DIMPA project
Digital Innovative Media Publishing for All

EXPLANATORY SHEETS: UNITY

Reminder: These roadmaps will allow a better understanding of the workflow of digital interactive contents production through practical recommendations and testimonies of professionals.
In that way, we intend to support learners and teachers in their learnings but also after the training, in their practical working life.

1. About the technology

The technology used	**Virtual Reality**
Final objective and result	Creation of a basic 3D digital world with the Unity software. The "world" will be composed of a land with some elements around The elements are game objects like planets around, astronaut, space rocket… **Important note:** This project is only available on Android with a google cardboard headset.
Description of the tool	VR is a combination of 3 elements: interaction, immersion, and digital world. It can be used for gaming, industry, education, health. Unity is a game engine used by developers to create VR experiences
Medium used (computer, tablet, phone)	VR can be experienced on a mobile phone thanks to a phone headset or with dedicated VR headsets (head mounted display or computer based) To create a project in VR it is necessary to use a computer because it requires dedicated software or game engines. In addition, implementing codes is also very often needed which is easily feasible from a computer.
Where will it be accessible (app, platform, website…)	When you develop a VR project you must keep in mind where it will be available: on computer? will it be an app? If yes on which phone, Android or iOS? On VR headset? Which VR headsets? How much is it to have an app available on app stores… **In our case, we have designed the project so it is accessible on Google Card Board (no need to invest huge costs) and on Android only.**

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	The reason for that is because we didn't want to create a proper app because it requires more work time and money. In general, VR applications and games can be downloaded on - application stores (like Google Store, Apple Store) - the headset's store (like Oculus) - online stores (like STEAM) When you develop a project on Unity, it is possible to download and check directly the result of your project on Oculus (if you have this headset) or on your phone (if you have a google cardboard). It will depend on the settings you have selected while developing your project on Unity: WebVR, Android, iOS…
How long did it take to develop this tool?	Developing VR is time consuming and requires some technical knowledges. In terms of time, it will really depend on the final objective of the project and its complexity. For this project we have used a game engine called Unity and we have developed a project that requires very little coding steps. This project can be reproduced in 15 minutes but requires some knowledges about Unity. In terms of steps: - Download and creation of unity account 10 Minutes - Research of the accurate Google VR package and download 10 minutes - Research of the prefabs, assets, and objects and download them 30 minutes - Understanding the basics of unity – key actions and tools 1 to 3 hours – depending on your level with 3D software - Setting up the scene 50 minutes - Testing and fixing you scene 25 minutes - In general, reproducing the tool takes from 10 minutes to 1.5hour depending on how comfortable one is with 3D modelling, manipulating 3D software and how technical the tool is.

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2. Used software

Name of the software	For this project, we have used UNITY Game engine and the version used is Unity 2019.3.15f1 Unity is a cross-platform game engine used to develop (among other) VR experiences
Name of the company	Unity Technologies (a game software development company based in the USA)
Copyright status (cc, proprietary system, etc)	Unity respects the intellectual property rights of others and expects its users to do the same. It is Unity's policy, in appropriate circumstances and at its discretion, to disable and/or terminate the account or access of users who repeatedly infringe or are repeatedly charged with infringing the copyrights or other intellectual property rights of others.

In case you have used additional resources for the content of your tool, please describe them below:

To create virtual worlds or a VR project in general you can either design and create your own elements, using 3D Modelling tools or you can save some time and import some elements that have already been created by others.

These existing elements are called ASSETS or PREFABS
An asset can be a texture, a tree, a sound, a building…anything that you want to import in your project. Assets can be in 2D or in 3D, it really depends on your needs.

You can download these assets for free or you can also buy assets if you need very specific elements.
Below are some resources where you can find assets:

- Unity asset Store is part of the Unity software and offers a very large library of assets that can be directly imported from the Unity interface.
- https://poly.google.com/ is a 3D object library developed by Google to encourage and promote VR and AR developers to share their creations
- https://free3d.com/ where you can find plenty of 3D models for free
- https://kenney.nl/ is a public domain license where you can download kits containing elements like nature, food, characters, audio effects…

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- https://itch.io/game-assets/top-sellers/free/tag-3d is a website that allows independent video game creators to host, distribute and sell their games.
  In addition the website proposes a library of assets for free under creative commons license

There are a lot of websites and libraries offering assets, mock-ups or 3D models for free, all you need is to find the one you feel at ease with and where you find all the assets you need.

3. Cost

Cost of the creation of this tool	For this project, there was no expense. Indeed, we have used free assets and the free version of Unity. Depending on your project, it may be required to buy a VR headset (standalone or PC based VR headset) which can be pricy. However, there is always the possibility to have “cheap” version of VR with Google Card Board headsets Or lastly develop a project based on WEB VR which is VR accessible on any kind of web browser
General pricing plan	Depending on the complexity of the project, paying resources or support can be required

In case you have used additional resources for the content of your tool, please detail their cost below:

The software is free of charge unless you buy additional elements like the one you can download on Unity Asset Store.

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4. Steps of production

Please describe each step of the production of the tool

Design phase

Why did you create this tool?	In this project, we wanted to show that it is possible to combine VR 3D modelling with some school classes, so we have decided to use it for Science and especially Solar System. With this VR app, we have located an astronaut on a planet and the rest of the Solar System is visible. Would you be able to identify on which planet the astronaut is? Creating such a scene is a way to immerse users into the VR world and enable digital manipulation of essential elements: our Solar System!
What functionalities does it have?	For this project, since we wanted to keep it simple, the only possibility is to explore the Solar System with a standing but rotating view point. Interacting with elements would have required coding steps which would have been too heavy for a first tutorial. In general Unity has as a very large scope of functionalities. Adding sound, images, movements, interactions, special effects are the very basics of Unity functionalities. In addition, since it is possible to insert some codes it turns it into an almost endless functionality tool
What will be its purpose? (pedagogical, communication, games, etc.)	This project is about the Solar System and dealing with perspective, size and elements. In general the projects that can be developed on Unity may have multi-purposes: from education, to entertainment (cinema, video games, communication campaigns) or even, at higher stage heavy industry or health industry purpose.

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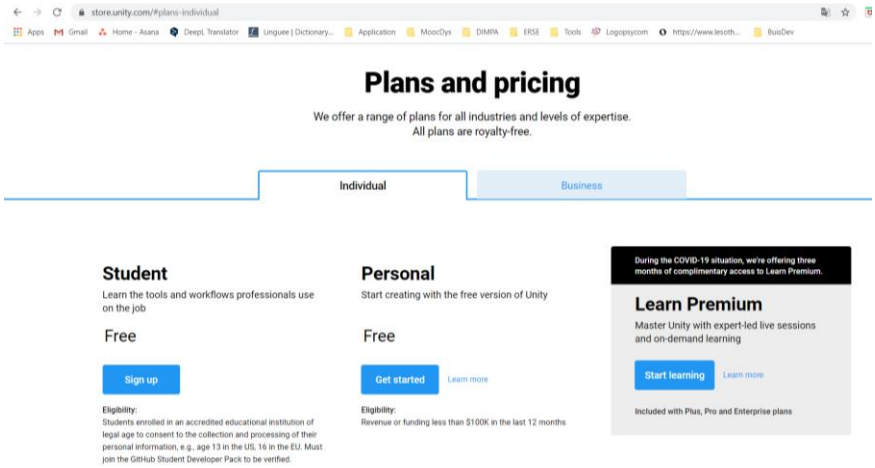
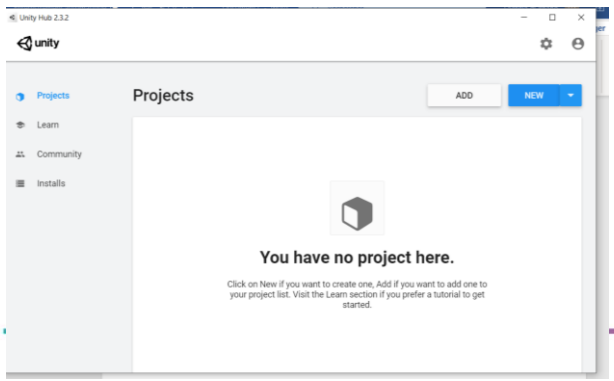
5. Creation phase

Please name and describe below the different steps of the creation of the tool (min 5)

DOWNLOAD UNITY AND CREATE YOUR ACCOUNT	To download unity let's go on Unity3D store -> https://unity3d.com/get-unity/download Take the Free Personal Package  In terms of size on the disk: On my disk Unity is 8.16 GO Plus you need some space for your project as well (images, videos, sounds, assets…)
UNITY FIRST PAGE	When Unity is downloaded and your account is created, you will reach the home page. All your Unity projects will be registered on this page. 

