UNIVERSITÀ
DEGLI STUDI
DI BERGAMO

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Serious Games and Unity

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Serious Games

Digital Games designed for **educational and learning** purposes, based on **simulation** of real-life environments or activities.

The main purposes is to:

- Engage
- Motivate
- Increase patient adherence to treatment

Definition of requirements

PHYSIOTHERAPISTS REHABILITATION

"SGS" REHABILITATION IN ACTUAL PRACTICE

SERIOUS GAMES IN LITERATURE

Requirements Guidelines

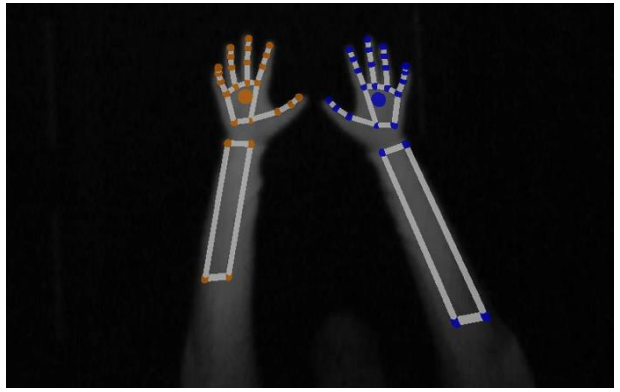
- Present **functional and cognitive** elements
- **Customization** of difficulty level according to the patient's abilities
- Be **stimulating, motivational, challenging**
- Present a useful game (i.e., **score**)
- Immediate audio and visual **feedback**
- Have a **good quality of design** and perception of the **3rd dimension**
- Manage **ranges and frequency of movement**
- Present a Natural User Interface (**NUI**)
- Provide **quantitative measurements** of the parameters and movements performed by the patient

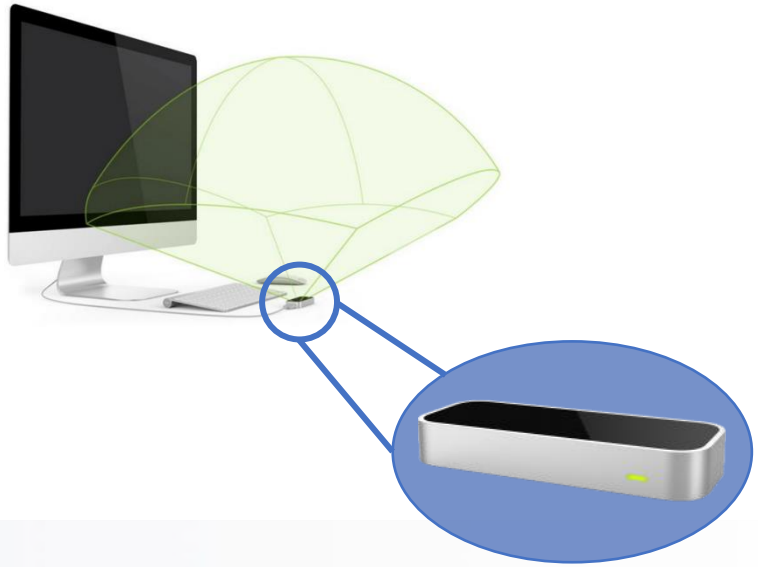
How Develop a Serious Game?

1. **Acquire Knowledge** about the pathology and the deficits of interest
2. **Research in literature** about the technology used, the serious games requirements, the conventional rehabilitation clinical practice
3. Define the **idea** of Serious Game
4. **Start the development** of the Serious Game

Leap Motion Controller version 1

- **Optical markerless** Motion Capture system
- **Hand** Tracking Device
- **CE marking**
- 27 joints for each hand
- **Cinematic parameters**
- Entry level, low cost
- Consumer technology
- Conic Field of View (FOV): 140 x120°
- Dimension: 3x8x1.13 cm





Examples of Serious Games [1/3]

