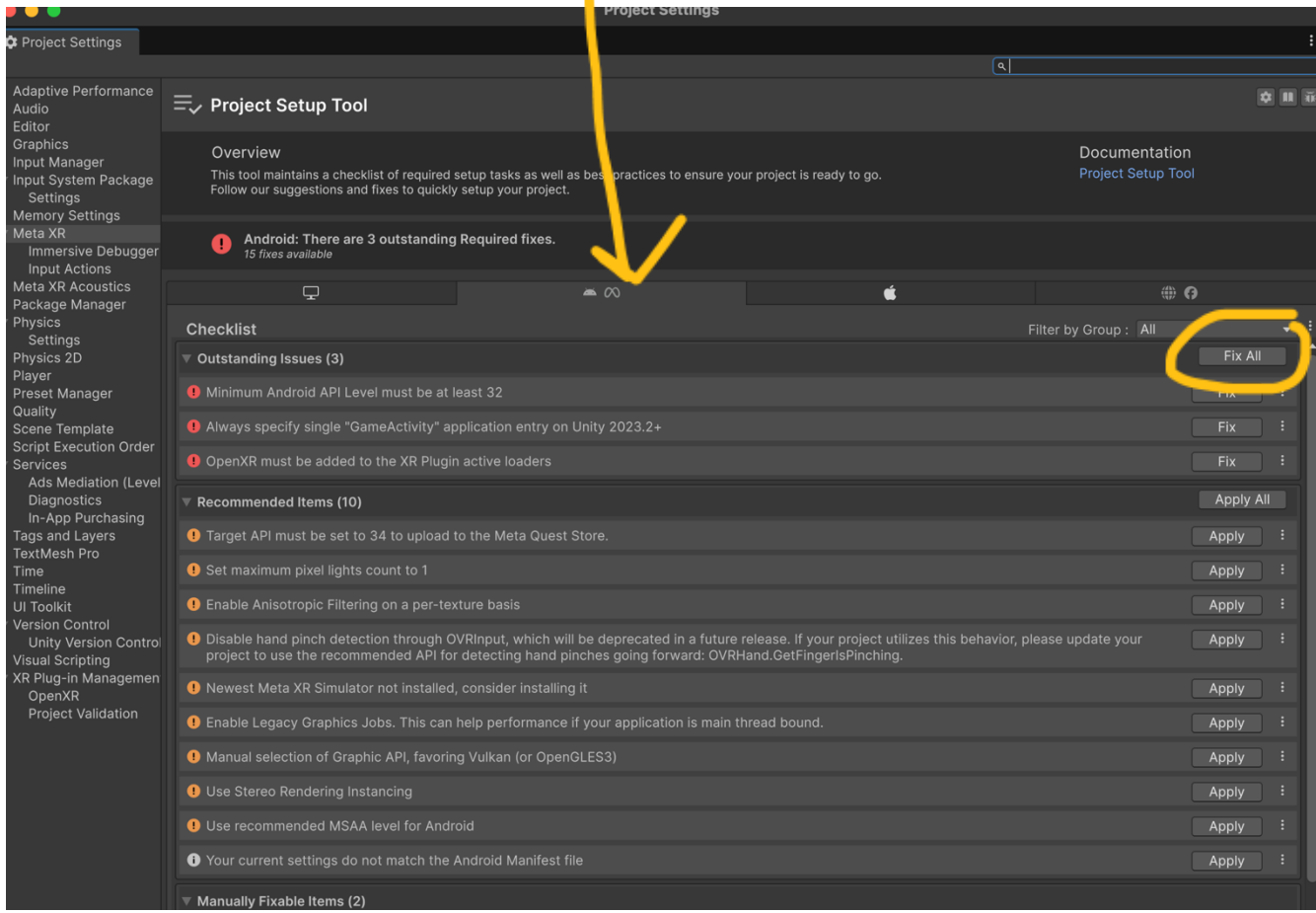


Click on Project Setup Tool

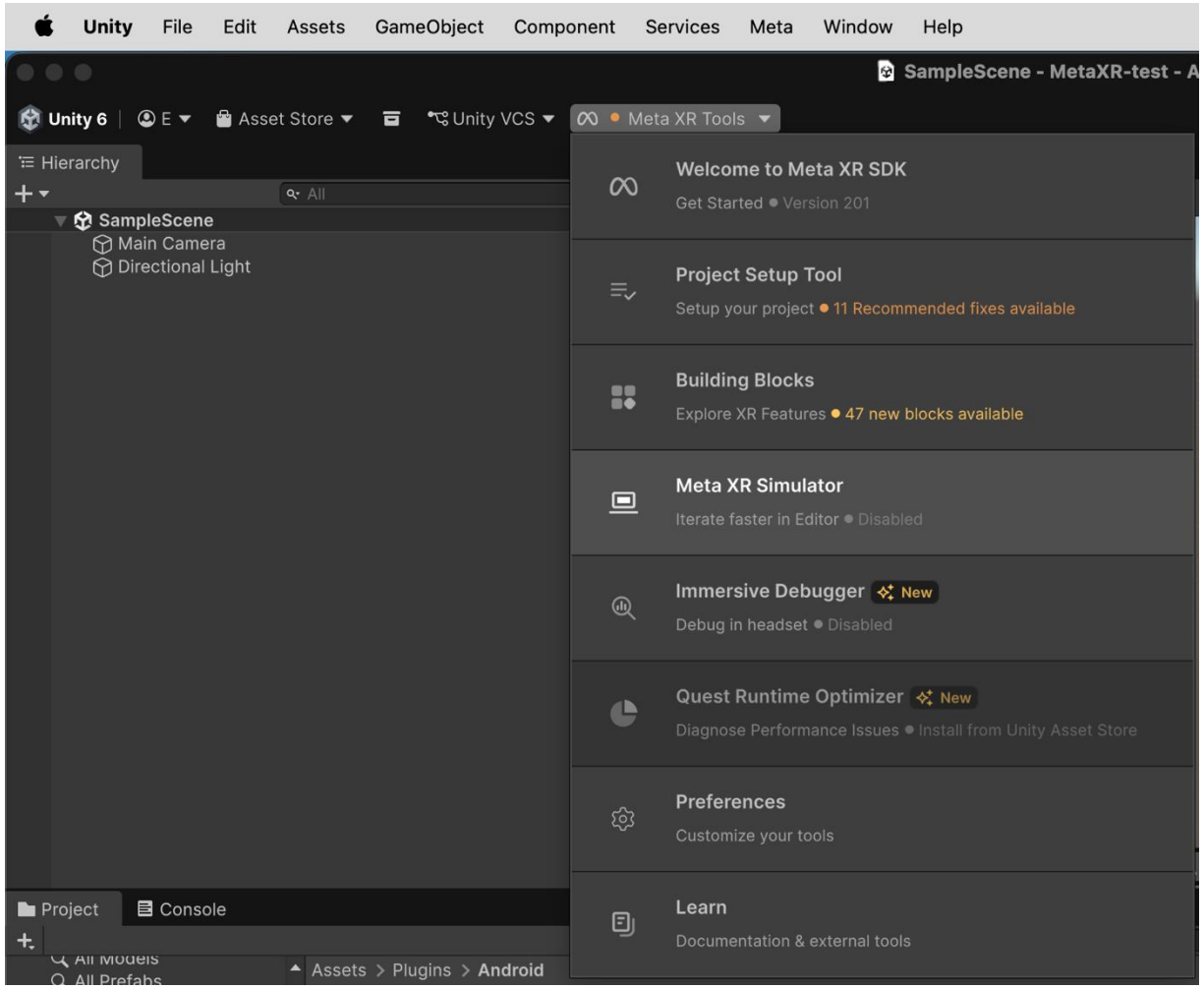


Fix All for Standalone and Fix All for Oculus/Android

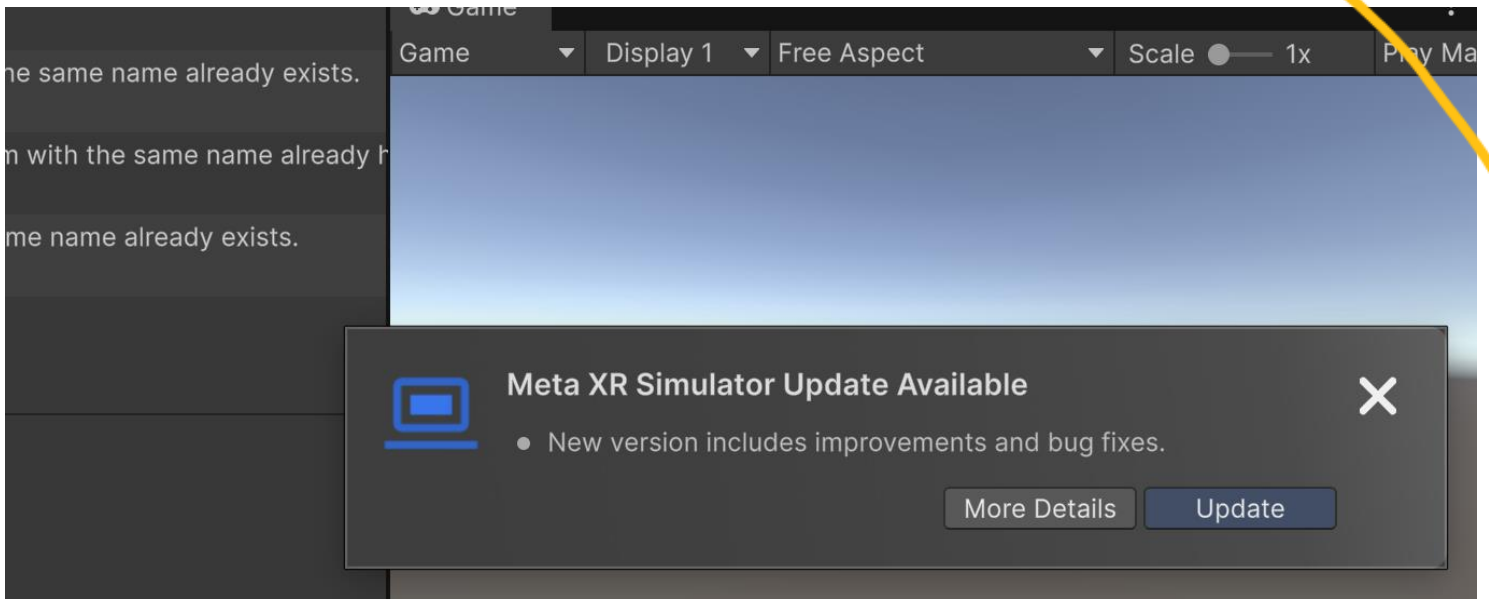


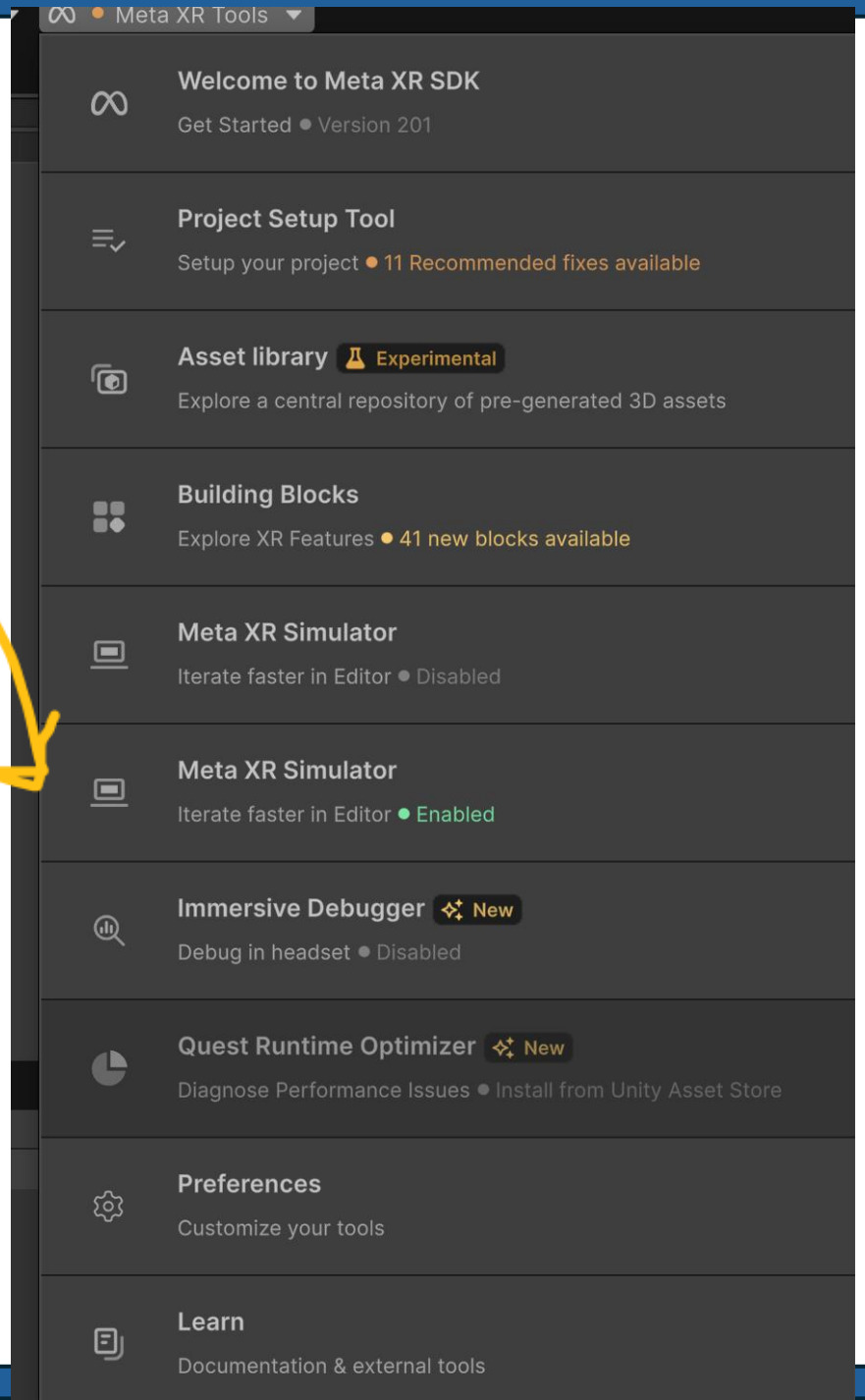


Go Back to Meta XR Tools and click on Meta XR Simulator to enable it