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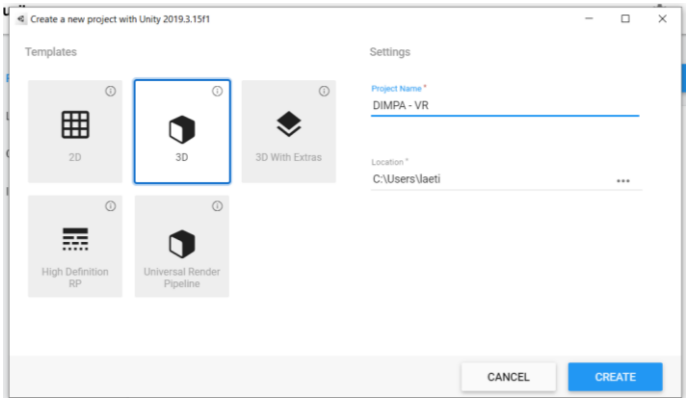
CREATE A NEW PROJECT

- Give a name to your project
  it will create a folder with your project in it and same name.
- Save it where it makes sense for you.

Tips: The best is to create a dedicated Unity folder.
It will make it simpler for you to have a quick overview at all your unity projects

- Select 3D – don't worry you be able to change 2D to 3D during your creation process.



When creating a new project on Unity, it will create a file on your computer (where you have selected your project to be saved)
This file will contain everything about your project namely the Asset folder. The Asset folder is essential, never delete it because it contains everything about your project: sound, images, textures, scripts…

Erasing the asset folder would be equivalent of deleting your project.

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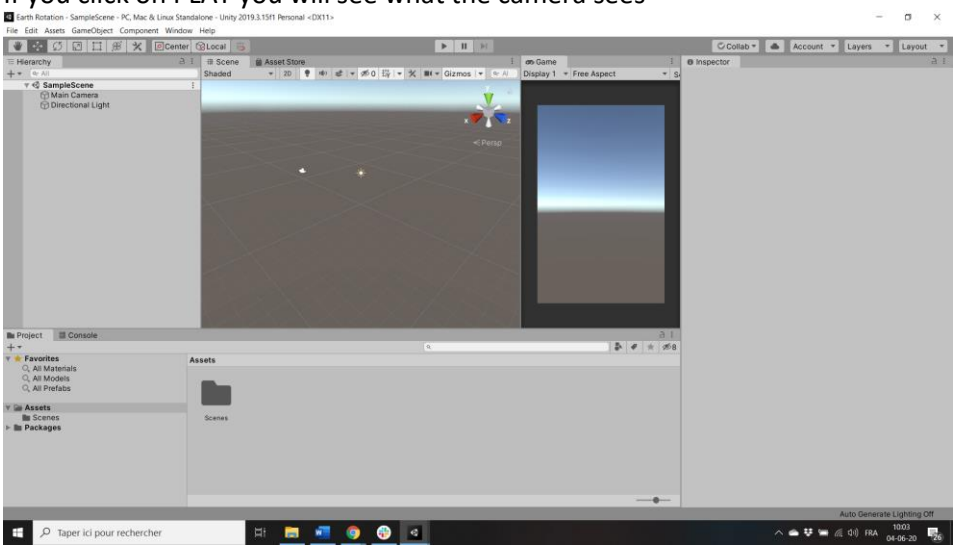
IMPORTANT INFORMATION ABOUT VR AND UNITY

Before starting with the creation phase, some essential information about Unity:

Let's have a look at UNITY's interface and the different tabs:

Scene tab: is where you create and modify the elements
Game tab: is what the cameras sees
Project tab: where all your elements are stored – these are the elements that you will put in your scene
Console is about error message and information
Inspector Tab: gives you all the details (position, size, scale, colour, effects, components…) about the object you have selected in your scene

If you click on PLAY you will see what the camera sees



If you modify positions, elements or objects while being on PLAY nothing will be saved.
IMPORTANT NOTE: always modify your scene out of the play mode.

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Some keyboard shortcuts:

Click right on your scene and hold down on it -> you will have a little eye and you will be able to view and navigate around your scene
Q -> hand : you can move your point of view on the scene without moving any elements.
W-> it allows you to move the objects you have selected either on the x axis, y axis or z axis
E-> it allows you to rotate the objects
R-> to scale the objects
T-> you can rectify the object
Y-> it gives you rotation, scale and movement at the same time

Of course, there are many more shortcuts and many more functionalities in Unity, these are only the basic one.

Some vocabulary:

What is a package?
Packages are collections of files and data from Unity projects, or elements of projects, which are compressed and stored in one file, similar to Zip files.
It can be a collection of source code with programs that you can import and export in your scene.
It allows you to skip some coding phase and use already developed elements.
Definition from docs.unity3d.comà

What is an asset?
An asset is a representation of any item that can be used in your game or project.
An asset may come from a file created outside of Unity (for instance a package) such as 3D models, audio file, image, textures or any of the other types of file that Unity supports
Definition from Unity Asset Workflow on docs.unity3d.com
https://docs.unity3d.com/560/Documentation/Manual/AssetWorkflow.html#:~:text=An%20asset%20is%20representation%20of,of%20file%20that%20Unity%20supports.

What is a prefab
A prefab stands for pre-fabricated. It means it is an already fabricated object that is ready to use.
One can design his/her own prefab game object and configure, store modify it with all its components, property values remaining.
It can be a game object that already contains script, features
Most of the time Prefabs are in the Asset folders which can be in the Package folder.

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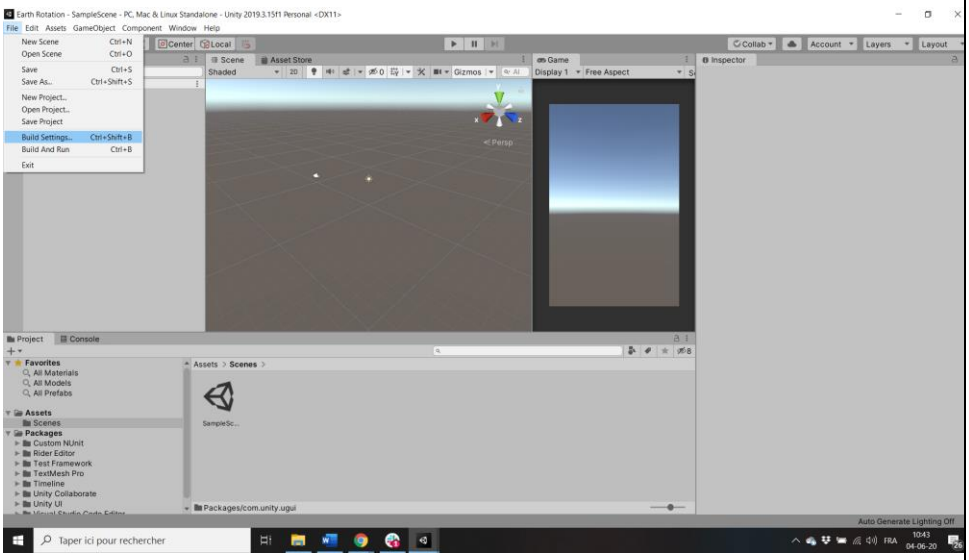
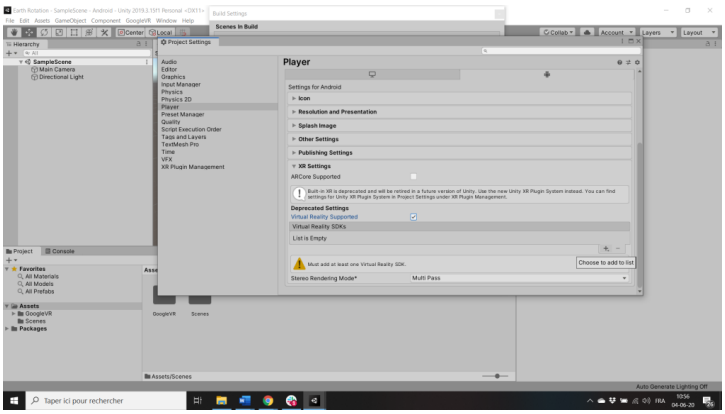
SET UP YOUR SCENE:	For this project to be compatible with Google Cardboard we need to change some settings: **File -> Build Settings -> Select ANDROID and click SWITCH PLATFORM**  Then click **PLAYER SETTINGS -> go to XR SETTINGS** **-> tick VIRTUAL REALITY SUPPORTED**  **click + to ADD Cardboard** **-> tick VIRTUAL REALITY SUPPORTED**

