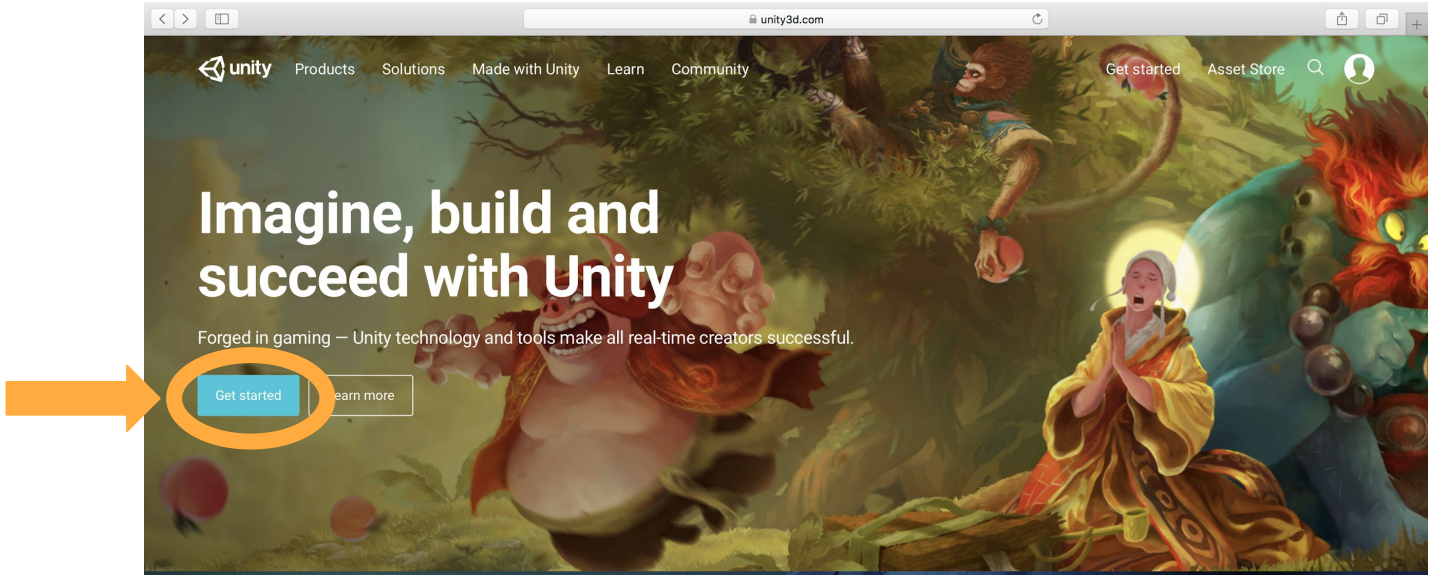
MakerSpace VR Challenge
Intro to Unity

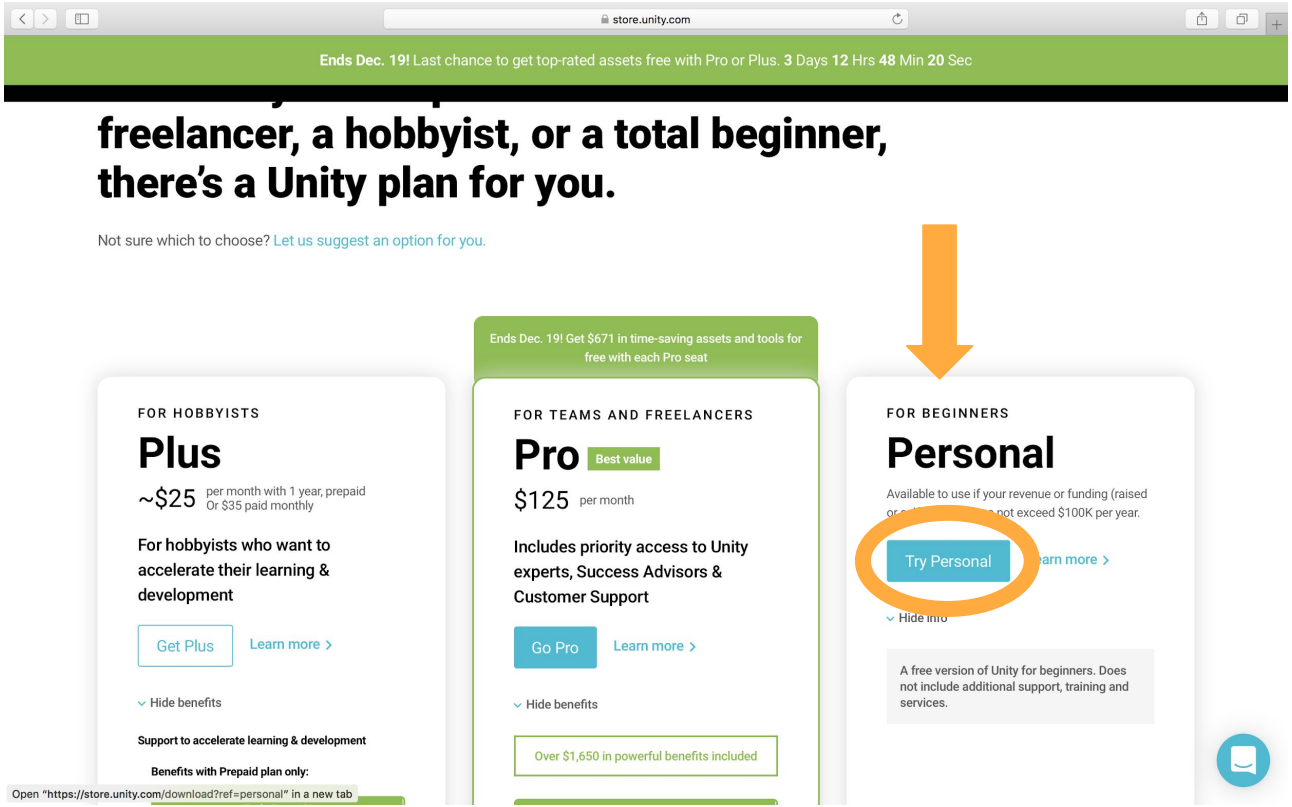
Workshop #1
January 16th, 2019

Installing Unity3D

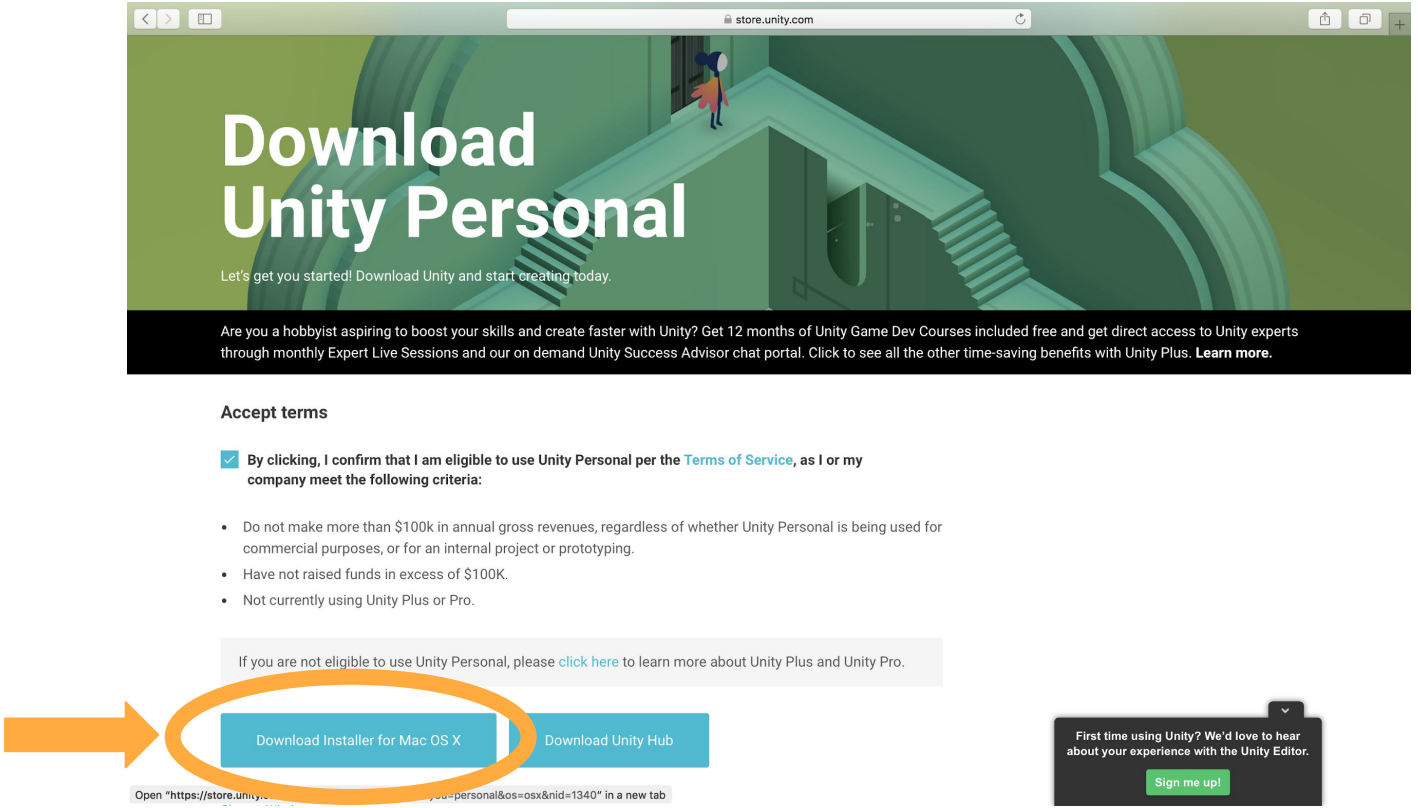
Go to Unity3D.com
Click on “Get Started”



Click on “Try Personal”



Download and Install Unity



Competition Info

Slack Group
makerspacevrchallenge.slack.com

- Main communication platform for the competition
- Directly message me about questions
- I will be posting links for new workshop material
- The group can use it to share useful information with each other
- Anyone with a uOttawa email address can join
    - If you don’t have a uOttawa email address, talk to me after the session and I’ll add you

Github Repository

github.com/elishapruner/Makerspace-VR-Challenge

- Github repo has:
  - Source code for workshops
  - Powerpoint slides
  - Links to YouTube videos
  - Competition instructions