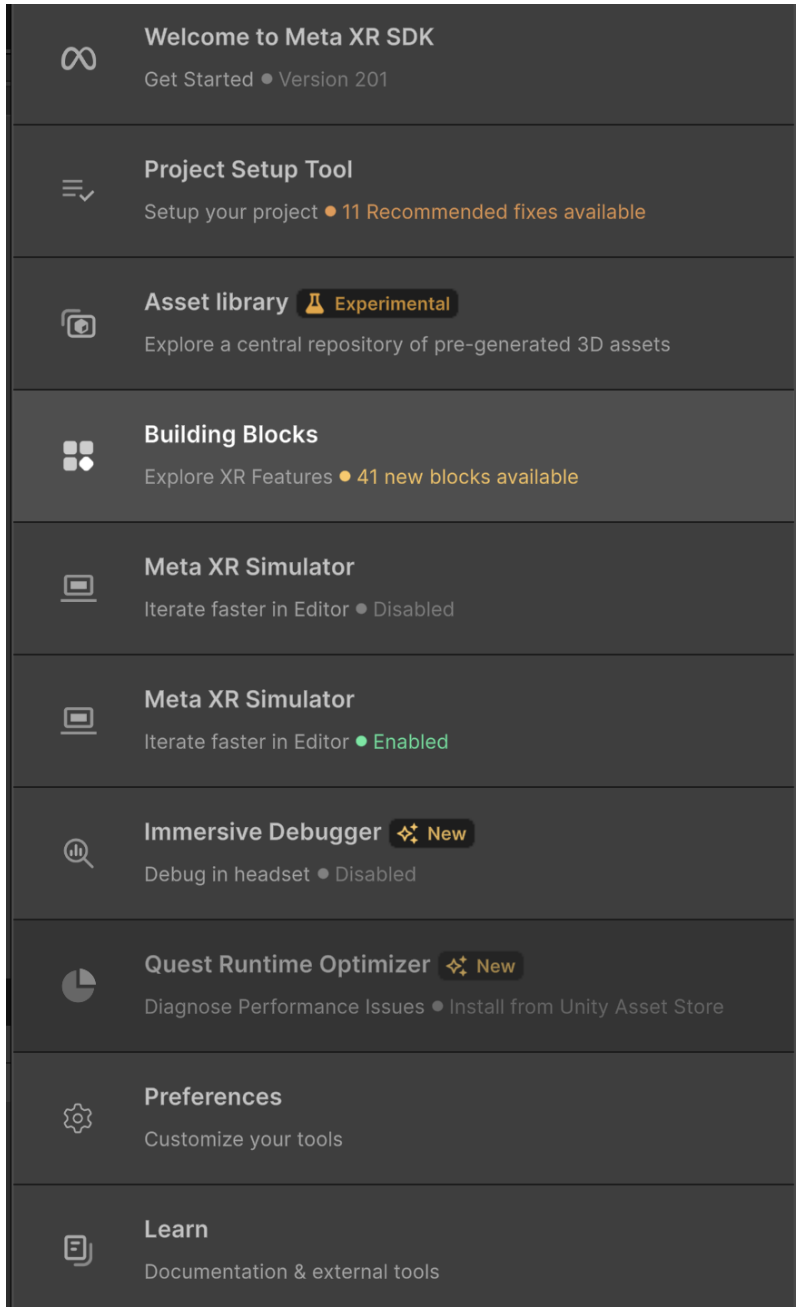
- It may ask to update, say yes
- When activated an “enabled” appears near the Simulator



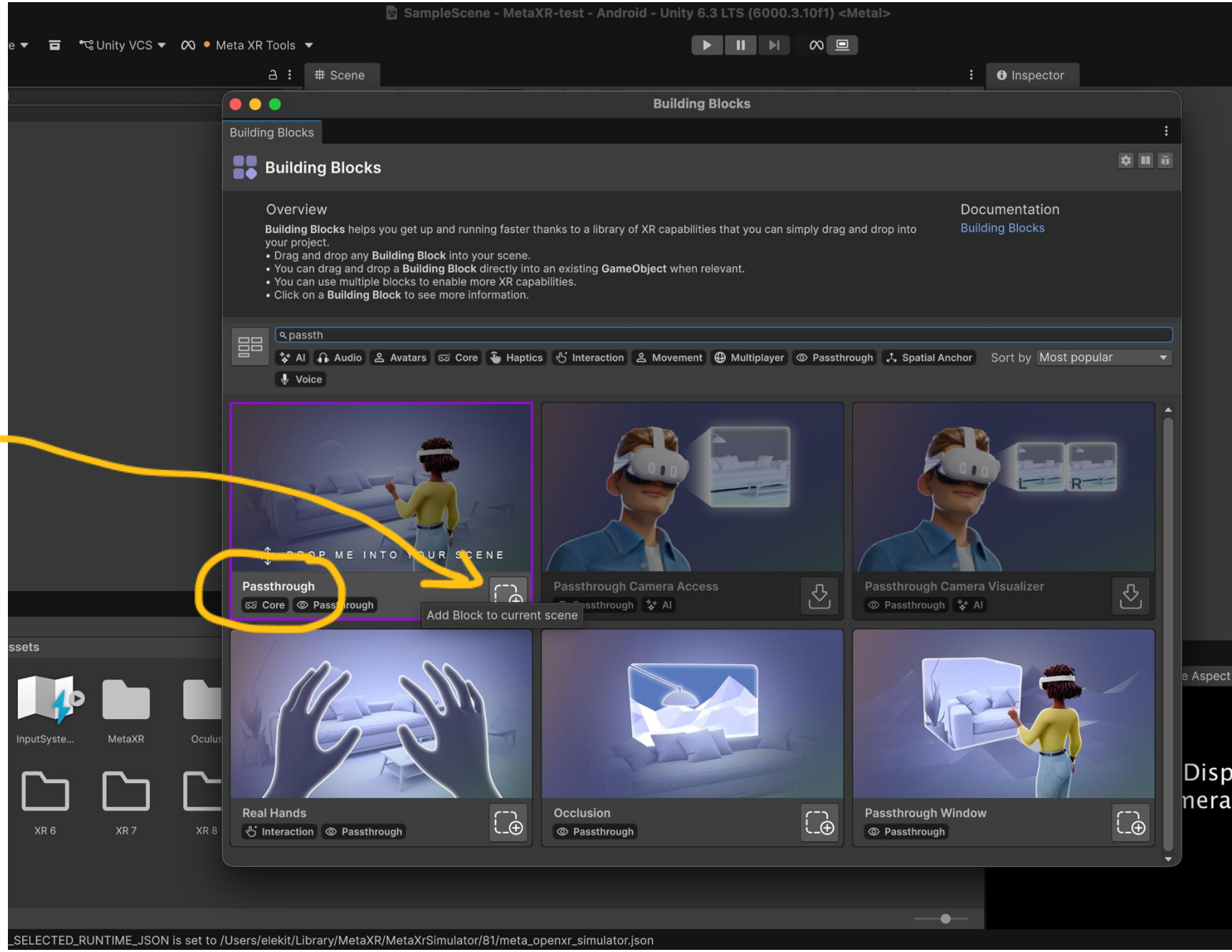


Setup the Unity Scene

- Now delete the Main Camera from the Sample Scene
- Click again on the Meta XR Tools and click on Building Blocks



- Search for Passthrough Block
- Click on the “Add Block to the current scene” button



- Now in the Scene you will have a Camera Rig used to track the player's input from the Headset and from the Controllers.

- The Camera Rig (the parent) has a script OVRCameraRig.cs attached, it uses input from the headset to change the position and rotation of the camera in the scene