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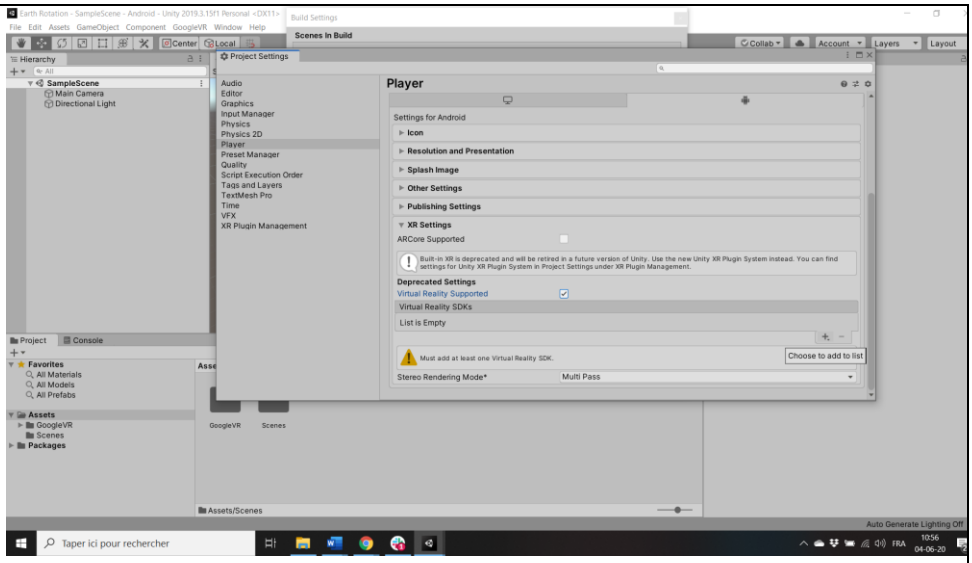
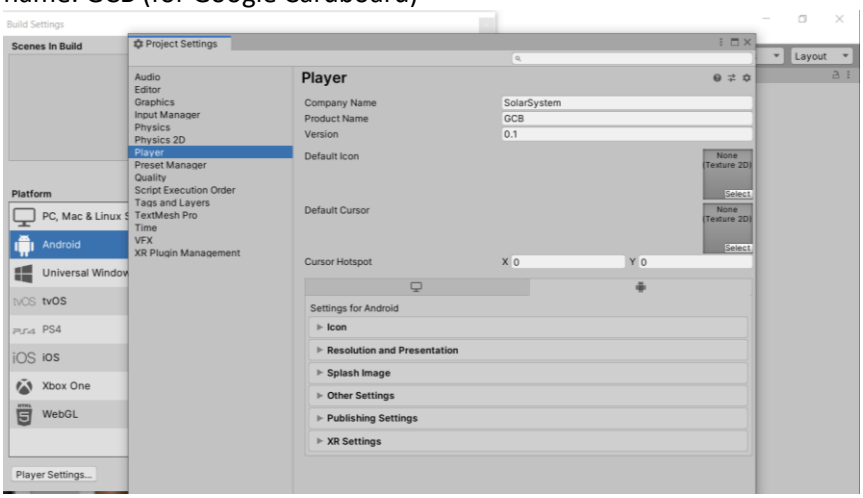


click + to ADD Cardboard

- To be able to find your project on your phone, you need to name it properly in the PLAYER SETTINGS

In this project we have changed company name: SolarSystem and Product name: GCB (for Google Cardboard)



Make sure in OTHER SETTINGS that the identification of your package name is encoded correctly:

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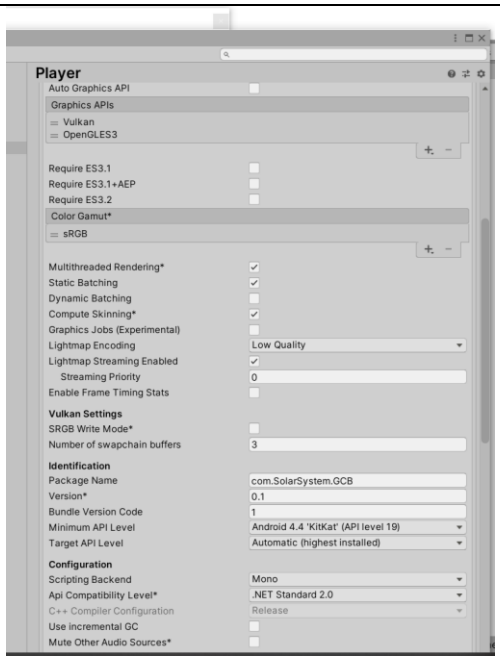
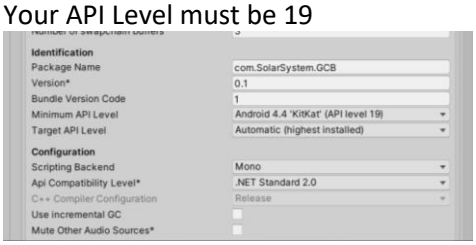
	 • Minimum API Level Your API Level must be 19  Now we all the settings are ready, and we can start creating our project
IMPORT A PACKAGE: ASSET	For this project we want to have a camera rotating so we will be able to see the scene in 3DoF To do that without coding, we need to import a package called **Google VR for Unity: GVR SDK for Unity v1.200.1** **Download the package ->** https://github.com/googlevr/gvr-unity-sdk/releases/tag/v1.200.1

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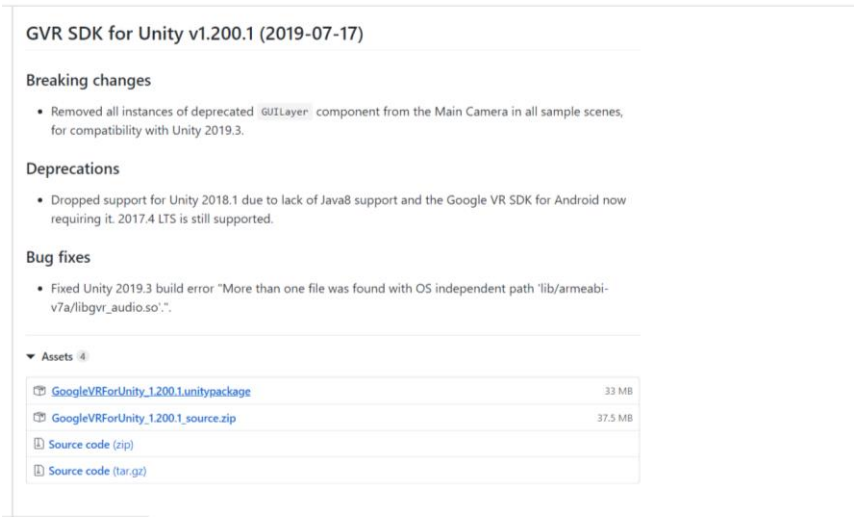
What is this package for?

It will make it possible to control the camera doing 360° rotation.
This package also enables, Reticle Pointer, Event Trigger and many more.



GVR SDK for Unity v1.200.1 (2019-07-17)

Breaking changes

- Removed all instances of deprecated `GUILayer` component from the Main Camera in all sample scenes, for compatibility with Unity 2019.3.

Deprecations

- Dropped support for Unity 2018.1 due to lack of Java8 support and the Google VR SDK for Android now requiring it. 2017.4 LTS is still supported.

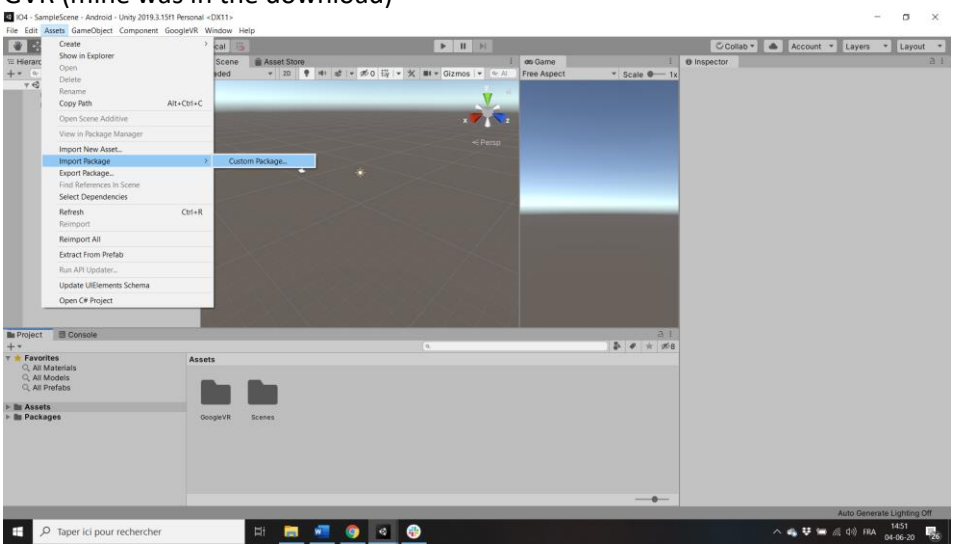
Bug fixes

- Fixed Unity 2019.3 build error "More than one file was found with OS independent path 'lib/armeabi-v7a/libgvr_audio.so'.".