Have class and need to leave early?

- If you have class at 7pm → head out whenever you need to
- Students who have class at 5:30 will start coming in at the middle of the session
- If you can't attend because class, or if the weather is bad, just watch the YouTube videos whenever you have a chance
  - I will post the YouTube videos Wednesday night after the workshop session
- Advantage of being here in person:
  - Meet and collaborate with other students
  - Meeting students who are not in your field that can help you with part of your app
  - Work with the VR headsets

About Us

- Elisha Pruner
  - Software Developer at the Ottawa Hospital
  - Recent grad from Computer Science
  - My experience is in medical visualization in Virtual Reality from patient CT and MRI scans
  - I also work with machine learning on CT, MRI, and X-ray scans to find features of interest
    - Convolutional neural networks, generating data sets and training images
  - Makerspace VR Challenge role → University end, student Workshops
- Justin Sutherland
  - Medical Physicist at the Ottawa Hospital
  - Treatment planning for radiation therapy
  - Research work is in Virtual Reality developing clinical applications for medical visualization
  - Makerspace VR Challenge role → Hospital end, implementing the apps for chemotherapy and radiation therapy treatments, patient feedback

About the Competition

Competition Goal

- Dr. Hanan Anis approached us, she wanted to create a VR challenge
- We wanted a project in VR that has a real impact on patients at the hospital
- Competition focus - building VR applications for patient experience
- How can we use VR to take a stressful and painful experience of chemotherapy and radiation therapy, and try to make it a more positive experience
- At the end of the semester we will be implementing your apps at the hospital

