

Developing Augmented Reality Application in Unity with Vuforia

1. Downloading Unity

The game engine, Unity, can be downloaded from the Unity website for Windows, Mac OSX, and Linux. Figure 0 shows the Downloads page of the Unity website. Unity is free for personal use and can be selected by choosing the ‘Try Personal’ tab.

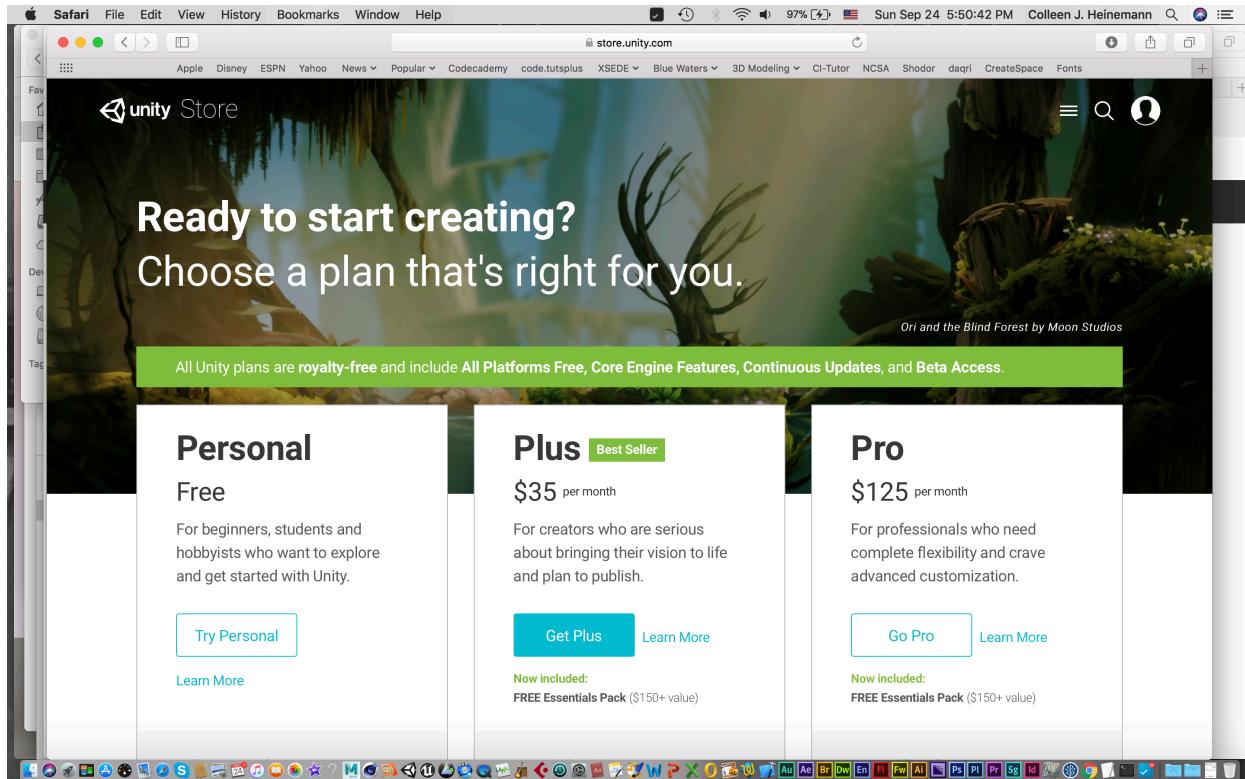


Figure 0: The Unity Downloads page

An installer will be downloaded and will guide you through the steps necessary to install Unity. Several additional add on packages can be selected beyond the standard Unity platform that is installed. Choosing platforms such as Android, iOS, etc. can be selected; however, they will take additional space on your hard drive and will make the installation process take longer.

2. Downloading Vuforia for Unity

The Vuforia package can be downloaded for numerous platforms from the Vuforia downloads page, as seen in Figure 1. To develop Augmented Reality applications with Vuforia with Unity, you need to select the ‘Download Unity Extension (legacy) tab. In addition to requiring the Vuforia package for Unity, Vuforia will be used to manage databases of image targets for your projects as well as the license keys associated with them.

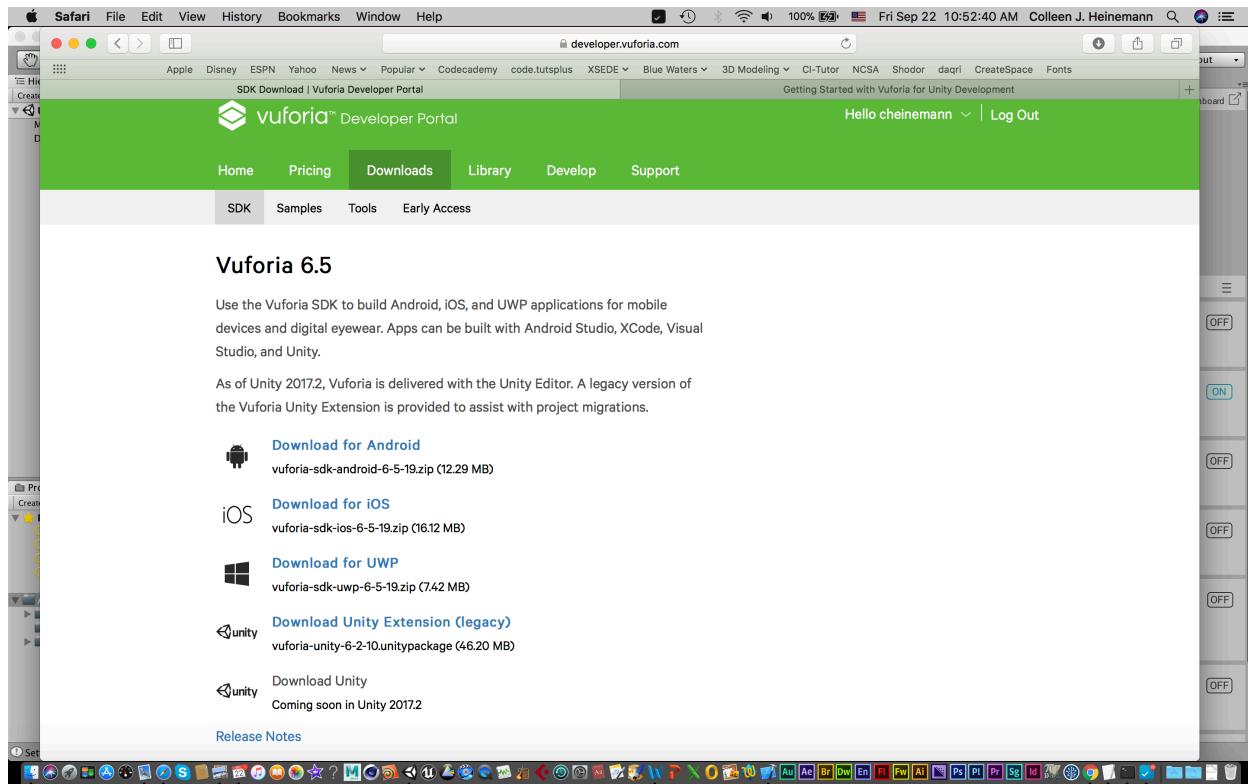
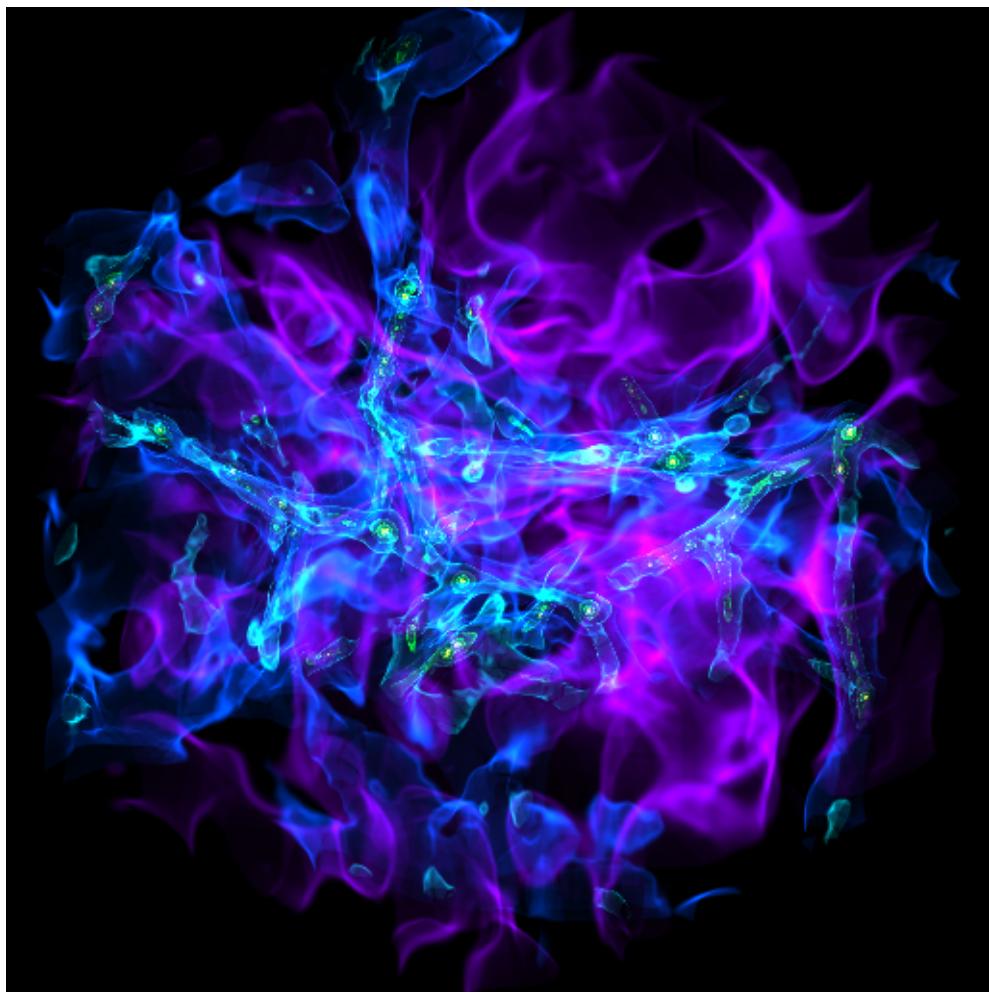