Assets 4

GoogleVRForUnity_1.200.1.unitypackage	33 MB
GoogleVRForUnity_1.200.1_source.zip	37.5 MB
Source code (zip)	
Source code (tar.gz)	

Import your package in your scene:
Click on Assets -> Import Package -> Custom Package -> Select the package GVR (mine was in the download)



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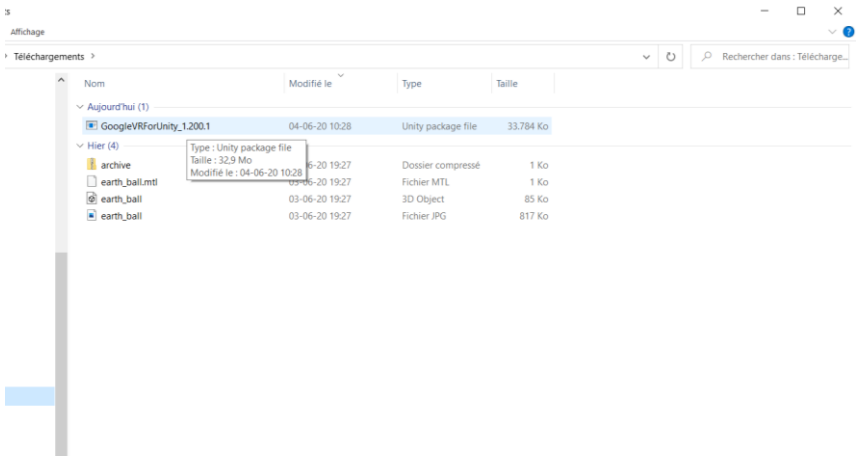
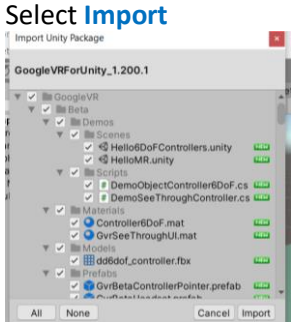
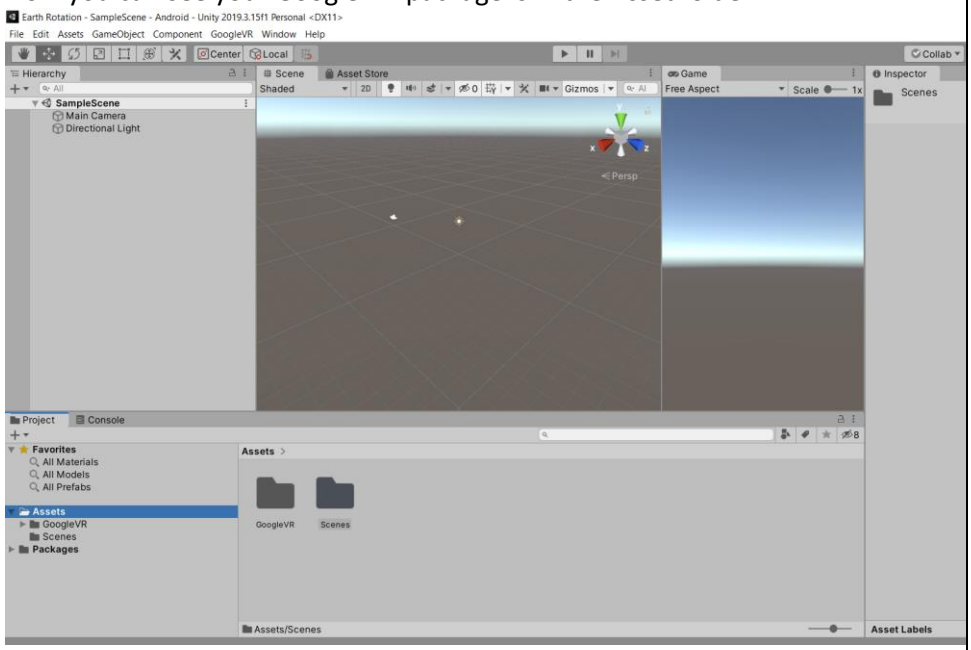


Select **Import**



Now you can see your Google VR package is in the Asset folder.



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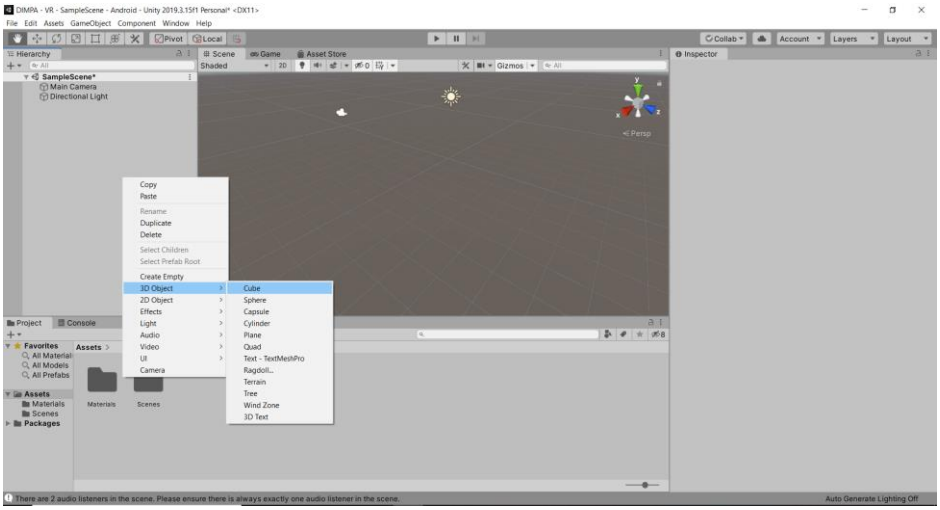
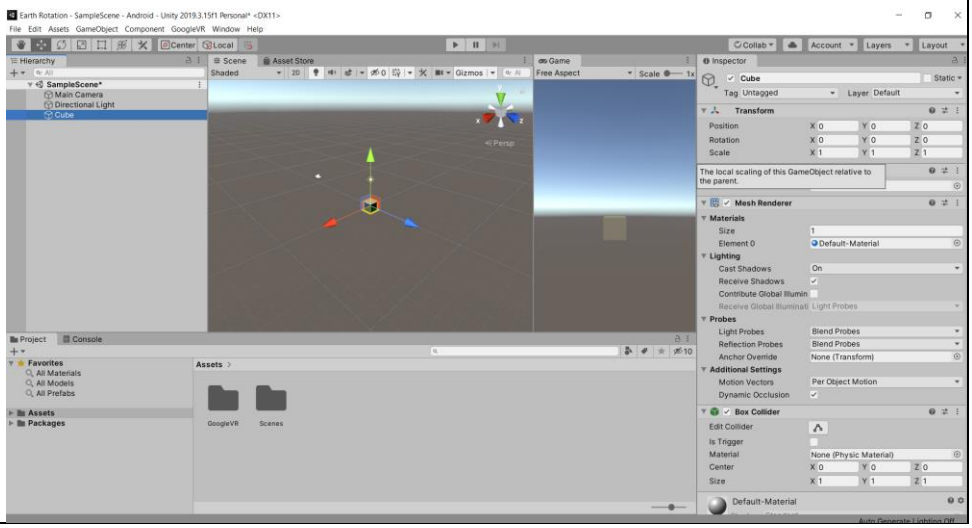
LET'S CREATE THE LAND!	Let's insert a cube and transform it into a land  To modify the cube, you can insert some values in the INSPECTOR TAB or you can modify it with the commands 

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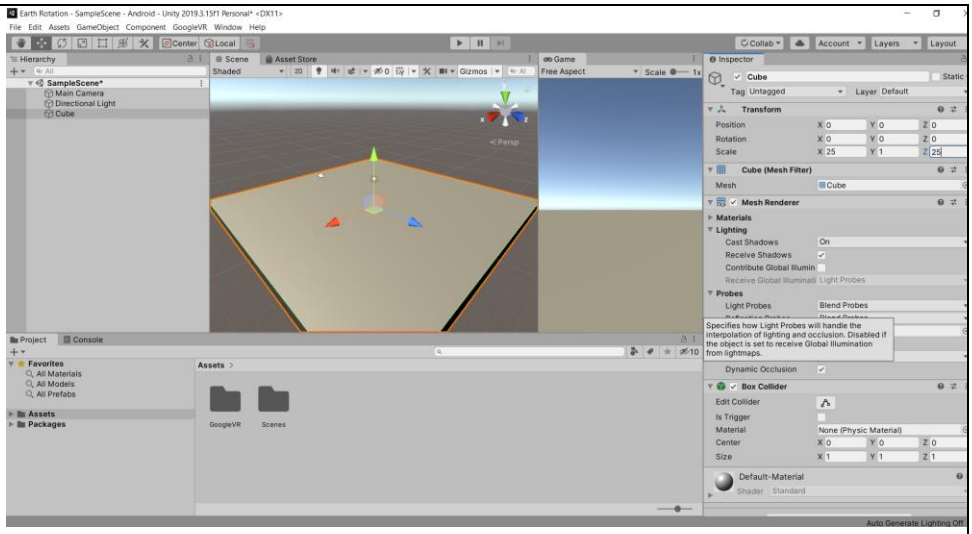
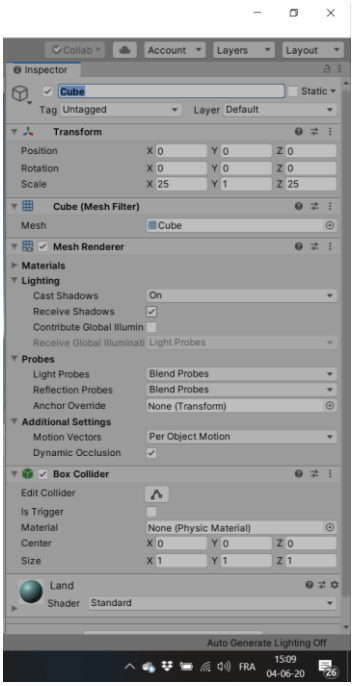