Chemotherapy and Radiation Therapy Treatments

What to Expect During Chemotherapy

https://youtu.be/WSUBGOtva0I

Chemotherapy

- Systemic treatment: kills cancer cells throughout the body
- Chemotherapy drugs administered by IV
- Nausea, dizzy, chemo fog
- Stressful, uncomfortable, boring
- Worst part is length of time, trying to stay positive
- Treatment lasts 30 min - 3 hours on average

What to Expect During Radiation Therapy

https://youtu.be/zecm_7sNYHs

Radiation Therapy

- Daily treatments of ionizing (high energy) radiation targeting tumours and avoiding normal / healthy organs
- 15-20 min per treatment, up to 43 times (usually less than that)
- Anxiety surrounding radiation
- Treatment position can be uncomfortable
- Claustrophobia
- Some patients require anxiety meds

Patient Experience

- Cancer and cancer treatment is scary
- High anxiety time - calm is most important
- Very very terrifying time for patients
- Stressful, uncomfortable, painful, uncertain

MakerSpace VR Challenge

- Create a VR experience for cancer patients to use during treatment
- Distract from discomfort, anxiety, pain
- Turn a difficult time and stressful treatment into a more positive experience
- Can target chemo treatment, radiation treatment, or both
- Current VR games on the market are not suitable for chemotherapy and radiation therapy
    - Mobility constraints - too much movement
    - Nausia - don’t want things flying at you at rapid speeds

Patient Story

Patient Story

Thoughts from Terry’s sister: From the Ottawa Hospital Focus Group (Jan 7, 2019)

I base my response on having been a cancer patient and experiencing virtual reality technology with my sons games. Personally I have always wanted to know exactly what is wrong and how to fix it. If a cancer patient can see and truly see what is going on then I feel the “fear of the unknown” will help alleviate those fears and then you can concentrate on how to get better and seek the best treatment available.

I do believe however that age has an effect on a patient’s behavior - the older generations want things to go away and the details of how it got there are not important to them and the fear takes over rational thought.

Patient Story (Continued)

When I experienced my sons virtual reality headset I was transformed into a world that seemed so real and amazing that I did in fact feel transformed. In one game I played I was tricked into believing that I was actually jumping off a cliff. But once I did jump and realized I was ok that gave me the confidence to move on just like in real life so I think how amazing that would be if I was a patient and could actually see the kind of cancer, where it is and how it will be treated.

I truly feel VR can motivate behavior and therefore reduce anxiety and aid in understanding treatment and recovery. Even as a doctor I can imagine that using VR would help alleviate their challenge of trying to explain a diagnosis without been too clinical .

Patient Story (Continued)

When I received chemotherapy treatments I think the worst part was really the length of time you lay there waiting for the treatment - remaining positive is a challenge - so if VR was introduced for not only diagnosis but for treatment as well I believe that would be very beneficial.

Who would not want to be transformed into some alternate reality and let your mind drift while you lay for hours at a time as a deadly cocktail is pumped into your veins (constantly wondering what it actually is and if it works).

Patient Story (Continued)

Radiation treatment can also be time consuming and frequent therefore a constant stress - again having the process explained using VR , and even perhaps applying it during treatment (if that was ever possible) would I believe help immensely.

In conclusion I really hope that this technology can one day become mainstream in hospitals and firmly believe that as a former cancer patient this will undeniably help with “the fear” most people have of something that people just simply don’t understand.

Patient Stories

- If you or a family member has gone through chemotherapy or radiation therapy and would like to share your story, please contact me on Slack
  - Come and talk with us in person
  - Talk to the group by Skype
  - Video recording on your phone
  - Typed letter
- Any help or ideas on how to integrate VR into this procedure would be a huge help to the group

VR Game - Fear of Vaccines

https://youtu.be/9CPVOt7QjcM

Today’s Workshop

Workshop #1 - Creating a simple virtual world

- Building simple 3D objects in Unity
- Camera - write a simple script to move the camera in the scene
- Designing Materials
- Texturing Objects

Create a New Project in Unity

Create a New Project in Unity

- Open Unity
- In ‘Location’, find a folder in your documents where you want to store the Unity project
- In ‘Project Name’ give the project a name
- In ‘Template’ choose ‘3D’
- Click on ‘Create Project’