Figure 1: Vuforia downloads page

2.1 Vuforia Target Manager

A vital step is to select the image target that you want to use for your application. Vuforia provides a place to upload your image and tells you how well the image will work based on the tracking done during utilization of your application. The more complex your image is, the better it will work as an image target. For example, the following image is used for the ‘Hello World’ application being developed in this tutorial:



It is necessary to upload the image to Vuforia by choosing the ‘Target Manager’ and then selecting ‘Add Database’ as seen in Figure 2. As can also be seen, if you have more than one database, you will see a list of the available databases that you can use.

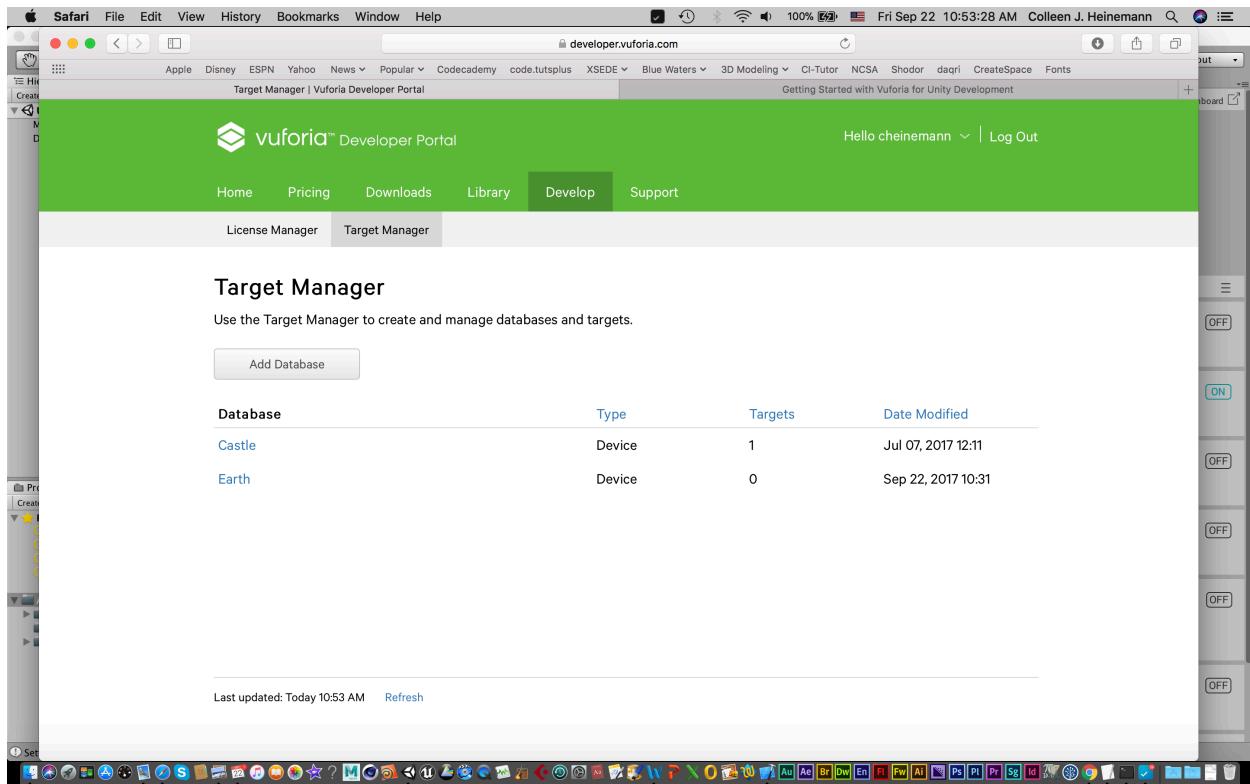


Figure 2: Target Manager on the Vuforia website where a database can be added for your application

2.2 Creating and Downloading the Database

The next step is to create a new database by selecting the ‘Add Database’ tab under the ‘Target Manager’ tab on the Vuforia website. You already need to have your image selected before completing these next steps.

After selecting the ‘Add Database’ tab, you should see a screen similar to this:

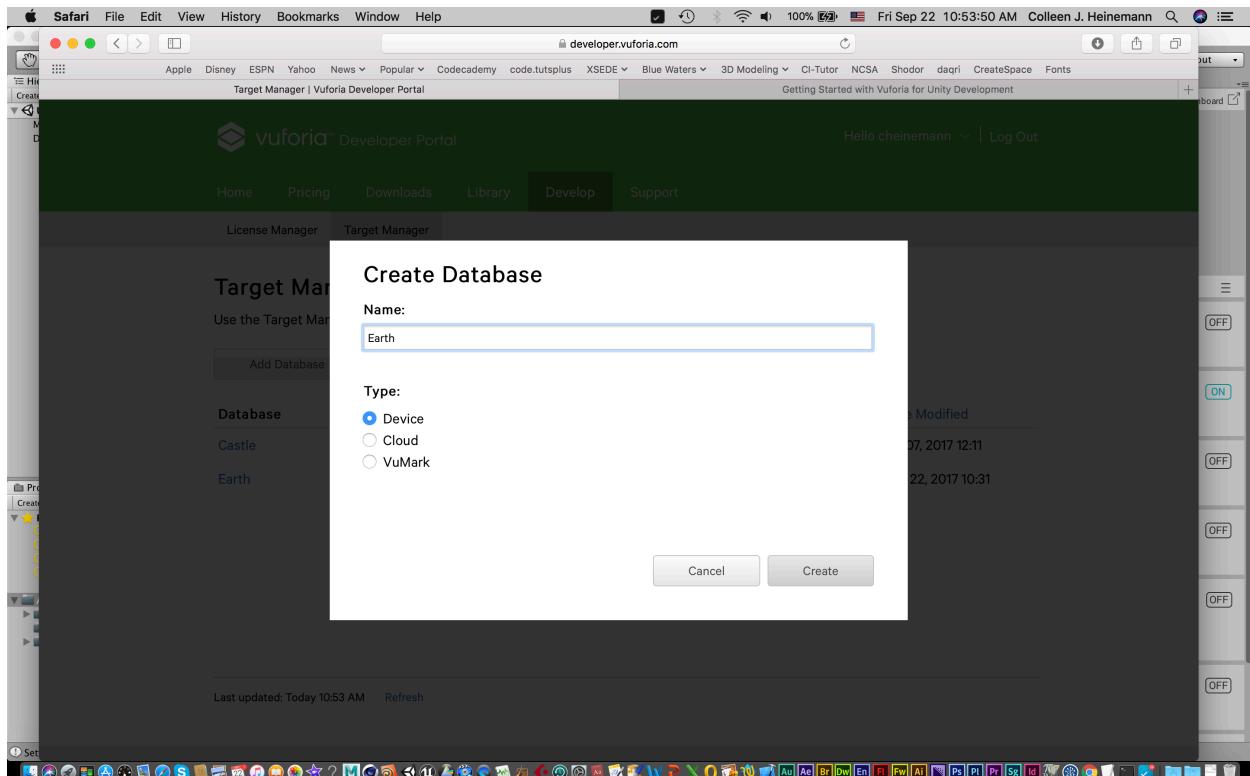


Figure 3: After selecting the ‘Add Database’ tab, you should see this ‘Create Database’ window

You will need to choose a name for your database. Because this ‘Hello World’ application will be utilizing a 3D model of the Earth as the application’s model, the database is named ‘Earth’. You can choose any name you want. You will also need to make sure that the Device button is selected under ‘Type’ because you will be developing your application for a device, such as a phone or tablet.

Once these two steps have been completed, you can select ‘Create’. Your database will now be shown, but it will be empty. It will now be necessary to add your target image to the database. There should be an option for you to select that says ‘Add Target’. When you select this option, you should see a screen similar to the one in Figure 4. Depending on the application you’re developing you may choose a different type of image target at the top of the screen, but for this tutorial, you should select the ‘Single Image’ option. You will then select your image target file from wherever it is on your computer, select the width (for this tutorial, it is 400), and give the target image a name. In this tutorial, it is named TARGET, but you can select a more descriptive name for your target. Once all of this is complete, you will select ‘Add’. This will add your image target to your database.

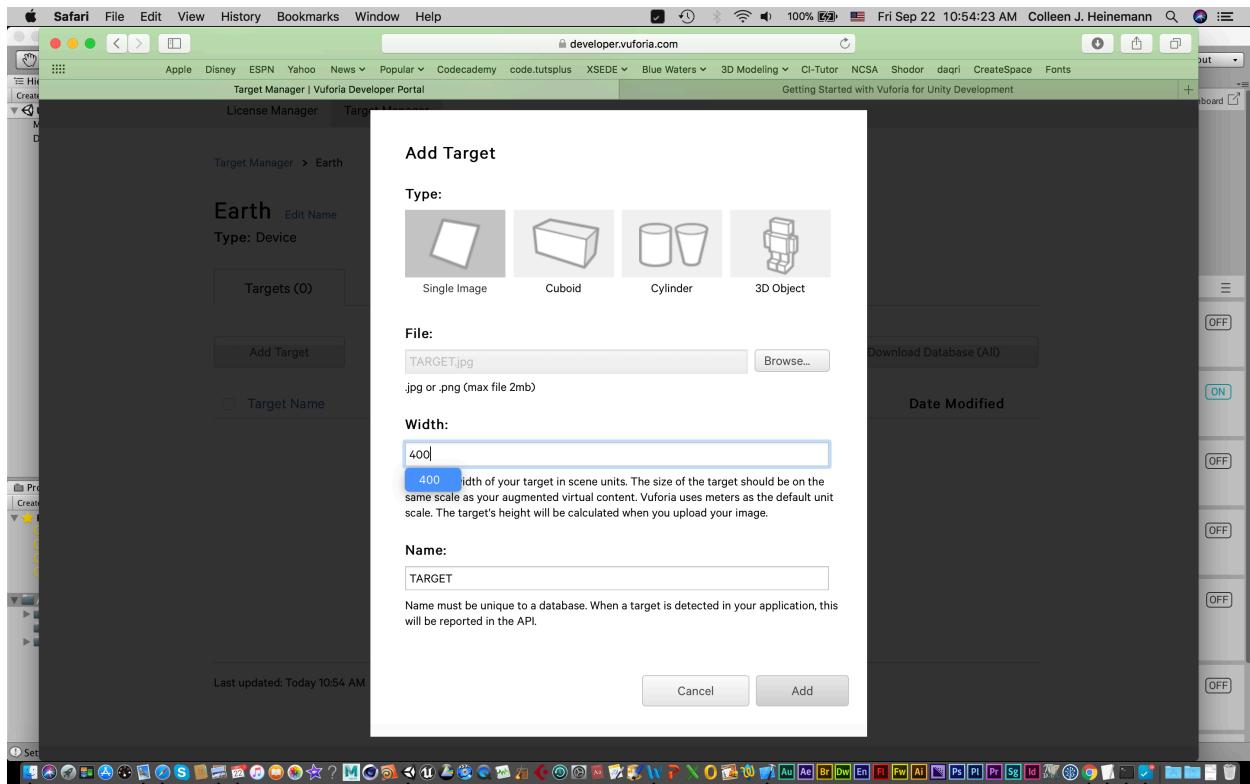


Figure 4: The screen seen after selecting the ‘Add Target’ option

Before you can utilize your target image from Vuforia in your application, it is necessary to download your database from Vuforia onto your computer. To do so, you will need to select the ‘Download Database’ option. If you have more than one database available, you will need to specify which database you want to download. In this case, we want to download the ‘Earth’ database.

Before downloading the database, you will want to select whether you want the database to be configured for Unity or for Android, Xcode, or Visual Studio. Because we are using the Unity Editor, we want to select Unity. You can then download the database as seen in Figure 5.