To rename an object -> INSPECTOR and rename it.
I have renamed the cube GROUND



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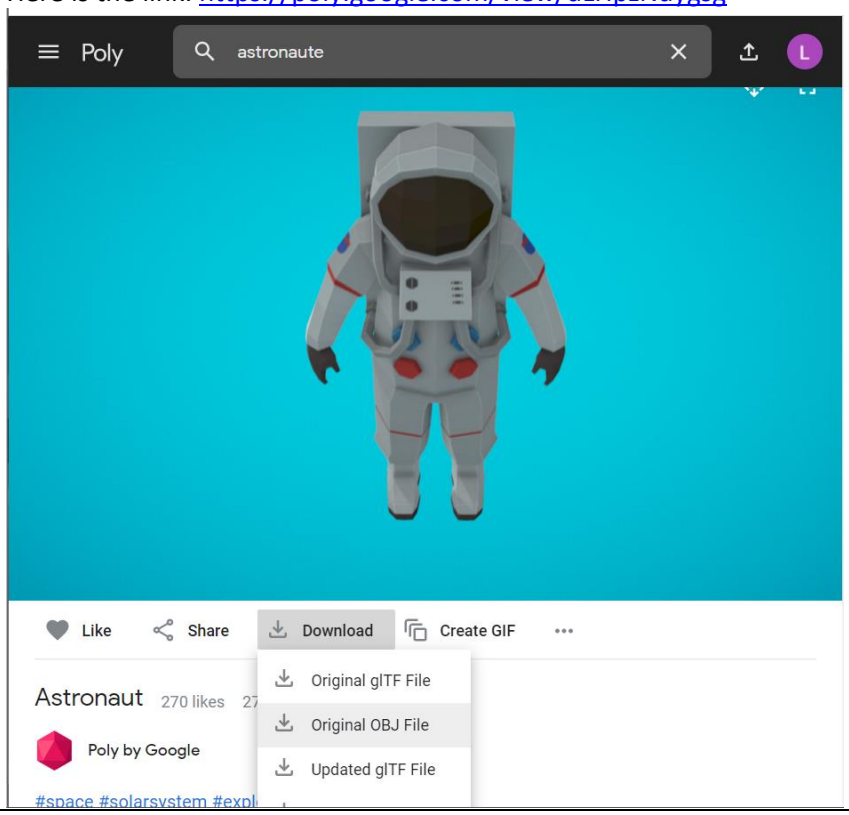
INSERT OUR GAME OBJECTS IN OUR LAND	For this project we want to insert several objects: An Astronaut and some planets. We can either create them or download them already designed. The website we will download our assets from is **POLY GOOGLE:** https://poly.google.com/ Always keep in mind the License. If you need some information about Creative Commons and License, there is a dedicated class about it on this MOOC In general, opt for assets that are creative commons, royalty free or even a public domain license **When you download a 3D element you need to select the format OBJ** Let's download an ASTRONAUTE Here is the link: https://poly.google.com/view/dLHpzNdygsg 

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Oct 22, 2017 People & Characters Uploaded 3D Model
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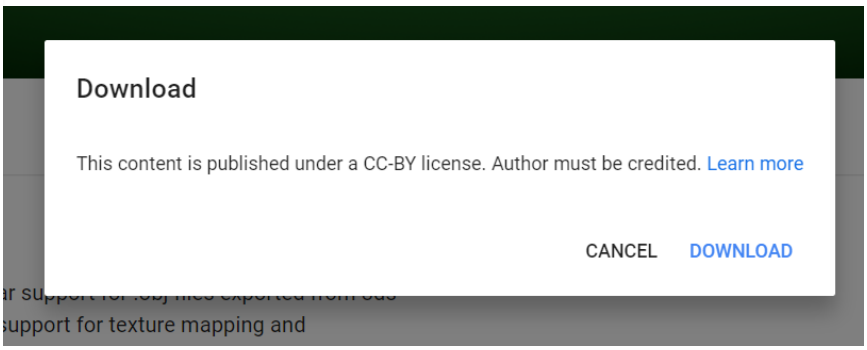
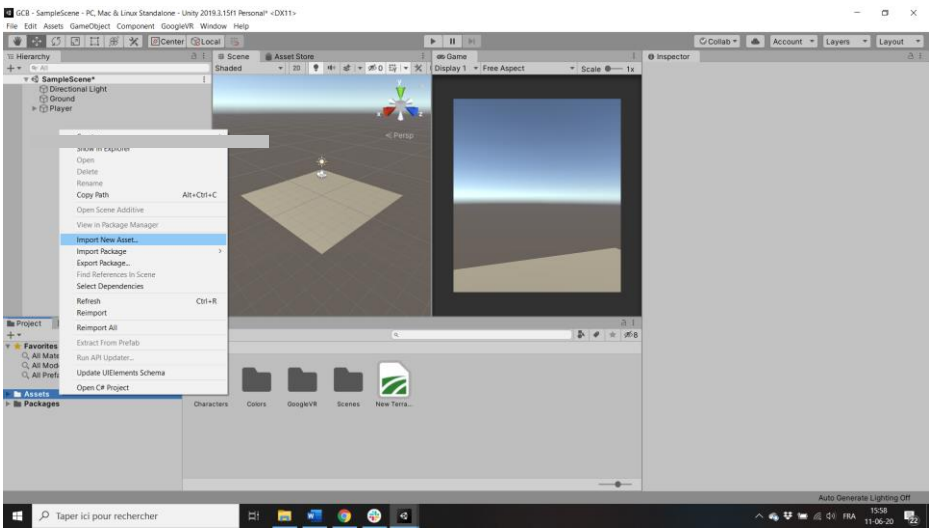


To import your Game Object in your land:

1. **Create a folder in your Asset**
   I have called it Character

2. **Import your asset**



3. **Select the file you want and import it**

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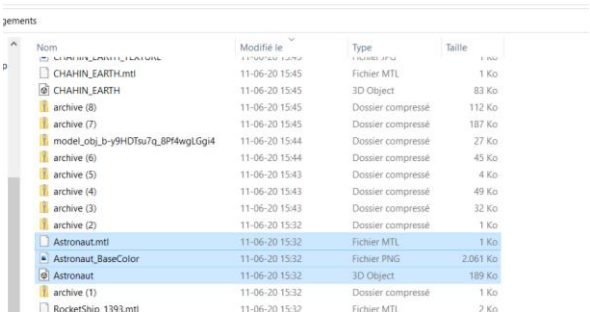
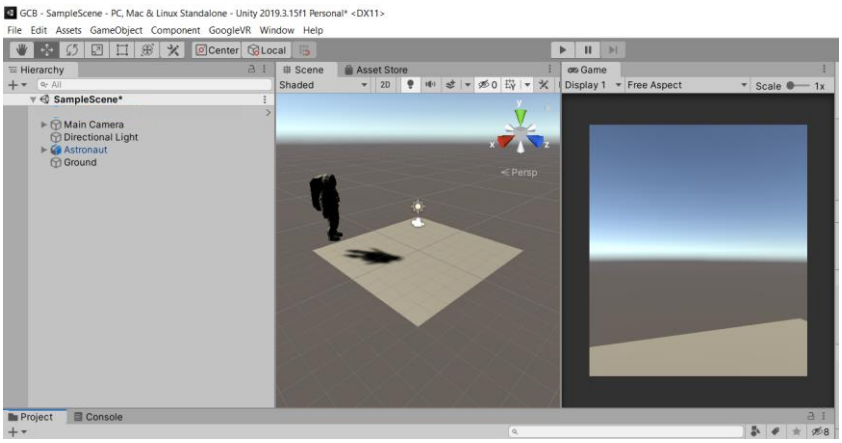


4. **Then go to your Asset folder called Astronaut and drag the element on the ground**

Conclusion: Your Astronaut is here!
Play with it and position him where you want, in 3D no need to worry about gravity 😉



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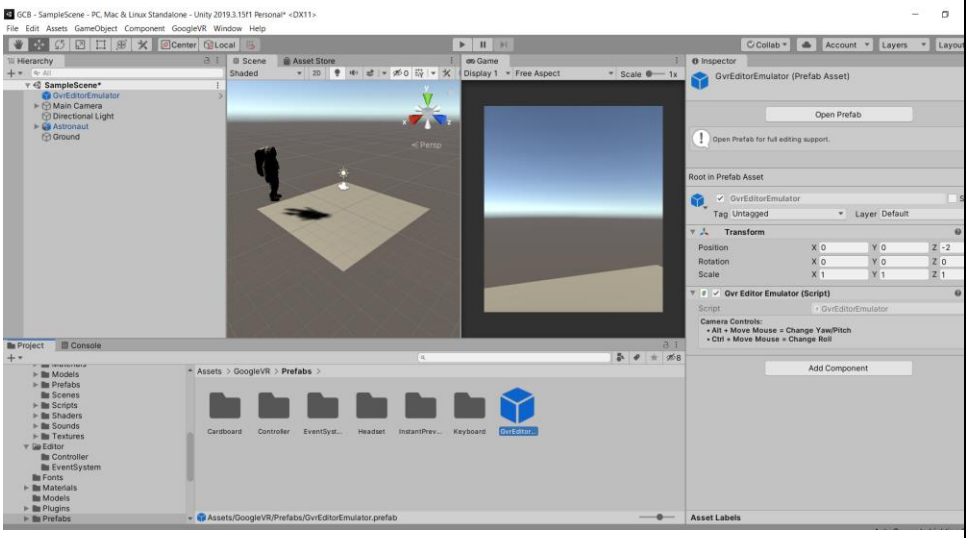
SET UP YOUR CAMERA	**<u>To set up the camera we will use our GVR package.</u>** **In the Google VR package select -> folder Prefabs -> GvrEditor Emulator** Drag it on the hierarchy /scene  It gives you control of the camera. **<u>IMPORTANT INFO:</u>** If you hit PLAY and do Alt + move mouse (left and right) and Ctrl + move mouse you will be able to move the camera in the play mode. **Remember to always get out of the play mode.** The problem is when we hit play, the camera is not well located – it goes to the centre and we cannot see everything To solve this issue we will: insert a player (understand an empty object that will be our eyes) To do so Insert empty object **Click Right on Hierarchy tab -> Create Empty**