https://developers.meta.com/horizon/documentation/unity/unity-ovrcamerarig/

- And a Passthrough package, that enables the MR system

https://developers.meta.com/horizon/documentation/unity/unity-passthrough/

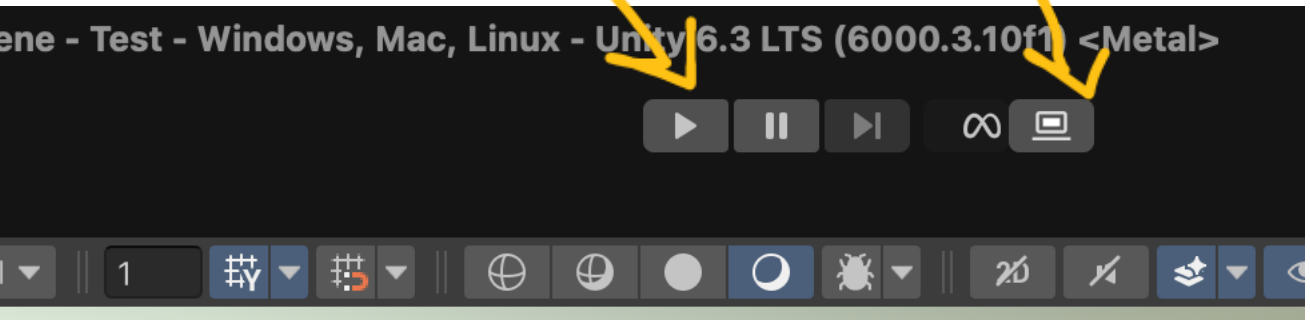
Exercise 1 – Add a cube

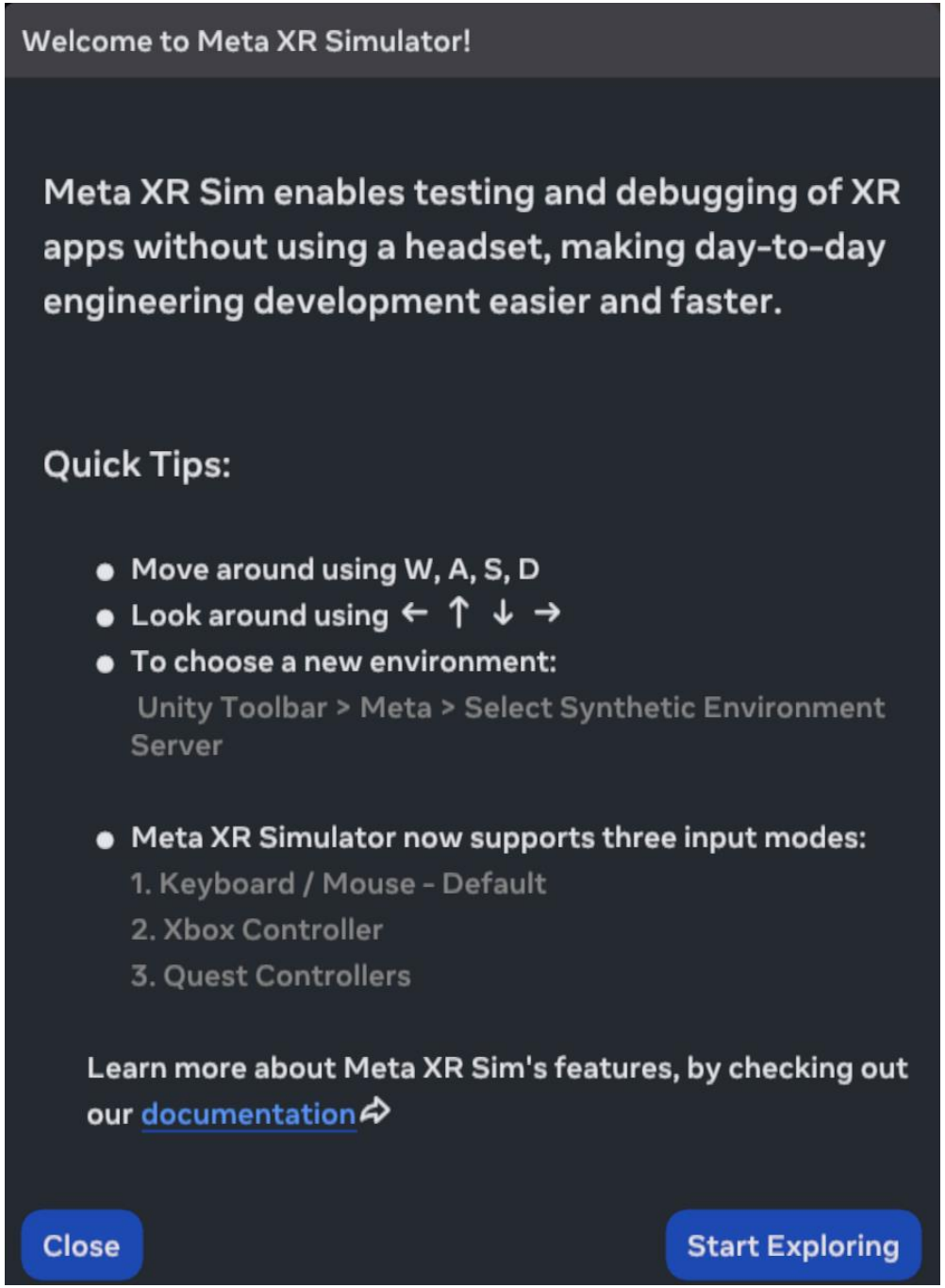
Add a cube to the scene

- In the scene add a simple cube and set it at x = 0, y = 1.2, z = 2
- Create a folder Scripts inside the Assets folder
- Create a Script “Floating Demo Object” and write:
- Attach the script to the cube in the scene

```
using UnityEngine;

public class FloatingDemoObject : MonoBehaviour
{
   private Vector3 startPosition;

   void Start()
   {
      startPosition = transform.position;
   }

   void Update()
   {
      transform.Rotate(0f, 45f * Time.deltaTime, 0f);

      float yOffset = Mathf.Sin(Time.time * 2f) * 0.08f;
      transform.position = startPosition + new Vector3(0f, yOffset, 0f);
   }
}
```

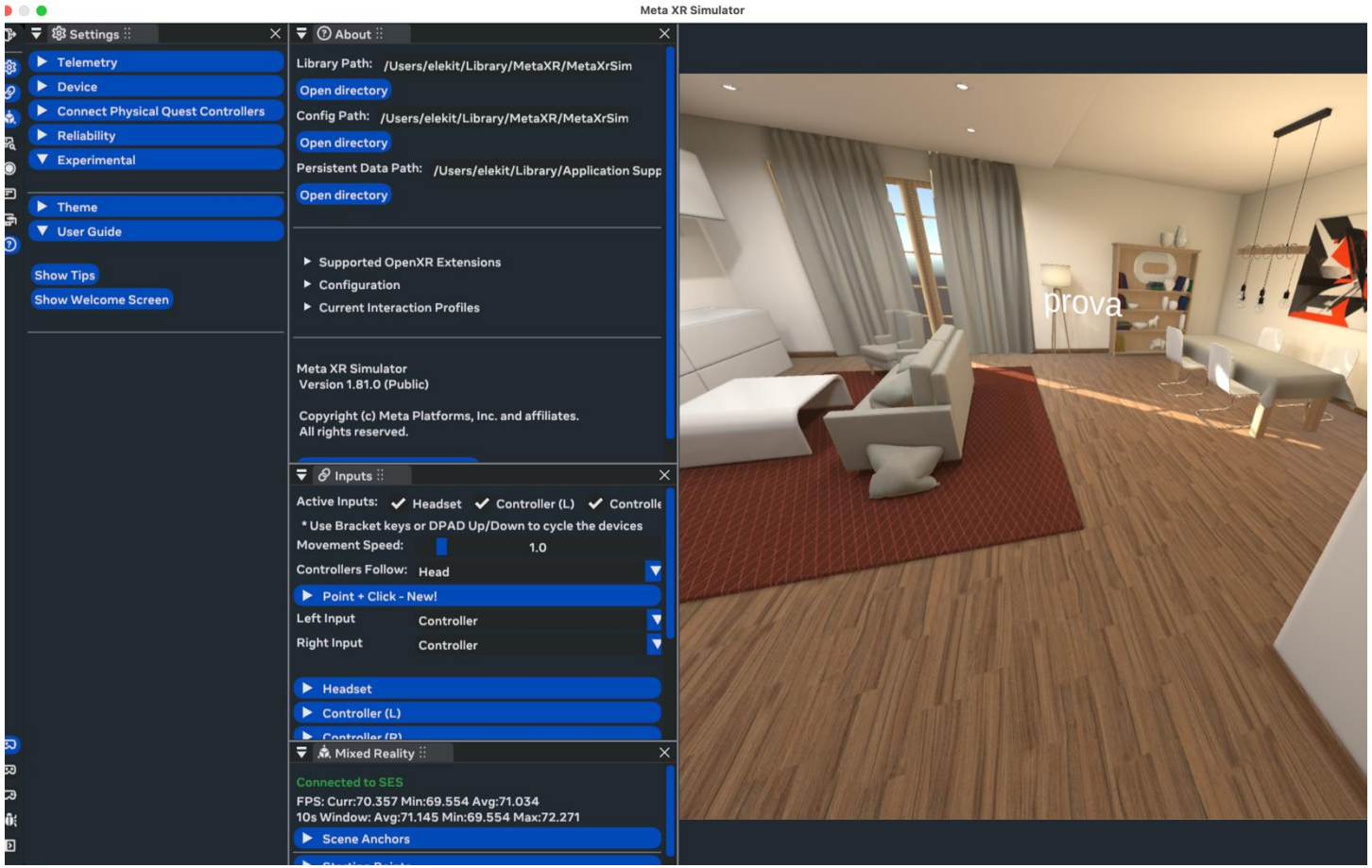
- Check that PC - XR simulator is enabled
- click Play