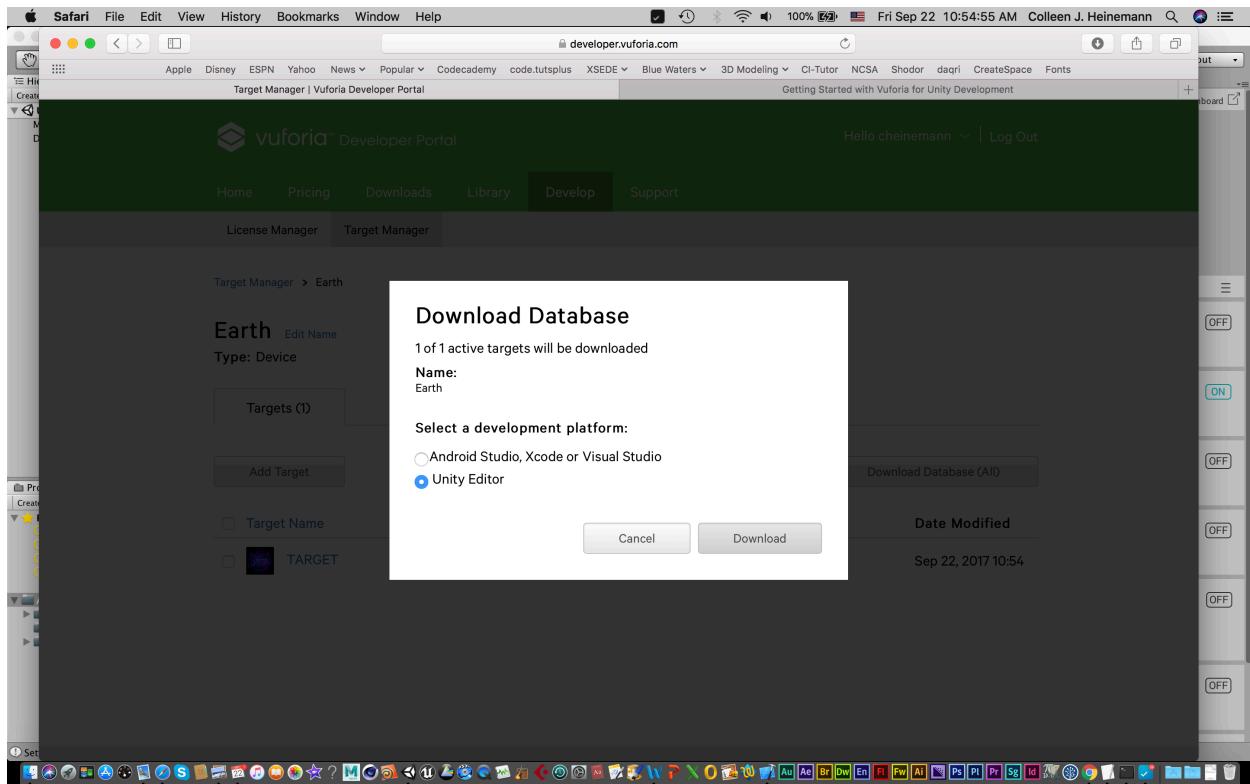


Figure 5: Configuration to download the Earth database

2.3 License Manager and Generation

In order to use the database you generated with Vuforia, it is necessary to create a license that allows for it to be used in your application being developed in Unity. On the Vuforia page, there is a tab next to the ‘Target Manager’ titled ‘License Manager’. If you select this tab, you should see a screen similar to the one in Figure 6.

As you can see, the Earth database does not have a license associated with it because it is not in the list of available licenses. In order to activate a license for the Earth database, you will need to select the ‘Get Development Key’ tab. Do not select the tab to buy a development key. A free license will suffice.

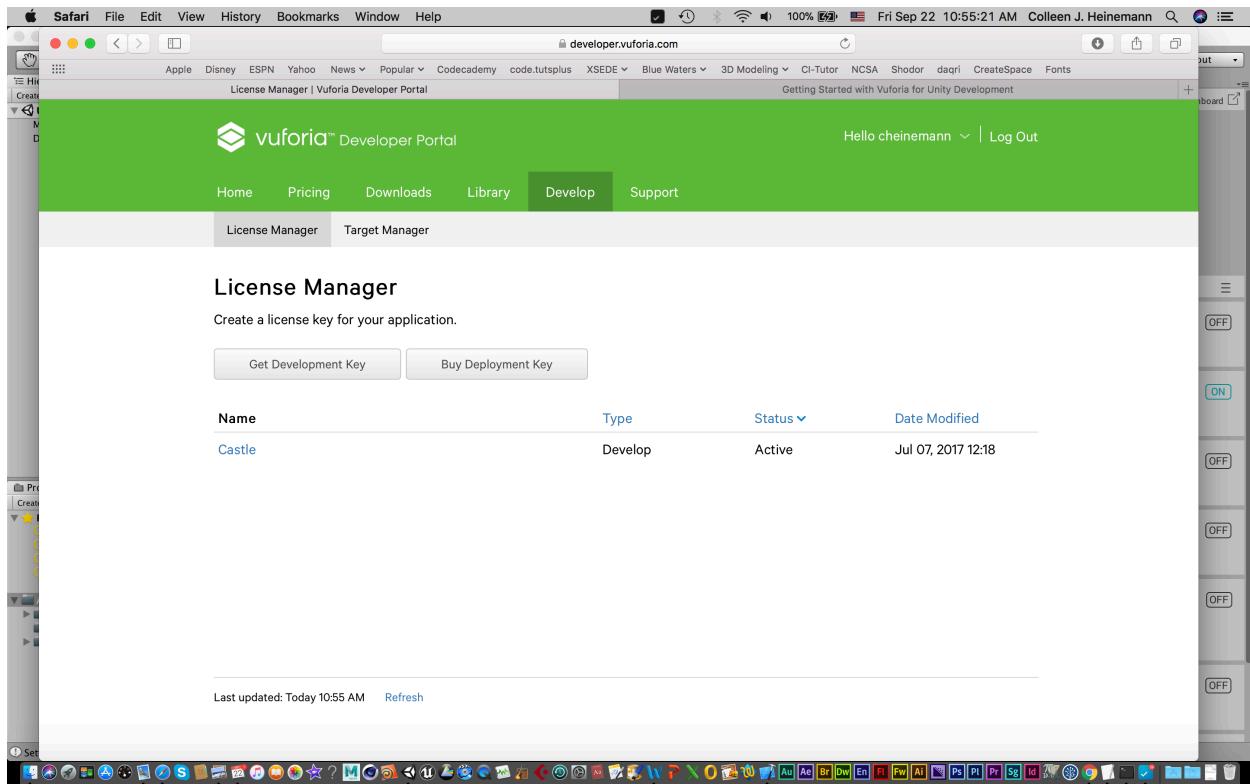


Figure 6: License Manager tab on the Vuforia website, showing all of the active database licenses available for use

When you select ‘Get Development Key’, you should see a similar screen to the one in Figure 7. This is where you will generate the free license key. You will select the name that will appear in your list of active licenses in the License Manager and agree to the terms and conditions before selecting ‘Confirm’.

Once you click ‘Confirm’, you should see a screen similar to the one in Figure 8. Here is where you will actually obtain the license key necessary for use in your application in Unity. The long jumble of letters and numbers in the greyed out box is the actual license key. You will ‘copy’ this key. It will be pasted into Unity in a later step.