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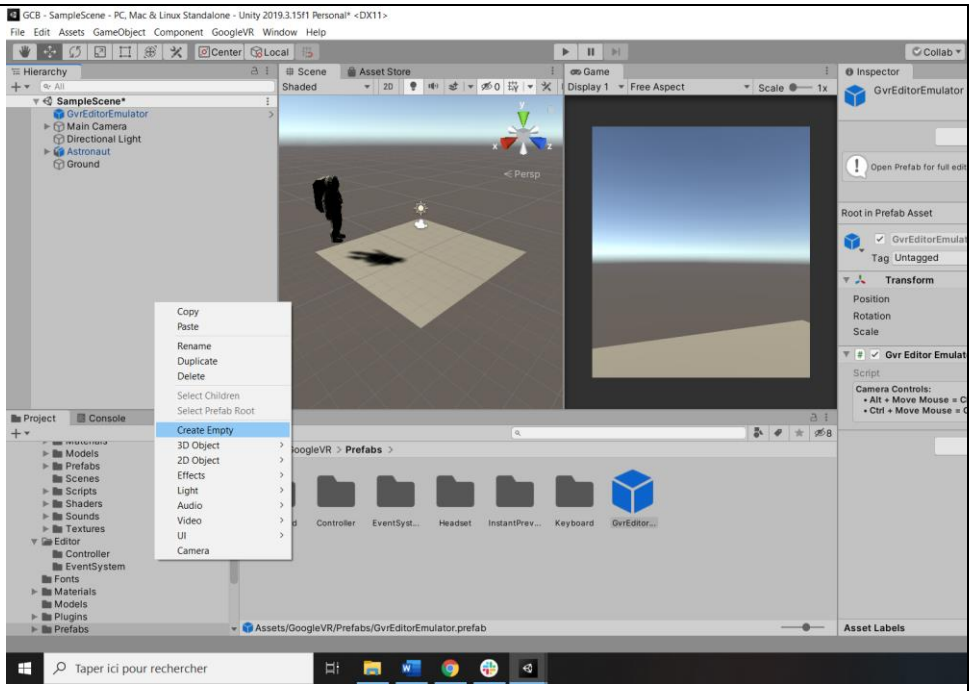
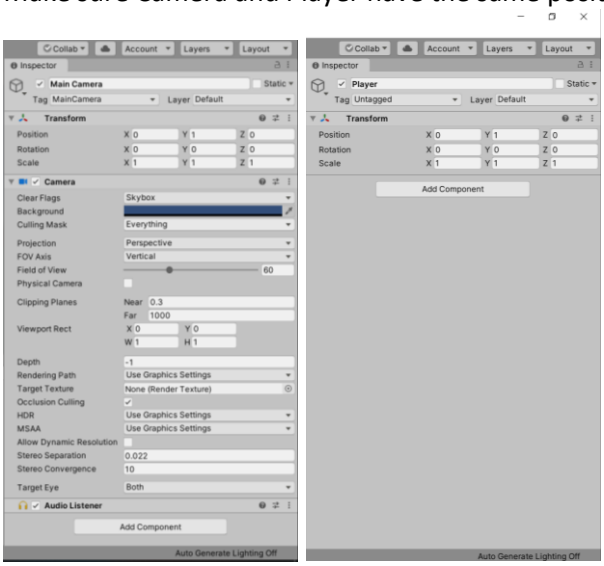


I have renamed the “empty object” PLAYER (see inspector tab)

And then DRAG the Camera inside this empty player:
Make sure Camera and Player have the same position:



Move, scale, and rotate the Astronaut so it is well positioned in front of your camera.

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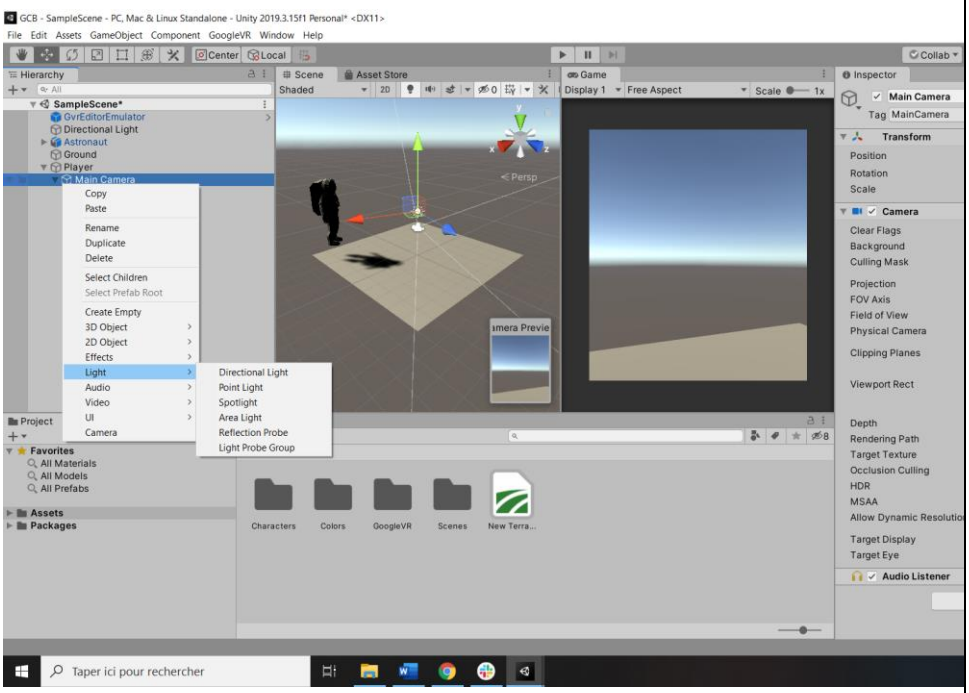
ADDING LIGHT TO THE CAMERA	Now that player and Camera are merged, we want to be able to point at objects. Because we don't want this tutorial to be too long and we want to avoid coding sequences we will only show you how to point a light at elements and not select them for now. If you are interested about selecting and triggering elements, have a look at the prefab GvrReticlePointer and the GvrEventSystem available in the Google VR Package **Assets -> Google VR-> Prefabs -> Cardboard -> GvrRetcilePointer** And Drag it in the main camera To add a light to your point of view (your camera in the player) you click right on the camera in your scene and select LIGHT.  In this tutorial we have selected SPOTLIGHT and you can also change the colour of the ray if you wish in the INSPECTOR Tab.

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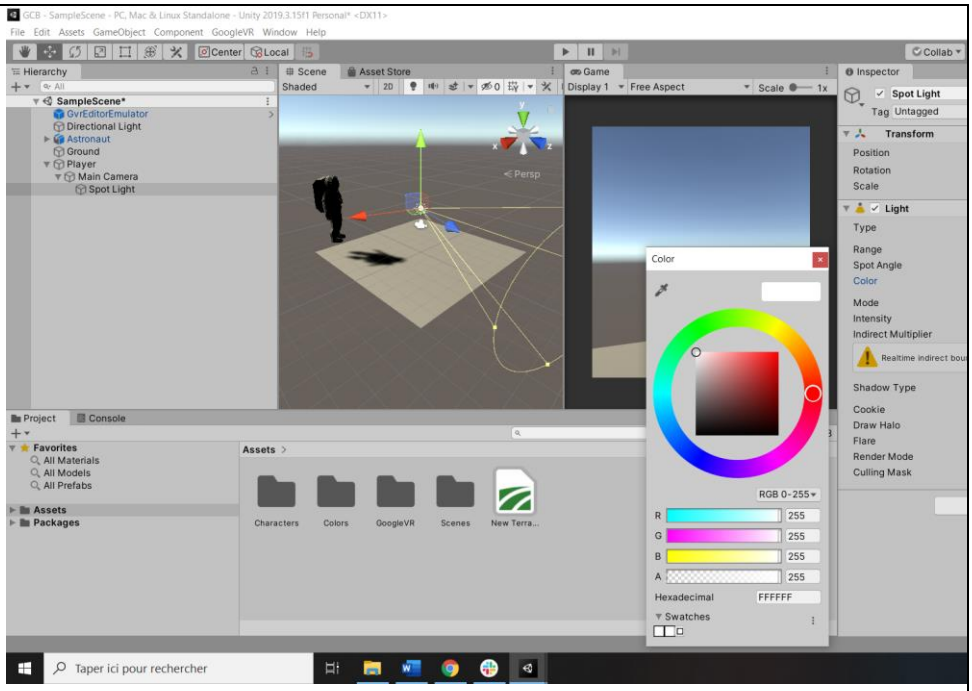
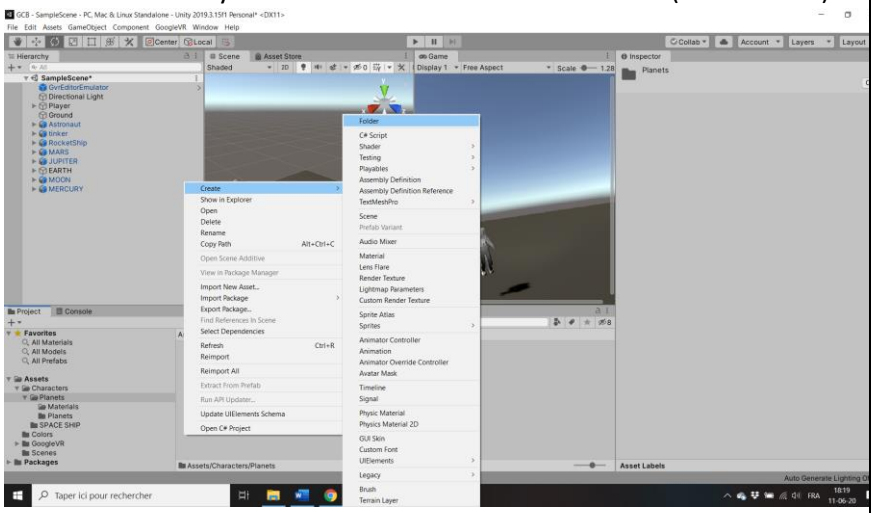