HDR Skybox

HDR Skybox

- High Dynamic Range (HDR) is a file format similar to JPEG or PNG
  - HDR images have more lighting information than a typical JPEG file
  - Current iPhones use the HDR image format for photos
- For VR, the HDR images provide the color and also light the scene
- HDR images are used in your scenes to make the sky

In Unity

- Click on the ‘Asset Store’ tab and search for ‘Free HDR Sky’ and click on it
- Click on the ‘Download’ button
- Now click ‘Import’

Add the Skybox to the Scene

- In the file menu, to to ‘Window’ → ‘Rendering’ → ‘Lighting Settings’
- In the Lighting Settings tab, click on the circle beside ‘Skybox Material’
- Choose ‘Skybox_Daytime’ or ‘Skybox_Sunset’
    - Alternatively you can drag the material directly into the Skybox Material box

Week 3 of workshops

- We will be creating our own custom HDR Skyboxes of real-world scenes

Basic 3D Objects

Adding 3D Objects to the Scene

- Right click in the ‘Hierarchy’ window and go to
  - 3D Object → Cube
  - 3D Object → Sphere
  - 3D Object → Capsule
  - 3D Object → Cylinder
  - 3D Object → Quad
  - 3D Object → Plane
- Rename, duplicating, or deleting the 3D object
  - Right click on the object and choose rename, duplicate, or delete
  - For renaming you can also slow double click
- Save your scene

Transformations

- Make sure the ‘Inspector’ window is visible
- Click on an object and you can see all of its values in the Inspector window
- You can use the arrows in the scene to translate the object in the x, y, z directions
- You can also do the translations more precisely in the Inspector window under ‘Transform’
  - Translate in x, y, z
  - Rotation in x, y, z
  - Scale in x, y, z
- In Unity when playing in VR → 1 unit = 1 meter
- Play with these features move the objects around, rotate them, and change their scale

Camera

Camera

- Click on ‘Main Camera’ in the Hierarchy window and look at its values in the Inspector window
- Camera view of the scene is shown in the ‘Game’ window
- Under ‘Transform’ in the Inspector window
  - Change the x, y, z position of the camera in the scene
  - Change the x, y, z rotation of the camera in the scene

Adding a Script to Move the Camera

- Create a new folder under ‘Assets’ called ‘Scripts’
  - Right click on Assets and go ‘Create’ → ‘Folder’
  - Name the folder ‘Scripts’
- Create a new script file called MoveCamera
  - Inside the Scripts folder right click and go ‘Create’ → ‘C# Script’
  - Double click on MoveCamera and it will open in a text editor or IDE
- IDE’s that you can use with Unity
  - Microsoft Visual Studio (comes with the unity install)
  - Atom, Sublime Text, VS Code
  - Rider (free with Jetbrains student account)
  - Pretty much anything works - i’ll be using Atom but use whatever you like

Adding a Script to Move the Camera

- Double click on ‘MoveCamera’ to open the file in your favorite text editor
  - Make sure the class is called MoveCamera, if not change the text here
- The class has two functions
  - Start()
    - Start runs once at the start of the program
  - Update()
    - Update runs every frame, updates 60 frames per second in Unity
- Depending on what you want your Unity program to do, you will generally start by putting your code in either the Start() or Update() functions

Adding a Script to Move the Camera

- Github Repo:
  - github.com/elishapruner/Makerspace-VR-Challenge
- Go to Github, go to Workshop 1, in the Start folder find the file MoveCamera.cs
  - Copy and paste the contents of the file into your own MoveCamera script
- Drag ‘MoveCamera’ onto MainCamera in the Hierarchy window to add the script to the camera
  - Alternatively click on MainCamera and go to the Inspector window, then drag MoveCamera into the empty space in the Inspector window
  - Alternative click on MainCamera and go to the Inspector window, click on ‘Add Component’, type MoveCamera in the search box