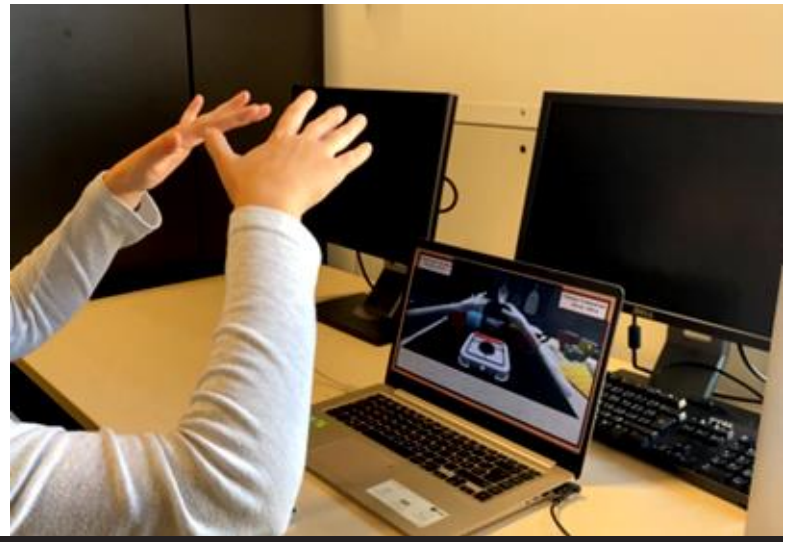
Moka Coffee

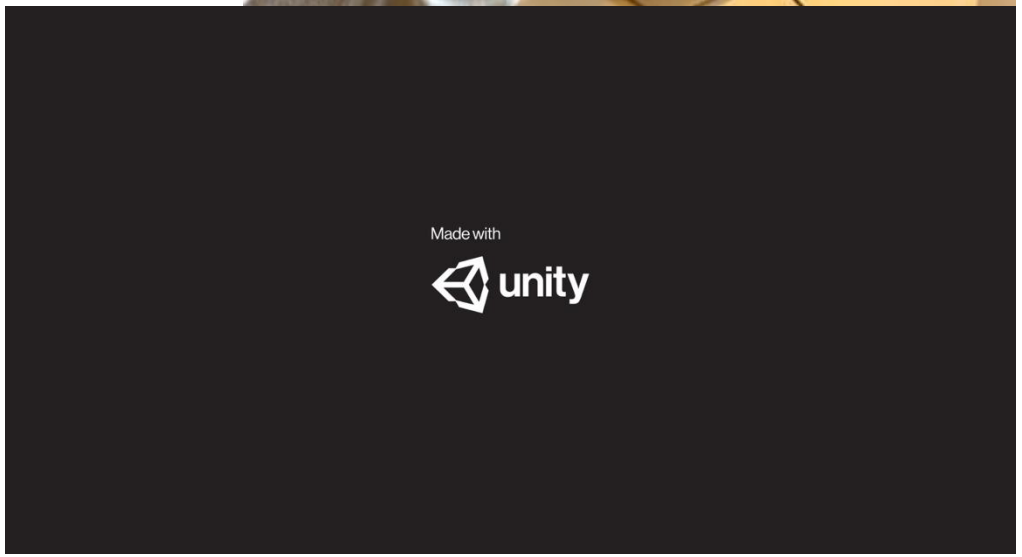
Parameters to customize:

- Touch or Pinch
- Dimension of Objects (small or Big)
- Displacement of the objects (ordered or casual)
- Help in the sequence

Parameters measured:

- Time to complete the exercise
- Errors in object displacement
- Partial time for each object





Examples of Serious Games [2/3]

Whac-a-Mole

Parameters to customize:

- Score to achieve
- Target change time
- Hand to use (right, left, both)

Parameters measured:

- Time to complete the exercise
- Score achieved
- Missed moles

Examples of Serious Games [3/3]

Paint On Canvas

Parameters to customize:

- Pinch or Touch
- Precision required (Low, Medium, High)
- Figure: Rectangle, Circle, Rhombus, Hearth, Cloud, Star

Parameters measured:

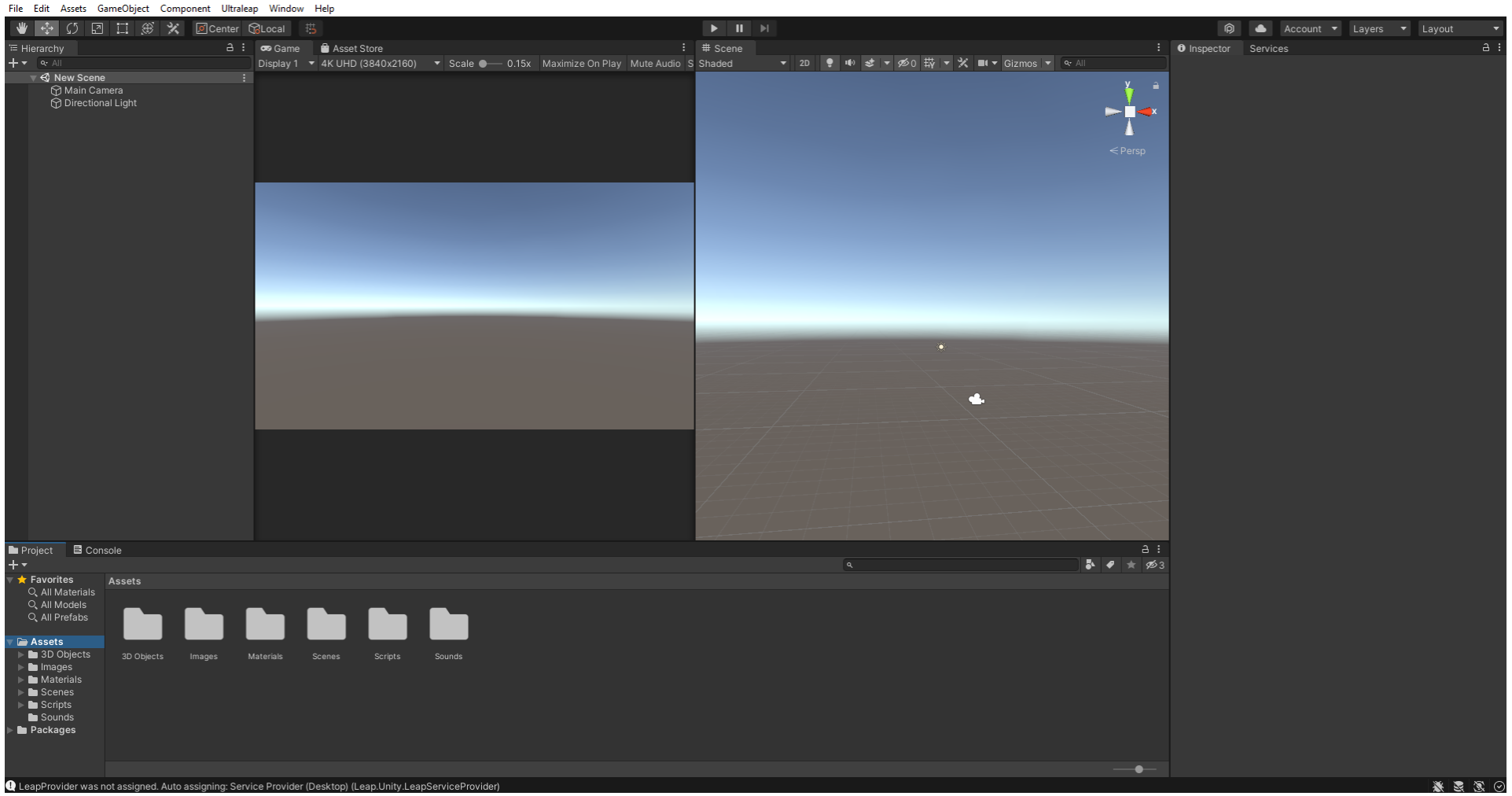
- Time to complete the exercise
- Rate of completion
- Velocity of movements
- Area covered