HOW TO COLOUR, PUT A TEXTURE OR INSERT AN IMAGE ON A GAME OBJECT

1. Create a folder in your asset with the name MATERIALS (for instance)



2. Click right -> CREATE -> MATERIAL

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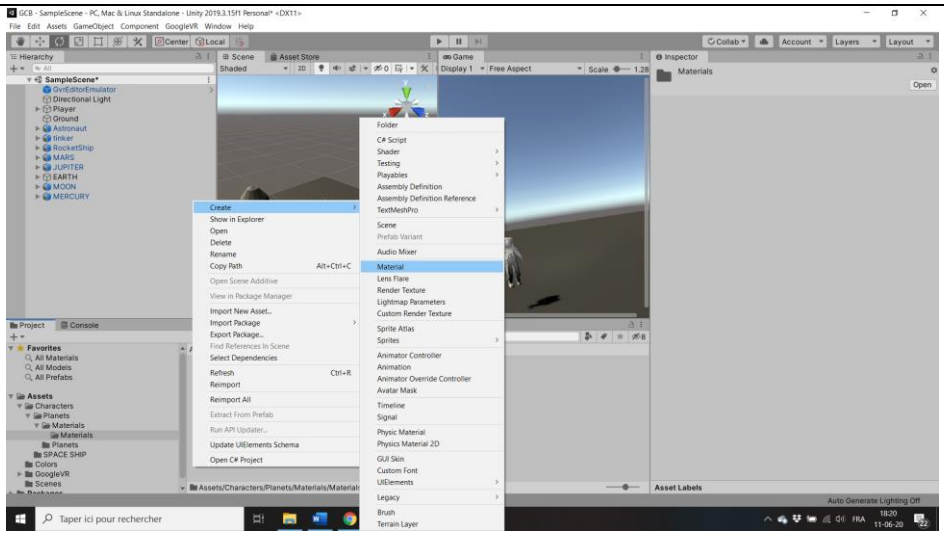

It will create a new material, rename it with the name you want (related to the game object)

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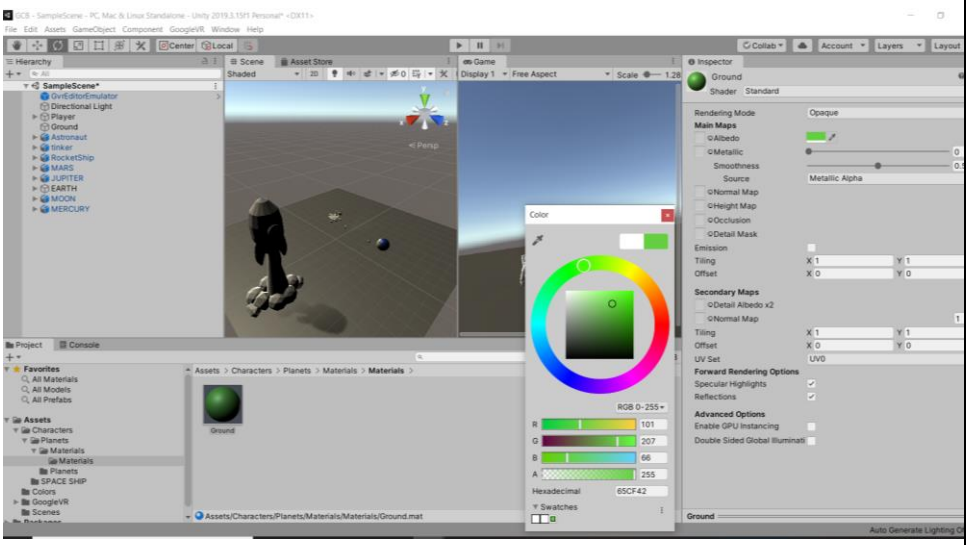
3. Colour it in the INSPECTOR tab



4. Drag it on your Game Object

Other option if you want to have your game object with an image:

Download the image in your asset (IMPORT NEW ASSET and import the image in png.)
For this project we have downloaded the below image:
“free high-resolution photo of sand, sun, sunlight, texture, floor, space, circle, surface, planet, Venus, solar system” ->
https://pxhere.com/en/photo/1262003
Make sure the format and the size are appropriate to the object and 3D features.

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	Drag the image on the Game Object.
ADDING OTHER ELEMENTS	Same procedure as for the Astronaut, we will import several planets and elements of the Solar System in our scene to make it more playful. All the resources have been downloaded on POLY.GOOGLE For this project we have downloaded a couple of planets from the Solar System and some elements for our Astronaut (a spaceship and a tinker) All the Game object can be seen on the SCENE TAB In this scene we have added elements like - planets of the Solar system - a spaceship - an astronaut - a tinker (all available on Poly with the CC-BY license)
SAVE YOUR SCENE	When your scene is finalised, and you have added everything you want you have to save it **File -> Save As ->** TIPS: save it in your Unity folder. We have named the project SSScene (SolarSystemScene) and you can find it your ASSET folder in the PROJECT TAB

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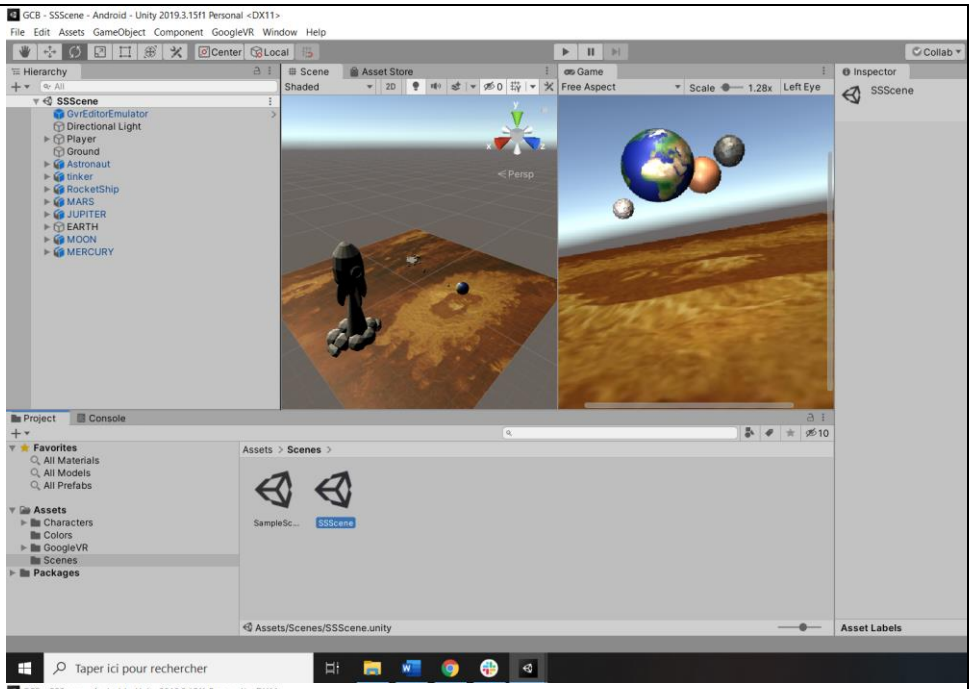