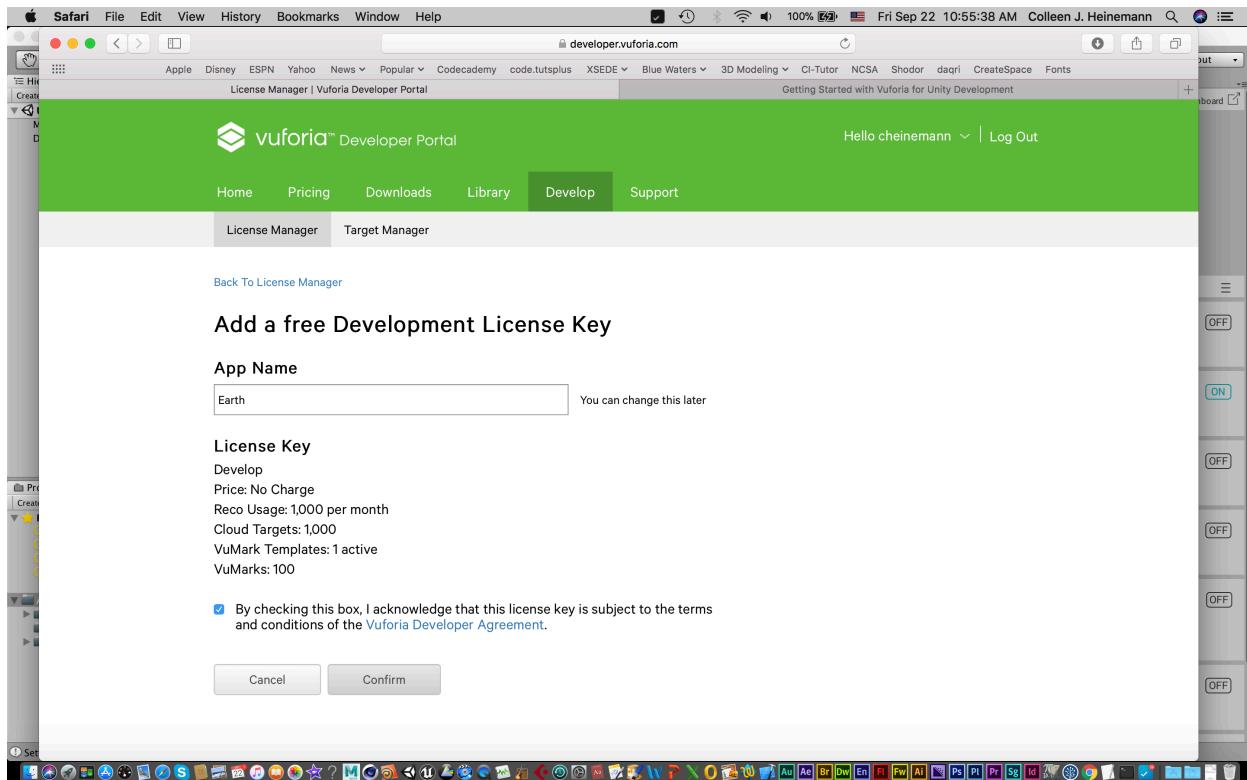


Figure 7: Options for activating a free development license key for Vuforia

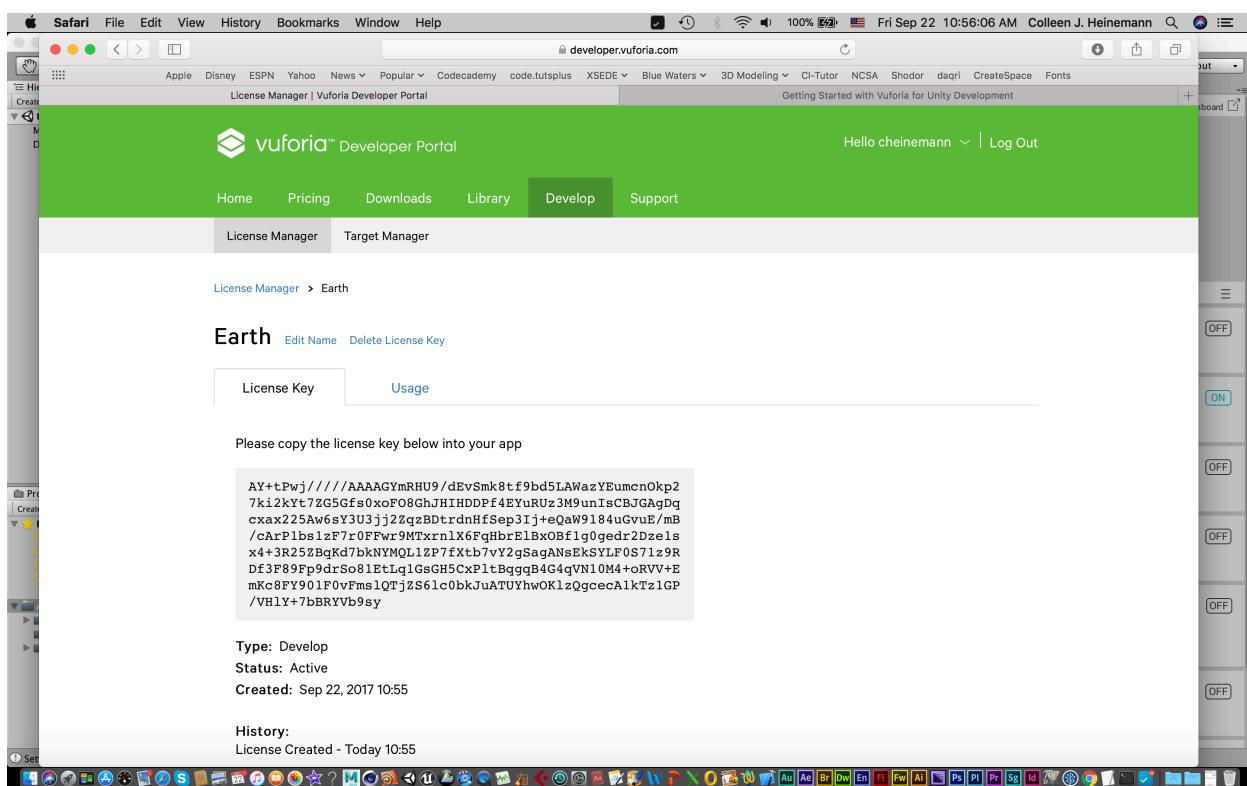


Figure 8: License Key generated by Vuforia that will be pasted into Unity in a later step

3. Unity Configuration and Setting up of AR Application

After completing all of the steps listed above regarding Vuforia, you can move to the Unity editor. The first time you open the Unity editor, it may ask you to go through a few preliminary configuration steps to set everything up. Then, you can create a new project. You want to select ‘3D’ and name your project.

The first step once your project opens is to delete the main camera as seen in Figure 9. It will be replaced by a camera specific to Vuforia in a later step.

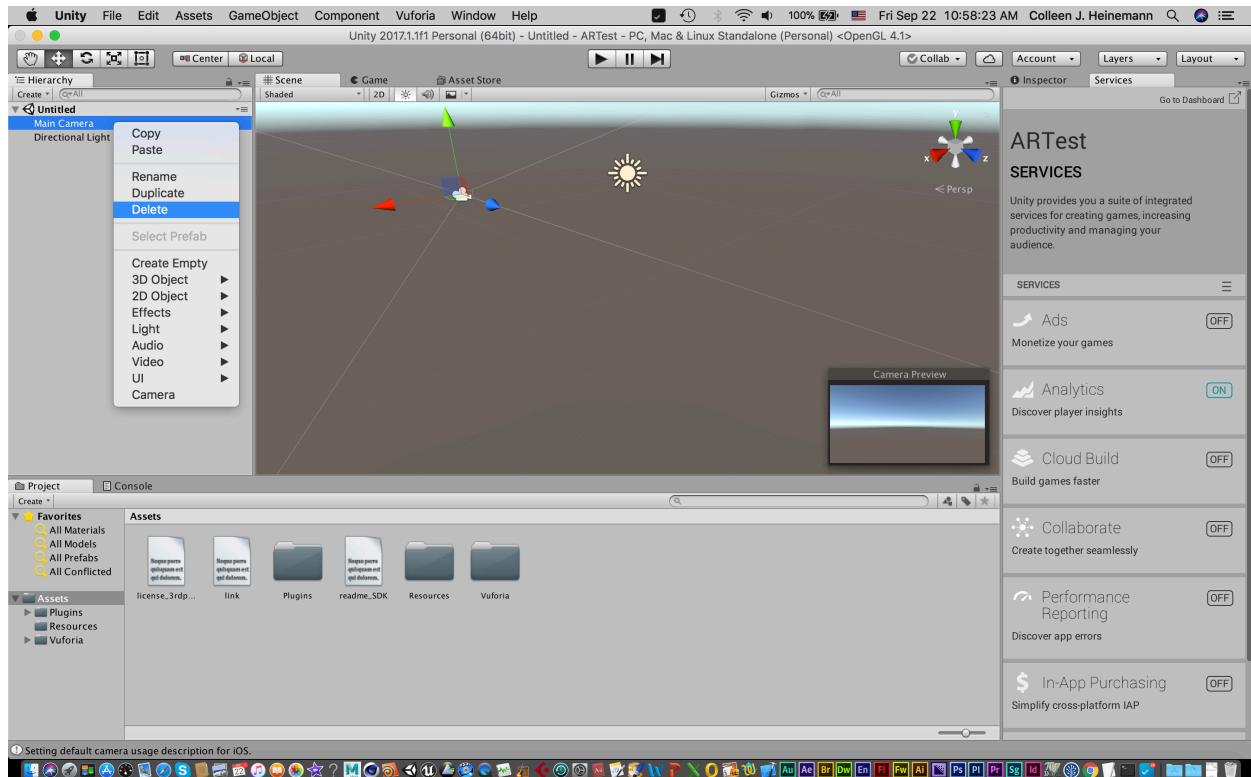


Figure 9: Deleting the main camera from the scene to be replaced by an Augmented Reality camera later