You can move in the simulator with:

- WASD for moving (position)
- Q,E for rotating the head (Roll)
- Arrows for rotating the head (Pitch and Yaw)



Some useful links

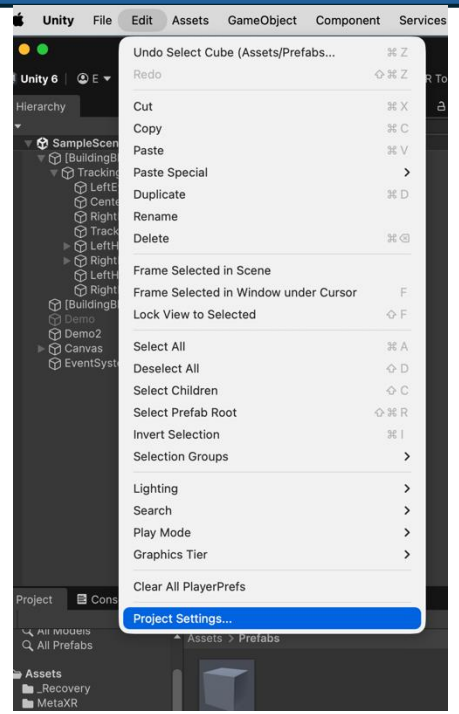
- Getting started with XR simulator: https://developers.meta.com/horizon/documentation/unity/xrsim-getting-started/

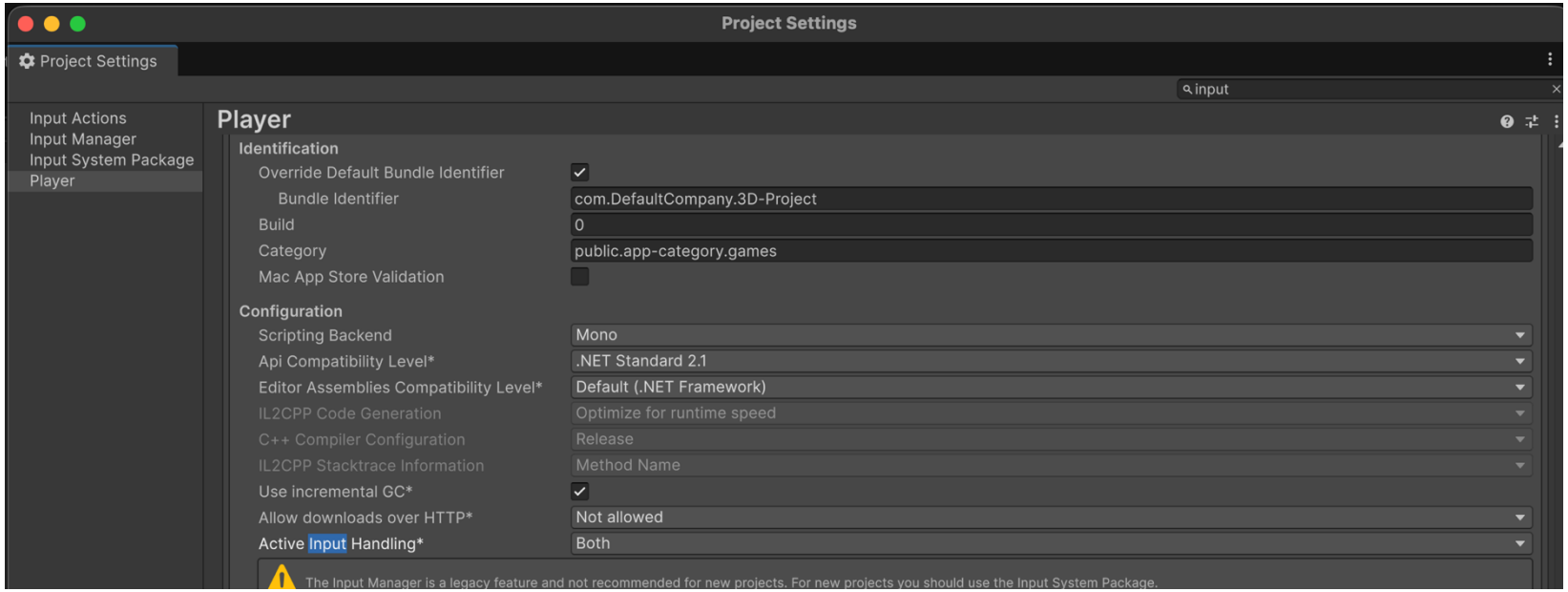
- XR simulator overview: https://developers.meta.com/horizon/documentation/unity/xrsim-intro/

Exercise 2 – Add a cube…dynamically

Setup Input system (my code uses old input system)

- Go to Edit → Project Settings → Player
- Search for Active Input Handling and choose “Both”
- Unity will restart the project…





Add a new cube

- Now in the scene disable the existing cube and then add in the scene a new cube and set it at x = 0, y = 1.2, z = 2 (no script should be attached to this cube)
- Otherwise you can delete the script from the existing cube

What you should have in the scene is an active cube at x = 0, y = 1.2, z = 2 without any script on it

- Create a folder Prefab
- Drag this new cube without script in Prefab folder to create the prefab
- Delete this new cube from the scene

Create a new script in the folder scripts

- Call the script **MRPlaceObjectDemo.cs** (see next slide for the code)
- Create a new Empty Object on the Scene and nale this Object something like “MRDemoManager”
- Add the **MRPlaceObjectDemo.cs** to the MRDemoManager object