Adding a Script to Move the Camera

- Press Play to run the game
  - Click on or off on ‘Maximize on Play’ to either expand the game window on play or not
- Use the keyboard keys:
  - Right, left, up, and down keys to move the camera
  - Use the + or - key to zoom in and out
- Things to play with in the script
  - Change the speed value, in C# floats need an ‘f’ letter beside the number, otherwise it assumes it is a double. In VR we always use floats instead of doubles
  - Change the keys that I used to different keyboard keys
    - https://docs.unity3d.com/ScriptReference/KeyCode.html

Materials

Creating New Materials

- In the Asset folder, right click and add a new folder called ‘Materials’
- Right click in the Materials folder and go ‘Create’ → ‘Material’
  - Name the material ‘CubeMat’
- Repeat for all of the 3D objects in the scene
  - So you will have CubeMat, SphereMat, CapsuleMat, CylinderMat, PlaneMat, QuadMat
- Drag the material onto the 3D object that it is assigned to
  - Can drag onto the name in the Hierarchy window
  - Alternatively can drag onto the object in the scene
- Click on the material and look in the Inspector window
  - Beside Albedo change the color by clicking in the box
  - Change the Metallic and Smoothness values in the slider

Textures

Setting Up the Scene

- Create a new Scene and name it ‘Texture Scene’
  - In the Scenes folder, right click and go ‘Create’ → ‘Scene’
  - Alternatively go File → New Scene
  - Alternatively go File → Save As to save the previous scene into a new scene
- Add a skybox, a plane, and a capsule to the scene
  - Add the MoveCamera script to the MainCamera object to move the camera with the keyboard
- Click on the Capsule in the Hierarchy window and go to the Inspector window
  - Under ‘Transform’ move the x, y, z positions to x=0, y=1, z=0
- Click on MainCamera in the Hierarchy window and go to the Inspector
  - Under Transform change the x, y, z positions to x=0, y=1, z=-4

Download a Texture from the Asset Store

- Go to Google and search ‘unity asset store’
- In the search area of the Unity Asset Store search for ‘brick texture’
- Under the Price filter, move the slider so that it only searches for free assets, click apply to apply the filter
- Choose a brick texture that you like
- In Unity, go to the Asset Store tab, in the search bar copy and paste the name of the asset you want to download
    - Download and install the asset
- Under Assets create a new folder called ‘Textures’, and drag the installed folder into the Textures folder

Create a New Textured Material

- In the Materials folder, right click and go ‘Create’ → ‘Material’ and name the new material ‘TextureMat’
- Drag TextureMat onto the Capsule object in the Hierarchy window
  - Alternative drag TextureMat onto the capsule object in the Scene window
- Click on Capsule in the Hierarchy window and go to the Inspector window
  - Either click on the circle beside each material property to choose a texture image, or drag the texture image directly into the box beside the name
  - Add the image for Albedo, Metallic, Normal Map, Height Map, and Occlusion

Workshop Task

Task: Create a House

- Create a new scene and name it ‘House’
- Using the basic 3D objects build a house using:
  - Cubes, quads, spheres, etc
  - Use the transforms like position, rotate, and scale to modify the shapes
- Use the Unity Asset Store to find free textures
  - Brick, roof, doors, windows, ground
- Use the MoveCamera script to rotate the camera around the house
- After you’re done, share a screenshot of your house
  - Share it with the group on Slack on the #Random channel
  - Share it on Twitter and Facebook

Next Week’s Workshop

Next Week’s Workshop

- Building more complex 3D objects in Unity
- Building 3D objects in Solidworks and importing them into Unity
- Using keyboard and mouse commands to move objects in the scene
- Making realistic terrain

Need Extra Help

- I'll be around the MakerSpace every Sunday from 1:00 - 4:00
- Message me on Slack
- Ask other students on Slack → Slack channels for help
  - #unity-help
  - #solidworks-help
  - #blender-help
  - #random

Using My Finished Unity Files

Using My Finished Unity Files

- If you want to use my Unity files, go to Github and download the project
- On your computer, create a new project in Unity
- Find the folder on your computer where the Unity project is stored, and go to the Assets folder
- Inside the Assets folder, copy and paste all of the files in the Finished folder for this workshop from Github
- You should now be able to run my files