The next step is to import the Vuforia package to Unity in order to utilize its features. This can be done by following the steps in Figure 10, Figure 11, and Figure 12. First, select the tab ‘Assets’ from the menu at the very top of the screen. Under ‘Assets’, there is an option to ‘Import Assets’ and then select ‘Custom Package’. From here, the Vuforia package can be selected. A menu will pop up, similar to the one in Figure 11, where you can pick and choose which portions of the Vuforia asset you want to import. For this tutorial, we will just use the default setting where everything is imported. You can then select the ‘Import’ option. It may take a few minutes to import the package. Once it is imported to your Unity project, you should see options in your Assets window at the bottom of the screen specific to Vuforia, similar to the options in Figure 12.

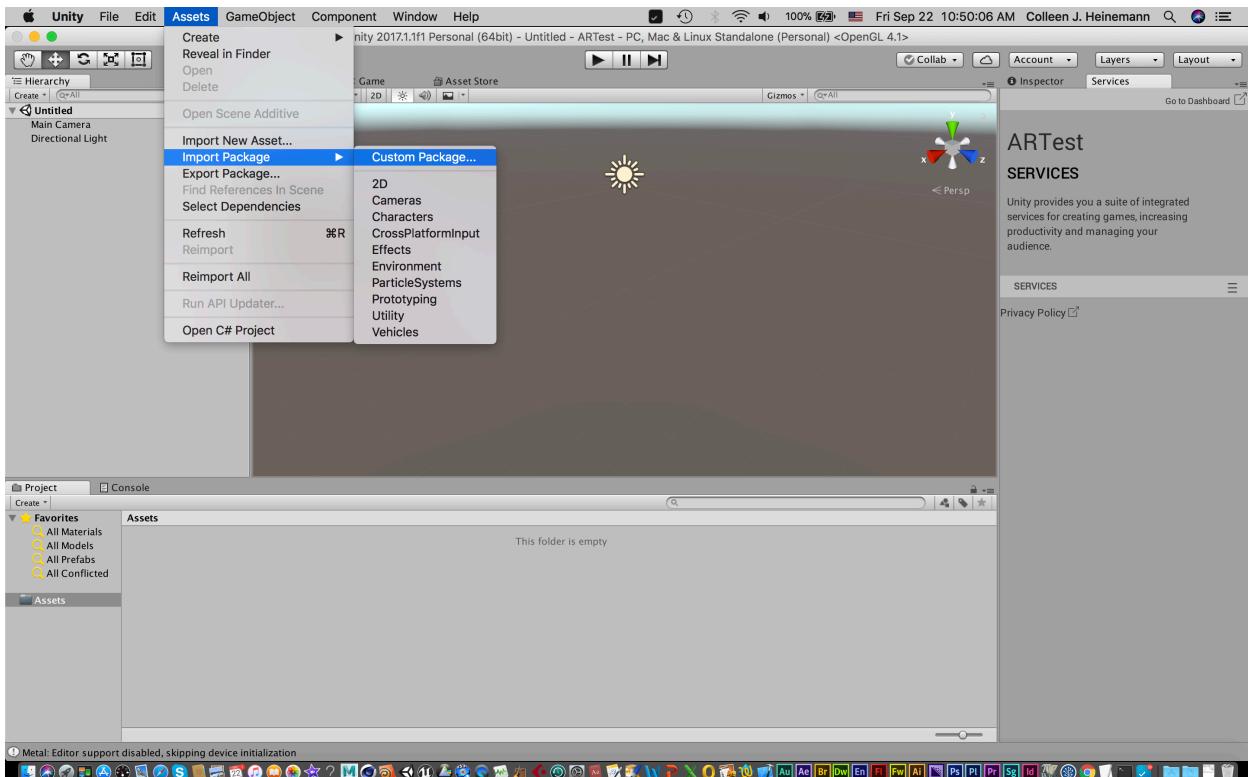


Figure 10: Configuration to select the option to import a custom package, such as Vuforia in this instance.

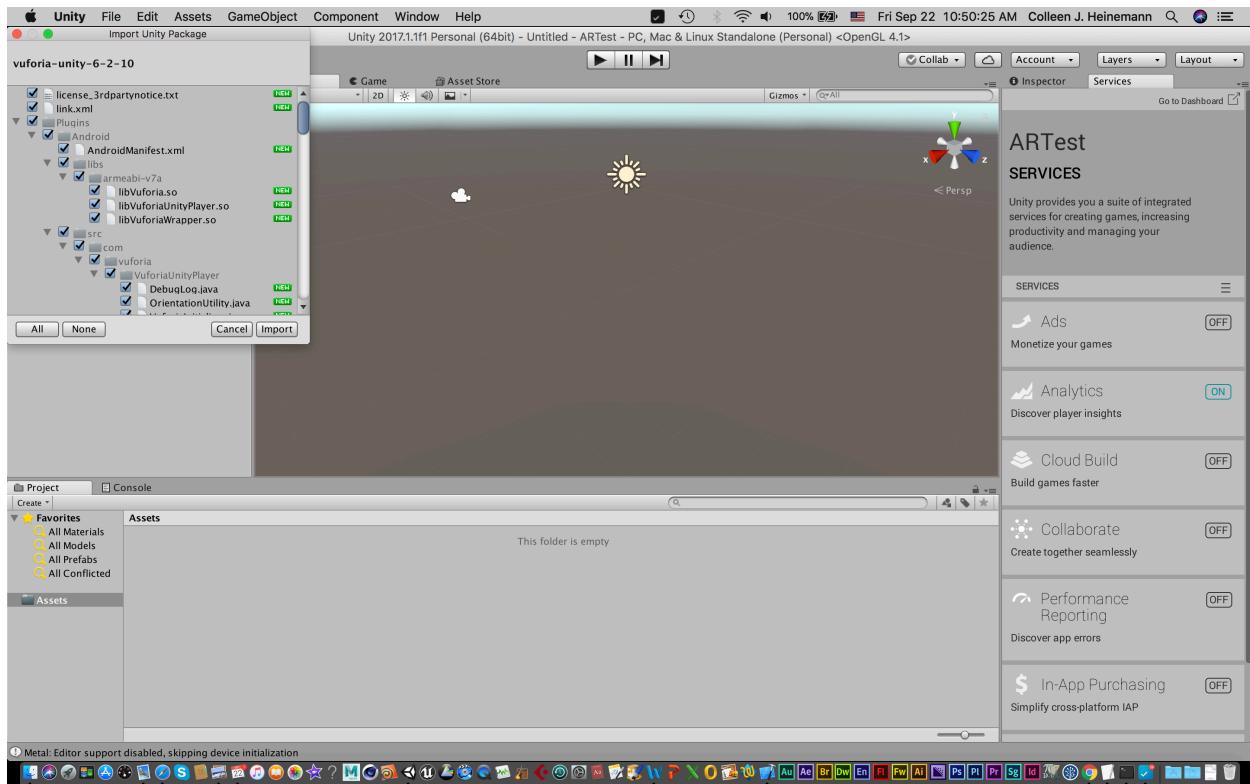


Figure 11: Window that pops up when you select to import the Vuforia package. You can pick and choose which options you want to select, but for this tutorial we will select all of the options and then select ‘Import’