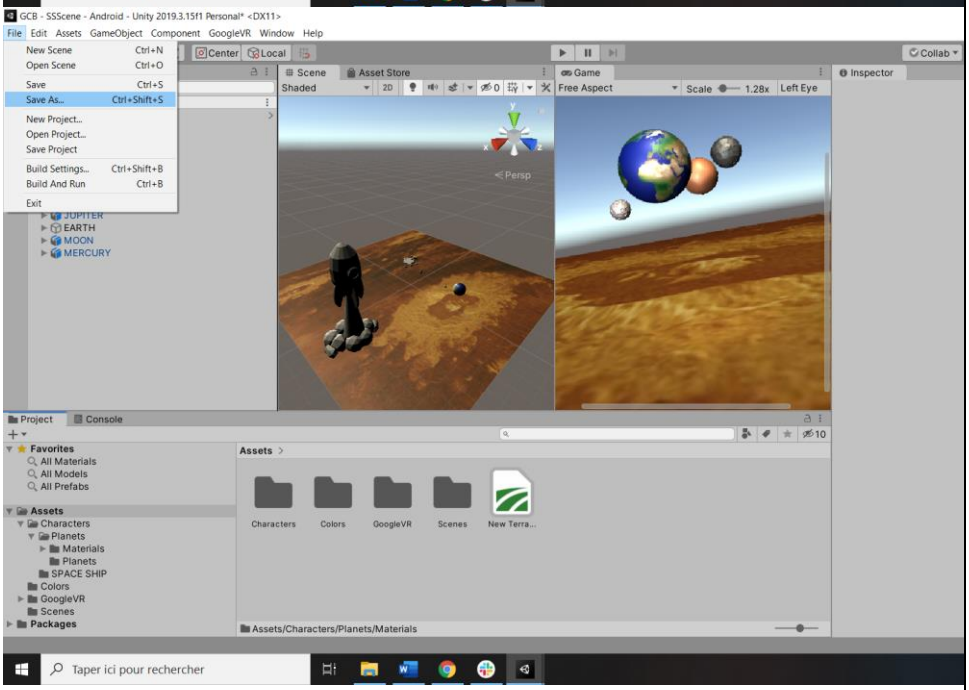

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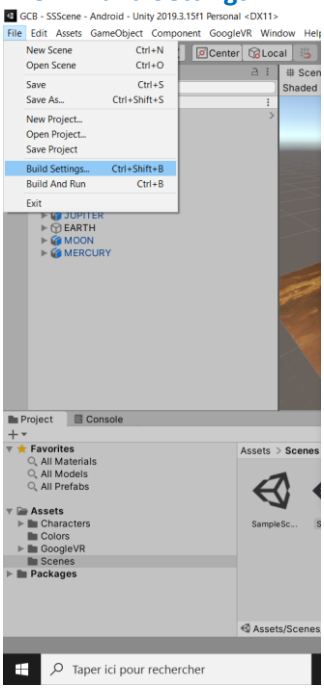
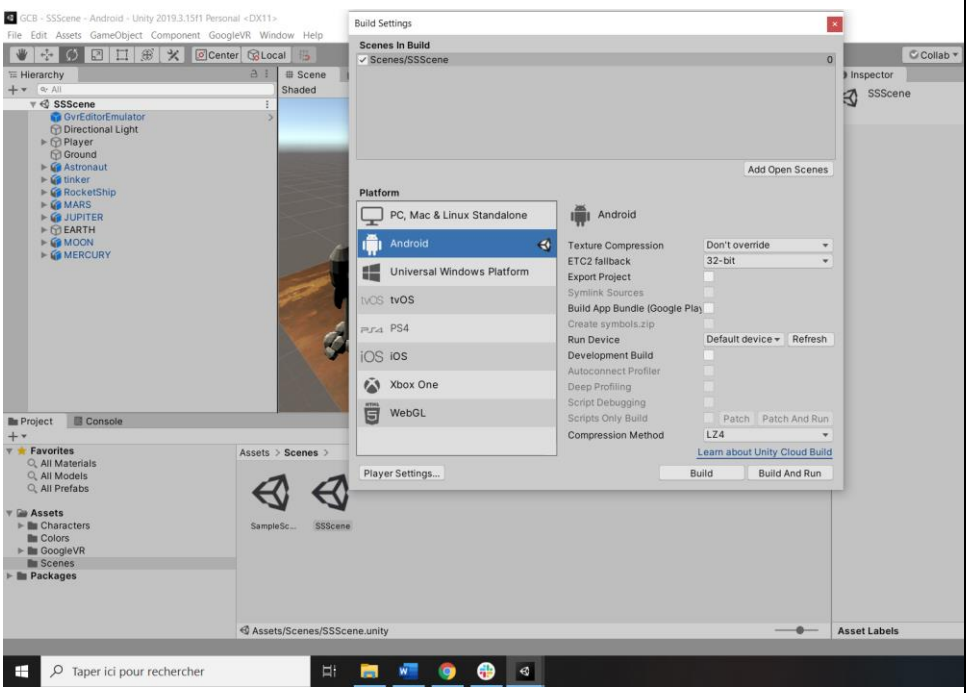
LET'S BUILD THE APP	To build your scene: **File -> Build Settings**  And then drag your scene in the SCENES IN BUILD and click BUILD AND RUN 

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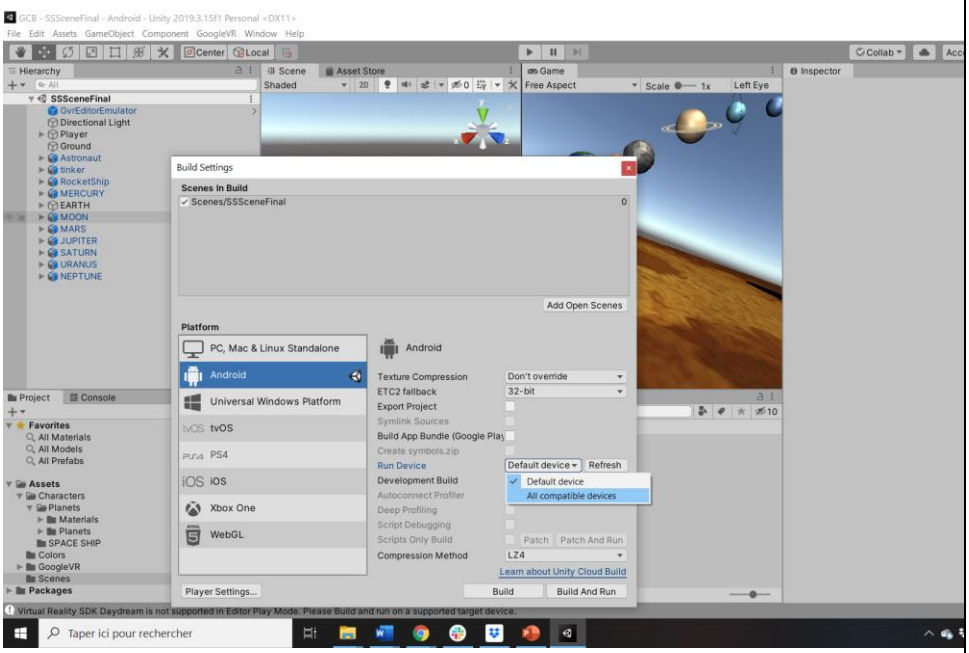
SET UP YOUR MOBILE	Before you extract your file you need to set up your phone. To be able to run the app on your Android phone, you will have to **enable Developer Options** that is to say: - open the **Settings screen**, - scroll down to the bottom, and tap **About phone** or **About tablet**. - Scroll down to the bottom of the **About screen** and find **the Build number**. - Tap the Build number field seven times to enable Developer Mode It will unhide it and you will be able to select it in your phone's settings Then Click on the **DEVELOPER MODE** and allow **USB DEBUGGING** option Plug your Phone to your computer and allow the connexion with the tow devices. Your phone is now ready to receive an .apk file (application)
RUN THE APP IN YOUR DEVICE	Go back on UNITY and plug your Android's phone to your laptop. Your device will appear in the RUN DEVICE section. Select it and click on BUILD AND RUN You will have to save the name of the apk. File and it will automatically run on your phone. Now you just need to launch the app and enjoy! 

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Release

Where did you publish the tool?	The app can be downloaded only on an Android Smart phone and run with Google Cardboard headset. Indeed, developing a project in VR requires to know and select in advance where the project will be visible.
Why?	At this stage, Android + Google Cardboard are the easiest, the most flexible and the cheapest ways to display VR
Have you encountered any difficulties in this step?	The fact that each program should be developed according to the final medium: iOS, Occulus, GoogleCard board makes it difficult to create an easily and largely accessible tool. Unfortunately, iOS remains more difficult to feel at ease with for great beginners
If yes, please explain	

6. Inclusive approach

What action did you implement to make this tool inclusive to as many users as possible?

Unfortunately, VR is by definition a bit exclusive, indeed, each program needs to be developed for a specific medium or VR headset. In our case, our model should have been more inclusive and propose for instance development for iOS but this would have turned the task into a much more complicated and longer one.

7. Good / bad practices

Would you recommend this software to the users?	Yes
Please explain	First, it is a free software that keeps on being updated and optimized. Second, it offers a lot of possibilities, in terms of graphic and functionalities

What recommendation would you give to people creating such tool or creating content on this technology?

Even though it is a bit complex, and the coding part is far from being simple, there is a lot of tutorials and help desk that can support user in their scene's creation Nevertheless, it is important to keep in mind that such a software requires practice and time to get the best out of it.

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