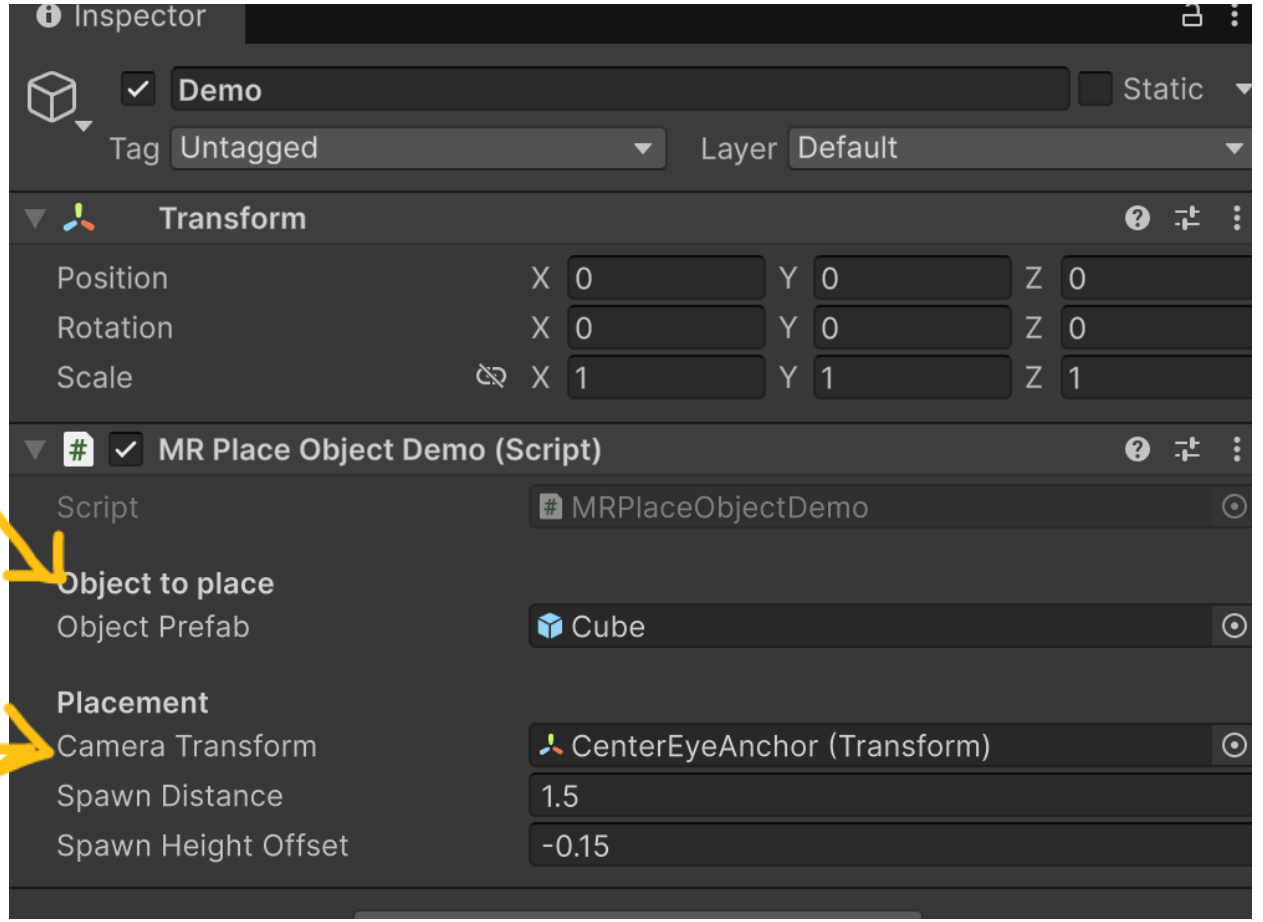
```
using System.Diagnostics;
using UnityEngine;
using UnityEngine.Debug;

public class MRPlaceObjectDemo : MonoBehaviour
{
  [Header("Object to place")]
  public GameObject objectPrefab;

  [Header("Placement")]
  public Transform cameraTransform;
  public float spawnDistance = 1.5f;
  public float spawnHeightOffset = -0.15f;

  private GameObject spawnedObject;
  private Renderer spawnedRenderer;

  private readonly Color[] colors =
  {
    Color.cyan,
    Color.magenta,
    Color.yellow,
    Color.green,
    Color.red,
    Color.white
  };

  private int colorIndex = 0;

  void Start()
  {
    if (cameraTransform == null && Camera.main != null)
    { cameraTransform = Camera.main.transform; }
  }

  void Update()
  {
    if (Input.GetKeyDown(KeyCode.Space))
    { PlaceOrMoveObject();}

    if (Input.GetKeyDown(KeyCode.C))
    {ChangeObjectColor();}

    if (spawnedObject != null)
    {spawnedObject.transform.Rotate(0f, 40f * Time.deltaTime, 0f);}
  }

  void PlaceOrMoveObject()
  {
    if (objectPrefab == null || cameraTransform == null)
    {
      Debug.LogWarning("Missing objectPrefab or cameraTransform.");
      return;
    }

    Vector3 forward = cameraTransform.forward;
    forward.y = 0f;
    forward.Normalize();

    Vector3 spawnPosition =
      cameraTransform.position +
      forward * spawnDistance +
      Vector3.up * spawnHeightOffset;

    Quaternion spawnRotation = Quaternion.LookRotation(forward);

    if (spawnedObject == null)
    {
      spawnedObject = Instantiate(objectPrefab, spawnPosition, spawnRotation);
      spawnedRenderer = spawnedObject.GetComponentInChildren<Renderer>();
    }
    else
    {
      spawnedObject.transform.SetPositionAndRotation(spawnPosition, spawnRotation);
      Debug.Log("position; " + spawnPosition);
    }
  }

  void ChangeObjectColor()
  {
    if (spawnedRenderer == null)
    {
      return;
    }

    colorIndex = (colorIndex + 1) % colors.Length;
    spawnedRenderer.material.color = colors[colorIndex];
  }
}
```

```
using System.Diagnostics;
using UnityEngine;
using UnityEngine.Debug;

public class MRPlaceObjectDemo : MonoBehaviour
{
  [Header("Object to place")]
  public GameObject objectPrefab;

  [Header("Placement")]
  public Transform cameraTransform;
  public float spawnDistance = 1.5f;
  public float spawnHeightOffset = -0.15f;

  private GameObject spawnedObject;
  private Renderer spawnedRenderer;

  private readonly Color[] colors =
  {
    Color.cyan,
    Color.magenta,
    Color.yellow,
    Color.green,
    Color.red,
    Color.white
  };

  private int colorIndex = 0;

  void Start()
  {
    if (cameraTransform == null && Camera.main != null)
    { cameraTransform = Camera.main.transform; }
  }

  void Update()
  {
    if (Input.GetKeyDown(KeyCode.Space))
    { PlaceOrMoveObject();}

    if (Input.GetKeyDown(KeyCode.C))
    {ChangeObjectColor();}

    if (spawnedObject != null)
    {spawnedObject.transform.Rotate(0f, 40f * Time.deltaTime, 0f);}
  }
```

Use camera transform to update position where to instantiate the cube every time the spacebar is pushed

```
  void PlaceOrMoveObject()
  {
    if (objectPrefab == null || cameraTransform == null)
    {
      Debug.LogWarning("Missing objectPrefab or cameraTransform.");
      return;
    }

    Vector3 forward = cameraTransform.forward;
    forward.y = 0f;
    forward.Normalize();

    Vector3 spawnPosition =
      cameraTransform.position +
      forward * spawnDistance +
      Vector3.up * spawnHeightOffset;

    Quaternion spawnRotation = Quaternion.LookRotation(forward);

    if (spawnedObject == null)
    {
      spawnedObject = Instantiate(objectPrefab, spawnPosition, spawnRotation);
      spawnedRenderer = spawnedObject.GetComponentInChildren<Renderer>();
    }
    else
    {
      spawnedObject.transform.SetPositionAndRotation(spawnPosition, spawnRotation);
      Debug.Log("position; " + spawnPosition);
    }
  }

  void ChangeObjectColor()
  {
    if (spawnedRenderer == null)
    {
      return;
    }

    colorIndex = (colorIndex + 1) % colors.Length;
    spawnedRenderer.material.color = colors[colorIndex];
  }
}
```

- In the Object Prefab put the Prefab of the cube
- In the Camera Trasform put the Center Eye Anchor in the scene (that is a child of the Camera Rig in the scene)