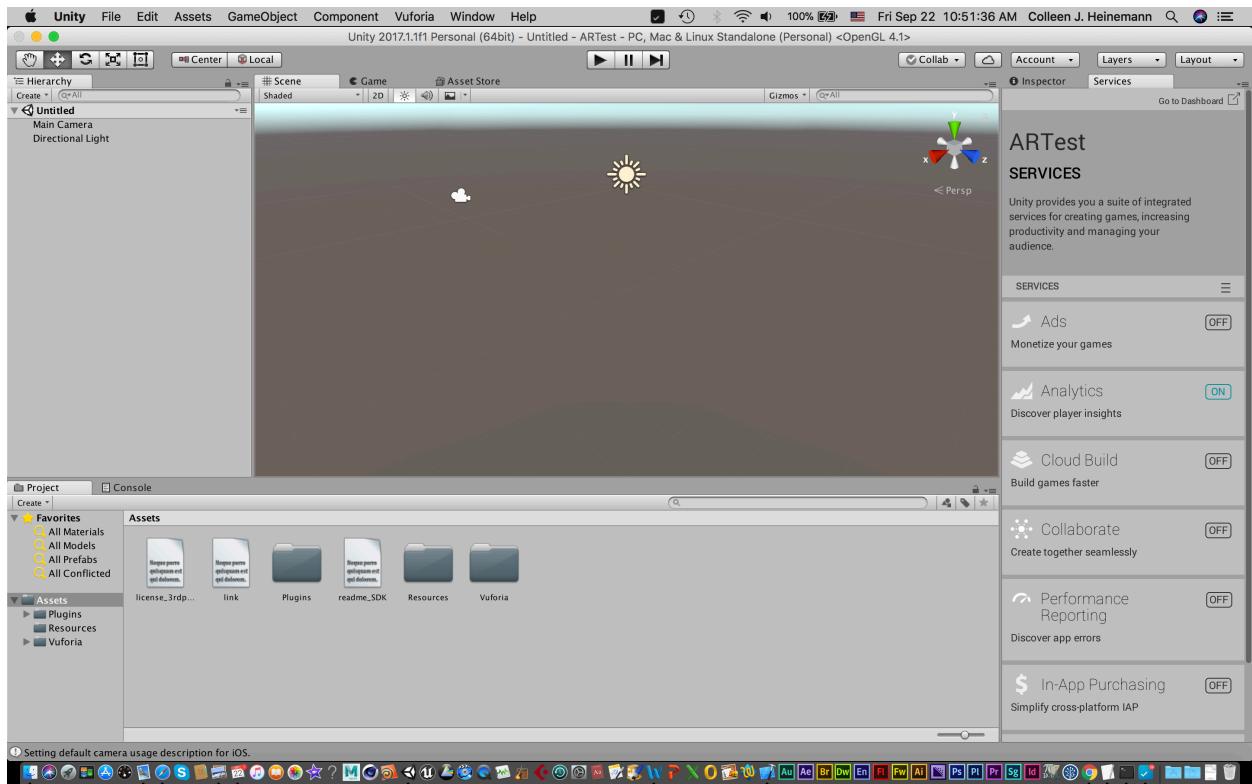


Figure 12: After importing the Vuforia assets, you will see a folder in the ‘Project’ window at the bottom of the screen specific to ‘Vuforia’. In the ‘Assets’ window, you should see options specific to Vuforia

3.1 Setting up Configurations for AR Application

The very first step to configure your project specifically for your AR application is to replace the main camera you deleted in Step 3 with an ‘AR Camera’ from the Vuforia assets package. To do this, you will need to select the Vuforia folder under the Assets option on the left side of the screen at the bottom. If you toggle the Vuforia folder to show its contents, you should see a folder called ‘Prefabs’. After selecting this folder, you should see a bunch of options under the ‘Assets’ window at the bottom of the screen similar to the ones seen in Figure 13. In this list of options, the first option should be the ‘ARCamera’. This will be used to replace the main camera that was deleted previously.

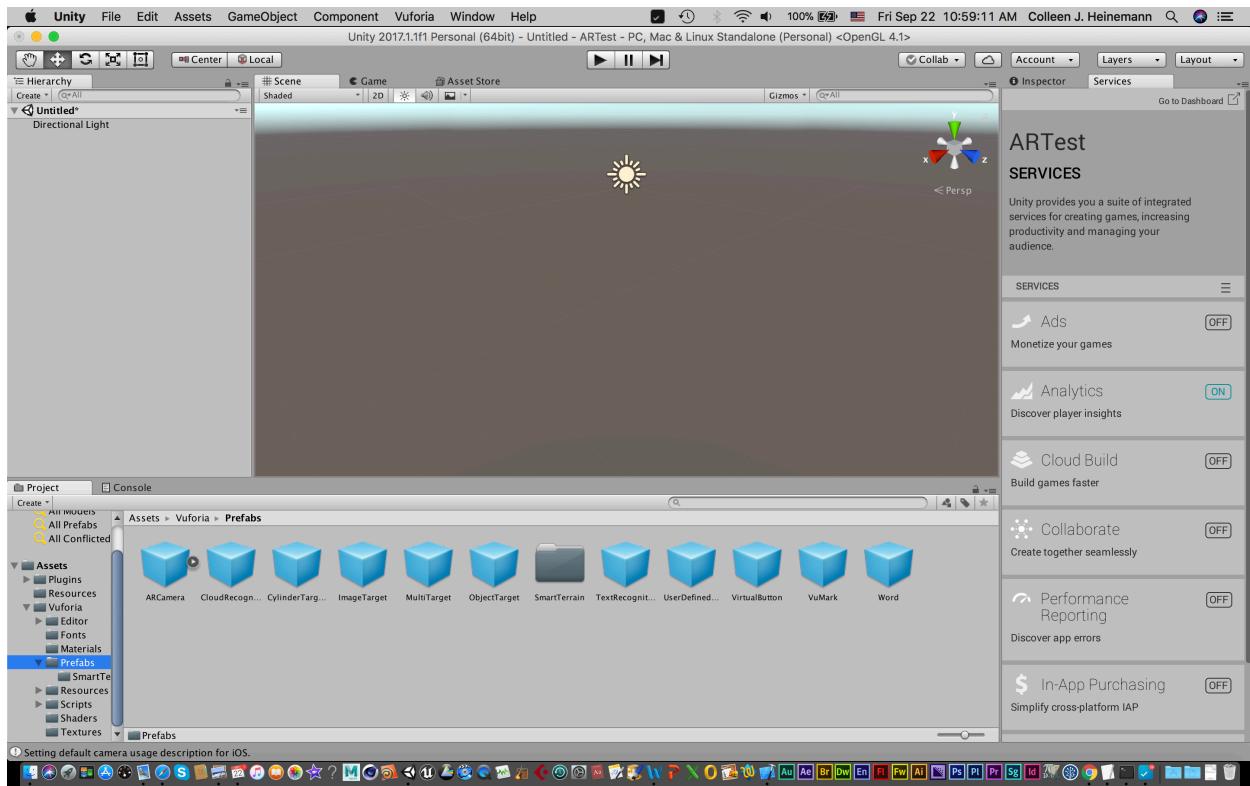


Figure 13: Placement of the ARCamera under the Vuforia assets package

To place the ARCamera in your scene, simply drag the ARCamera from the bottom portion of the screen where it is available in the Assets up to the left side of the screen labeled ‘Hierarchy’. If you have successfully dragged the ARCamera to the scene, you should see it listed in the Hierarchy as ARCamera. It should look similar to Figure 14.