Unity and VS

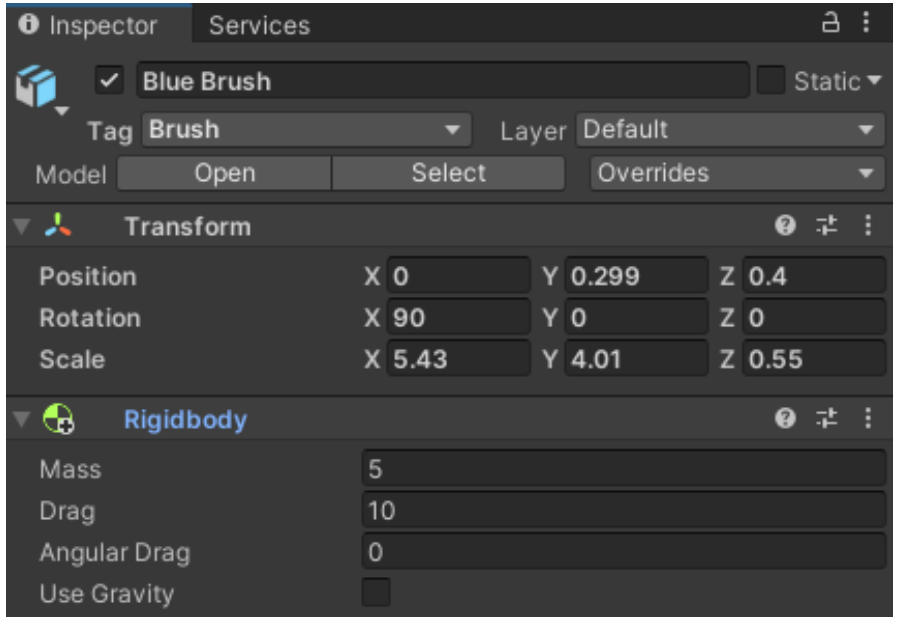
C#

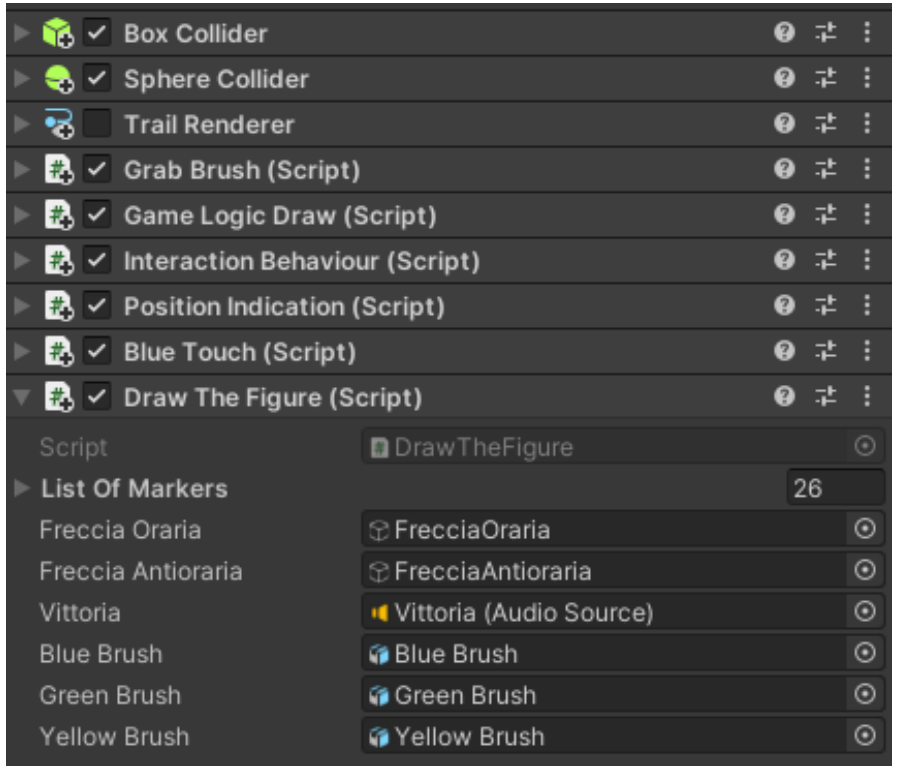
Visual Studio

Unity

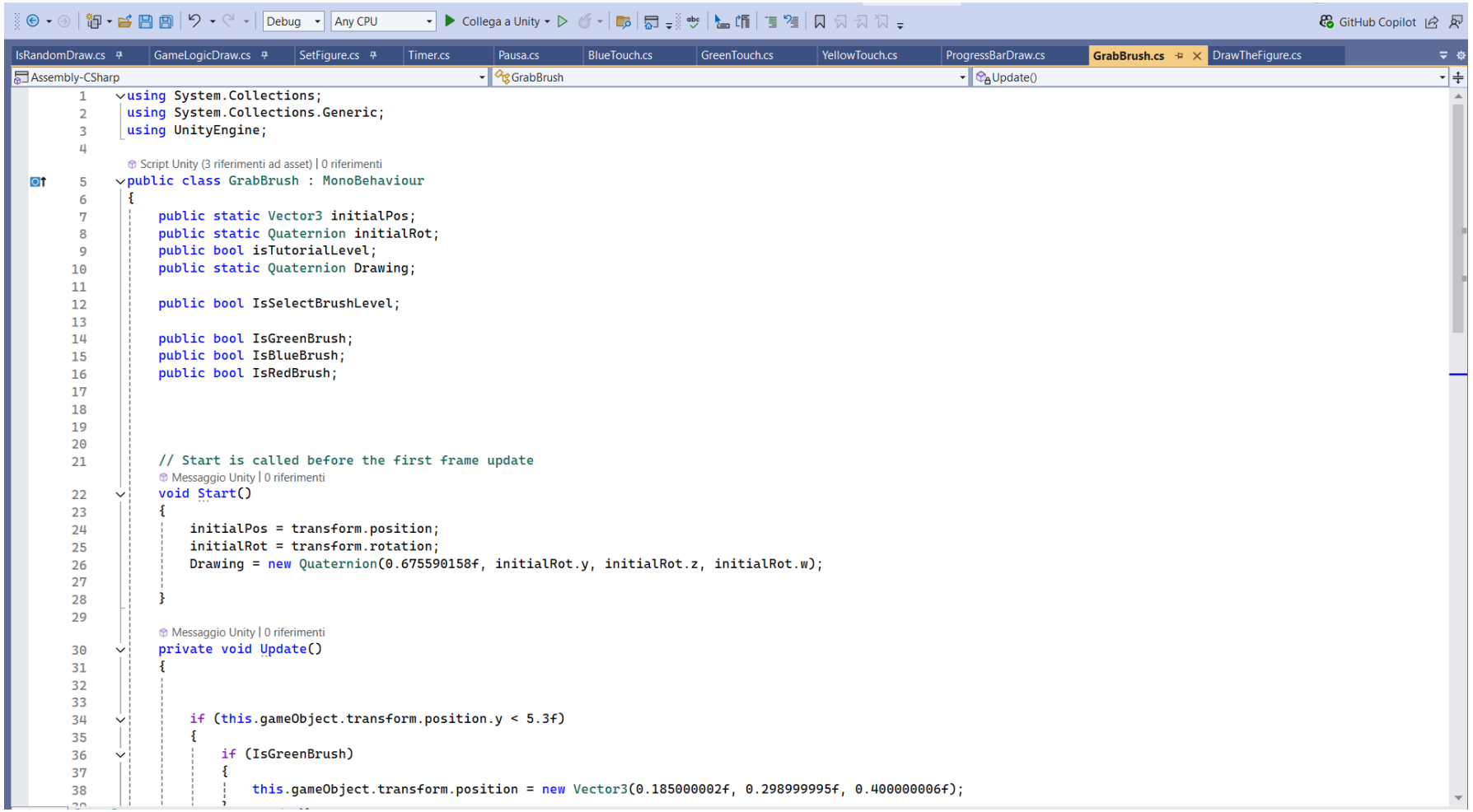


Example of Inspector





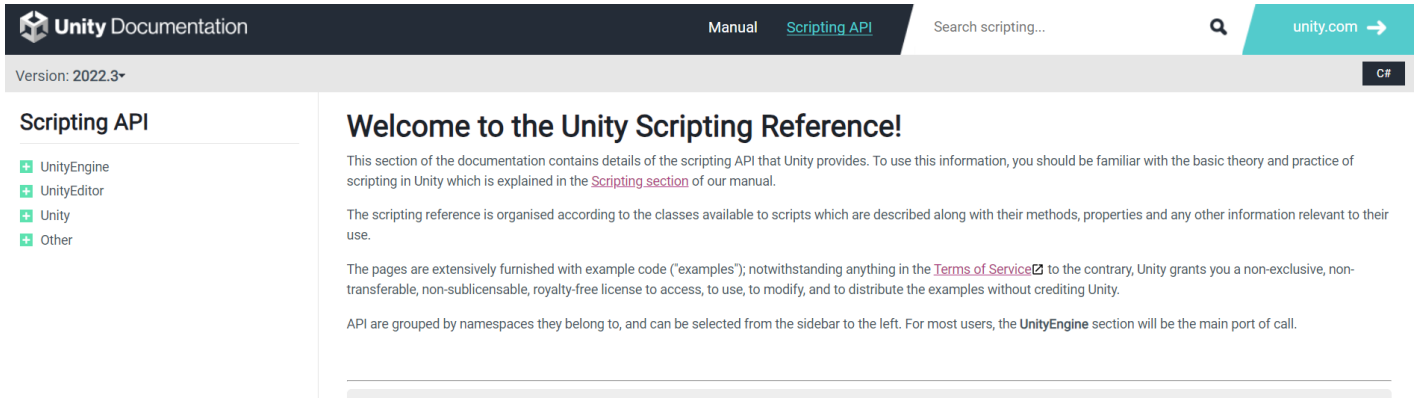
Example of Script in C#



```
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

Script Unity (3 riferimenti ad asset) | 0 riferimenti
public class GrabBrush : MonoBehaviour
{
    public static Vector3 initialPos;
    public static Quaternion initialRot;
    public bool isTutorialLevel;
    public static Quaternion Drawing;

    public bool IsSelectBrushLevel;

    public bool IsGreenBrush;
    public bool IsBlueBrush;
    public bool IsRedBrush;