Test it in the Scene

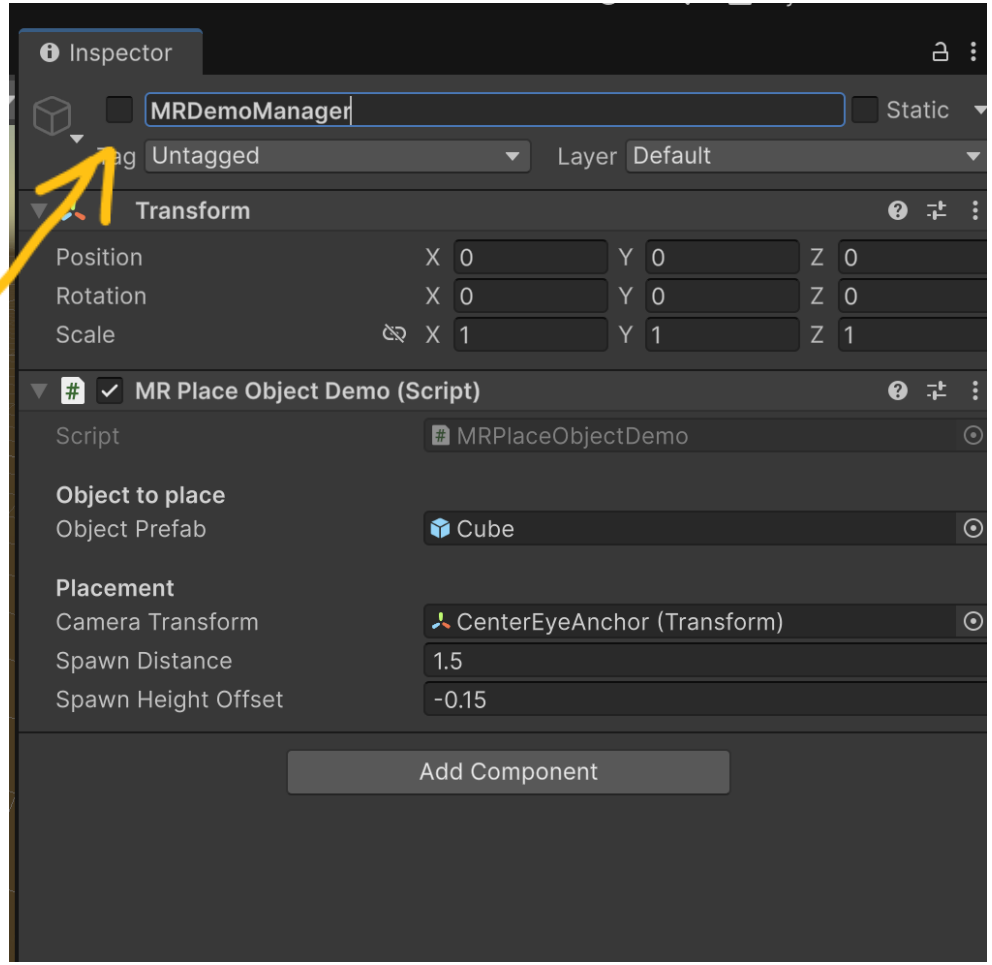
- You can eventually click on keyboard “C” to change material’s color of the cube

Exercise 2 *variant* – Add a cube…dynamically

Using Oculus OVR Camera Rig script

Create a new script in the folder scripts

- Create a new script **MRDemo2.cs** (see next slide for the code)
- Disable the “MRDemoManager” object in the scene
- Create a new Empty Object on the Scene and name this Object something like “MRDemoManager2”
- Add the MRDemo2**.cs** to the MRDemoManager2 object

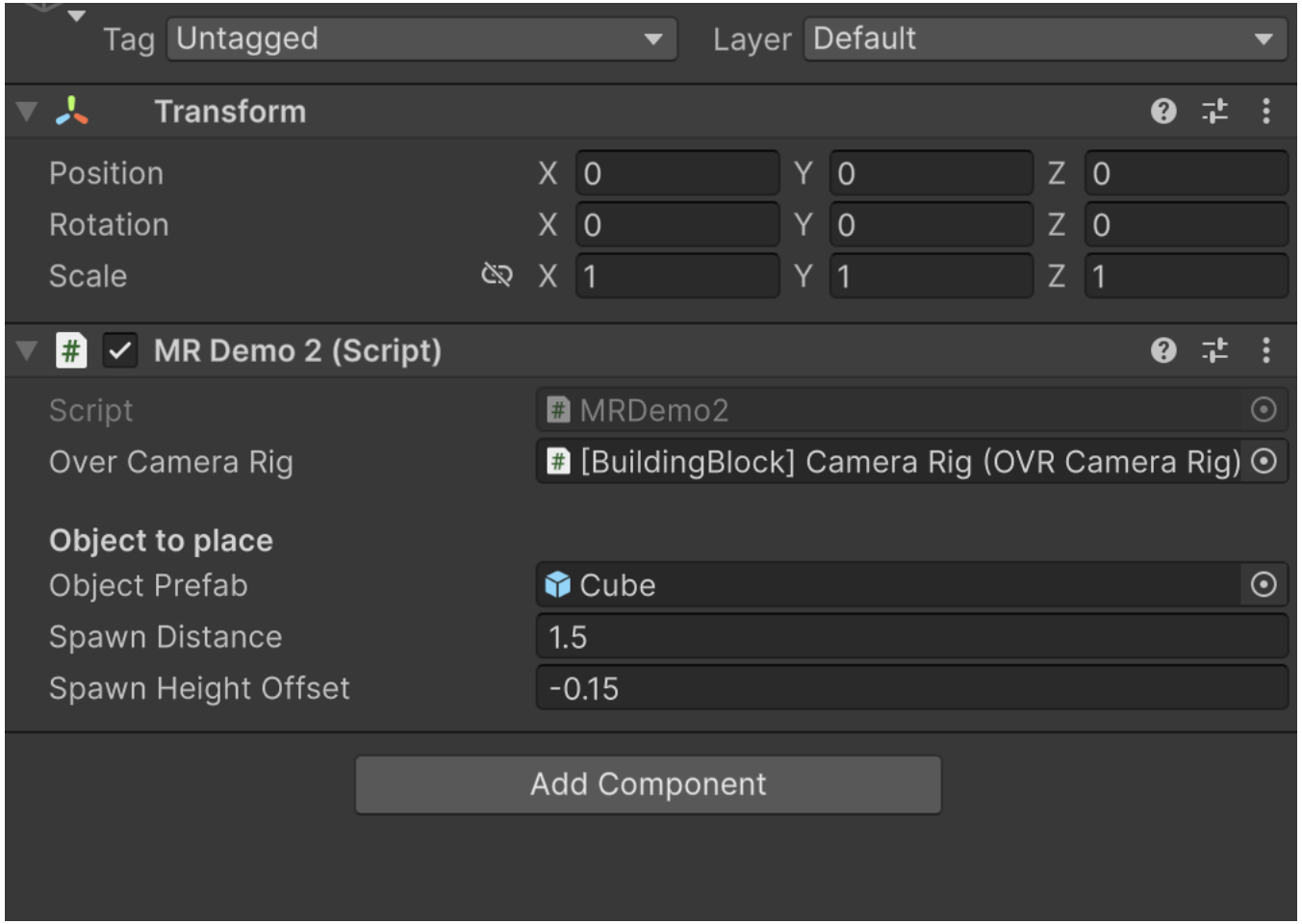


```
using UnityEngine;

public class MRDemo2 : MonoBehaviour
{
    public OVRCameraRig overCameraRig;

    [Header("Object to place")]
    public GameObject objectPrefab;

    public float spawnDistance = 1.5f;
    public float spawnHeightOffset = -0.15f;

    private GameObject spawnedObject;


    void Start() { }

    void Update()
    {
        if (Input.GetKeyDown(KeyCode.Space))
        { PlaceOrMoveObject(); }

    }

    void PlaceOrMoveObject()
    {
        var cameraTransform = overCameraRig.centerEyeAnchor.position;
        if (objectPrefab == null || cameraTransform == null)
        { return; }

        Vector3 forward = overCameraRig.centerEyeAnchor.forward;
        forward.y = 0f;
        forward.Normalize();

        Vector3 spawnPosition =
            cameraTransform +
            forward * spawnDistance +
            Vector3.up * spawnHeightOffset;

        Quaternion spawnRotation = Quaternion.LookRotation(forward);

        if (spawnedObject == null)
        { spawnedObject = Instantiate(objectPrefab, spawnPosition, spawnRotation); }
        else
        { spawnedObject.transform.SetPositionAndRotation(spawnPosition, spawnRotation); }
    }

}
```

- In the MRDemoManager2 object set the parameters of the script MRDemo2

- Now the script MRDemo2 expects a Camera Rig script attached to the Camera, so you should add the Camera Rig parent in the scene here

- Add the prefab of the cube here



Test it in the Scene

center eye anchor: is the main Unity camera within the Meta XR Camera Rig hierarchy

In both examples I took the Center Eye Anchor:

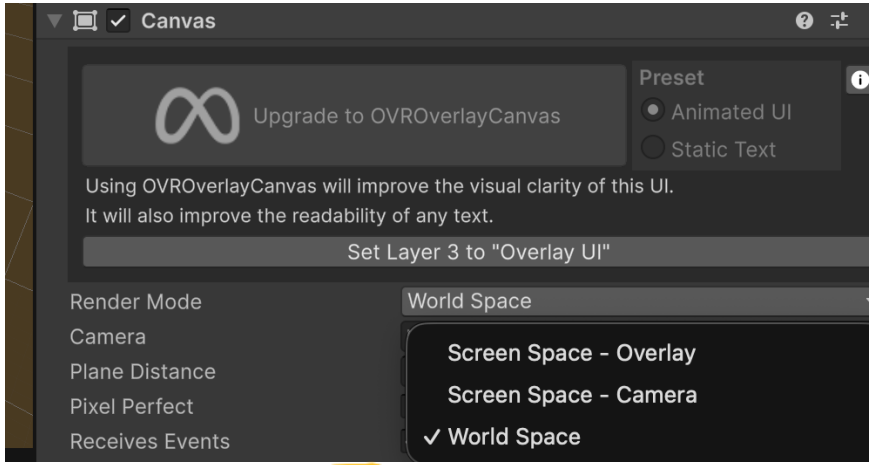
In the first example the code expects a simple camera, and I give the Center Eye Anchor manually on the UI

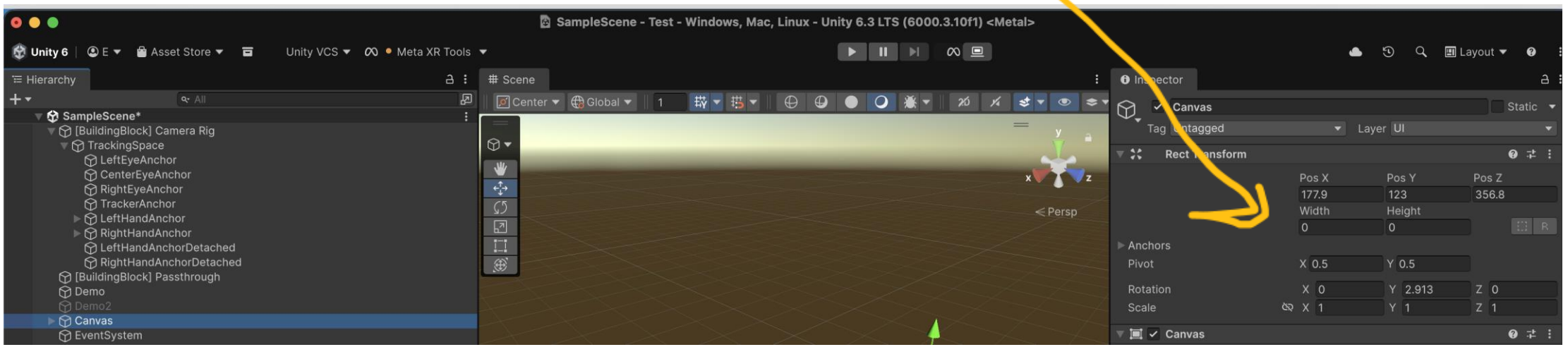
In the second example I get the main script OVR Camera Rig that exposes a centerEyeAnchor variable, and I get it inside my code.

https://developers.meta.com/horizon/reference/unity/v72/class_o_v_r_camera_rig/

Exercise 3 – Add a canvas in front of user’s face (camera follow)

- Add a Canvas in the Scene
- Set it to World Space
- Set Width and Height to 0

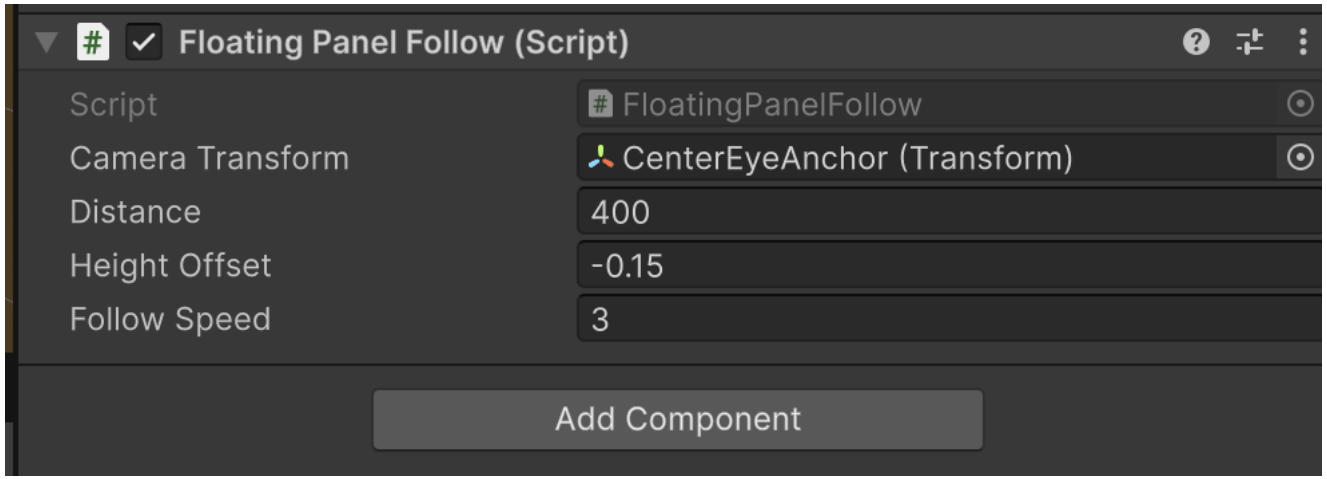




- Add a Text (TextMeshPro) inside the Canvas
- This time adjust the size of the Text and write somethins in it, I will write “Prova”
- Now create a new Script in the Scripts folder: **FloatingPanelFollow.cs** (see next slide)
- Attach the script **FloatingPanelFollow** to the Canvas

```
using UnityEngine;

public class FloatingPanelFollow : MonoBehaviour
{
    public Transform cameraTransform;
    public float distance = 1.2f;
    public float heightOffset = -0.15f;

    void Start()
    {
        if (cameraTransform == null && Camera.main != null)
        { cameraTransform = Camera.main.transform; }
    }

    void Update()
    {
        if (cameraTransform == null)
        { return; }

        Vector3 forward = cameraTransform.forward;
        forward.y = 0f;
        forward.Normalize();

        Vector3 targetPosition =
            cameraTransform.position +
            forward * distance +
            Vector3.up * heightOffset;

        Quaternion spawnRotation = Quaternion.LookRotation(forward);
        transform.SetPositionAndRotation(targetPosition, spawnRotation);

    }
}
```

- In the script **FloatingPanelFollow** attached to the Canvas set a wide Distance such as 400



Test it in the Scene

- Now you can test it in the Simulator

Precious info and guidelines on UIs

- You can find different kind of UI design tutorial, documentation and guidelines here:

https://developers.meta.com/horizon/documentation/unity/unity-isdk-create-ui-overview/