    // Start is called before the first frame update
    Messaggio Unity | 0 riferimenti
    void Start()
    {
        initialPos = transform.position;
        initialRot = transform.rotation;
        Drawing = new Quaternion(0.675590158f, initialRot.y, initialRot.z, initialRot.w);

    }

    Messaggio Unity | 0 riferimenti
    private void Update()
    {


        if (this.gameObject.transform.position.y < 5.3f)
        {
            if (IsGreenBrush)
            {
                this.gameObject.transform.position = new Vector3(0.185000002f, 0.298999995f, 0.400000006f);
```

Documentation

- Unity Documentation: https://docs.unity3d.com/ScriptReference/index.html



- C# and Programming:
  - W3Schools: https://www.w3schools.com/cs/index.php
  - StackOverflow: https://stackoverflow.com/
  - Video Tutorials
  - ……

Leap Motion Controller Integration

- Documentation of Leap Motion Controller in Unity: https://docs.ultraleap.com/

- Integration of Leap Motion in Unity: https://docs.ultraleap.com/xr-and-tabletop/xr/unity/getting-started/index.html

- Introduction of Hands Avatar: https://docs.ultraleap.com/ultralab/hands-module

3D Objects Finding

WebSites Examples:

- Sketchfab: https://sketchfab.com/features/free-3d-models

- TurboSquid: https://www.turbosquid.com/Search/3D-Models/free

- Free3D: https://free3d.com/3d-models/

- Blender: https://www.blender.org/download/