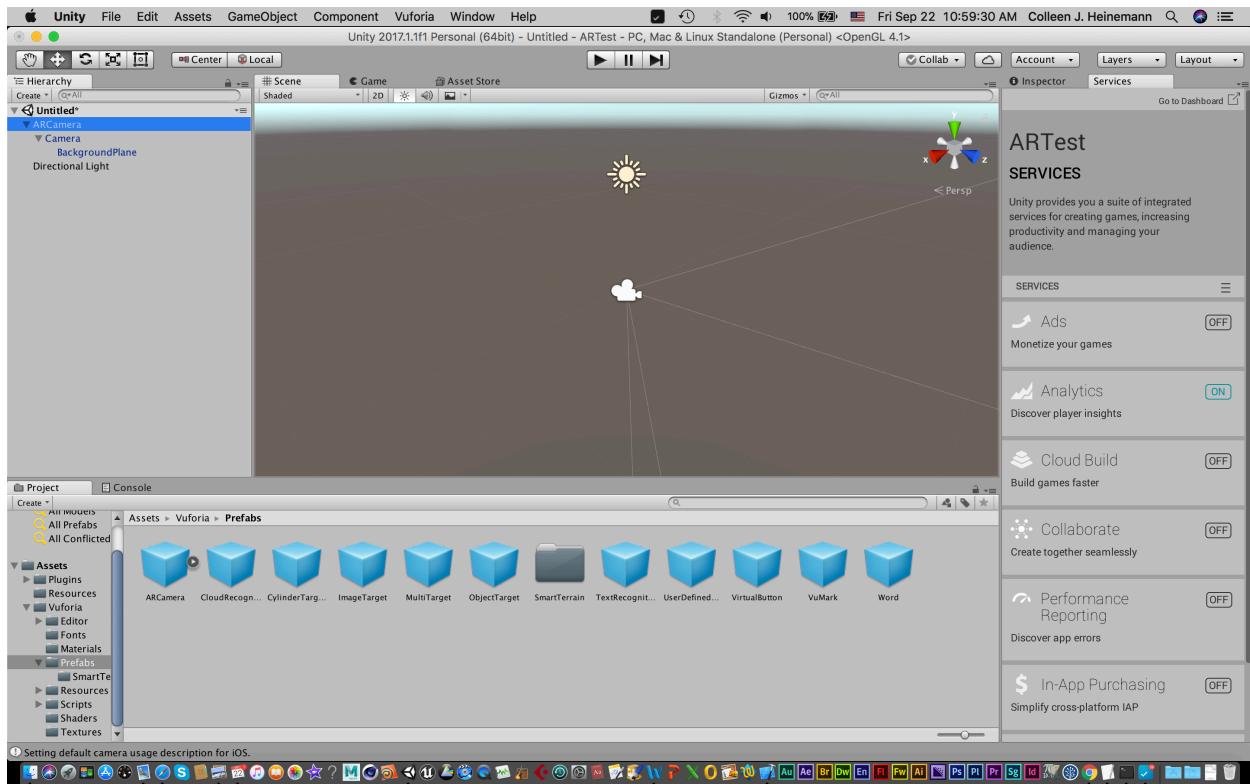


Figure 14: Placing the ARCamera in your scene by dragging it up from the Assets window to the Hierarchy of the project

3.2 Activating Vuforia in Your AR Application

Now that you have a Vuforia element in your Unity project, the next step is to actually place the items specific to your AR application in the project. In order to be able to see and use your image target and, therefore, your 3D model, you need to activate Vuforia in your project.

To activate Vuforia in your project, you are going to paste the License Key that you copied from Vuforia in Step 2.3 into the Inspector window on the right side of your Unity screen. When your ARCamera is selected in the Hierarchy on the left side of your screen, there should be an option in the Inspector window on the right side of your screen to modify the Vuforia configuration. If you select this option, a new window should open in the Inspector view with a blank box near the top of it. It is in this blank box that you want to past your License Key specific to the project you are working on. Note that if you accidentally use a different License Key from a different project, for example, it will not work.

These steps should look similar to Figure 15. All other configuration options should remain as they are in the default mode.

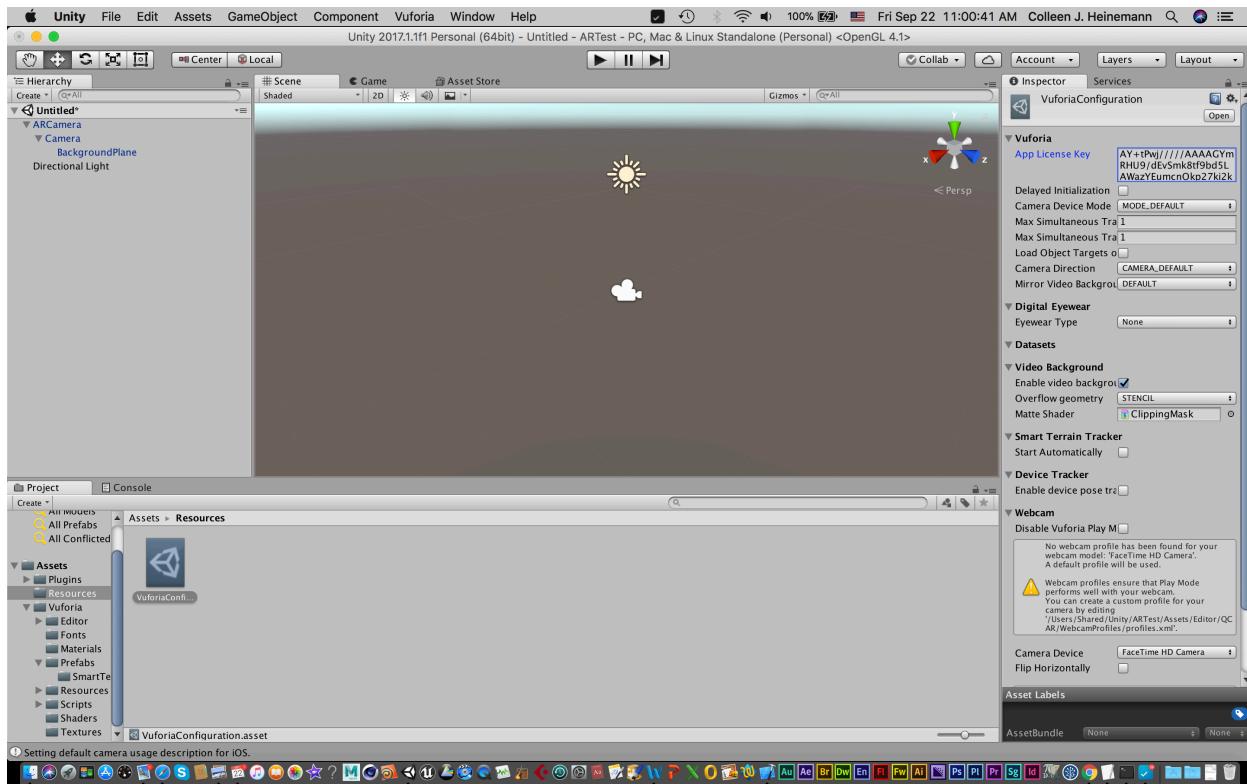


Figure 15: Inserting the Vuforia License Key specific to this tutorial in the Inspector window

Now, in order to use the database that you downloaded from Vuforia in your AR application, it is necessary to import the database that you downloaded in Step 2.2. It should be saved on your computer somewhere (most likely in your Downloads folder).

To import your database specific to this AR application, you will follow steps similar to importing the Vuforia package in Step 3. You will follow the same steps of selecting Assets in the menu at the top of your screen, toggling down to Import Assets and selecting the option for Custom Package. Upon selecting this, you should see a screen similar to the one in Figure 16 that asks you to select the file that you actually want to import. In the case of this tutorial, the file we want is Earth.unitypackage. Remember that Earth is the name of your database.

Once you have selected the correct file, you can select the ‘Open’ tab near the bottom of the screen. Similarly to importing the Vuforia package in Step 3, you should see a small window like the one in Figure 17 that asks you to select the information related to the database that you want to import. Here, we will leave it as the default where it imports everything in the database. You should then select ‘Import’. Depending on the size of your database, this may take a few minutes.

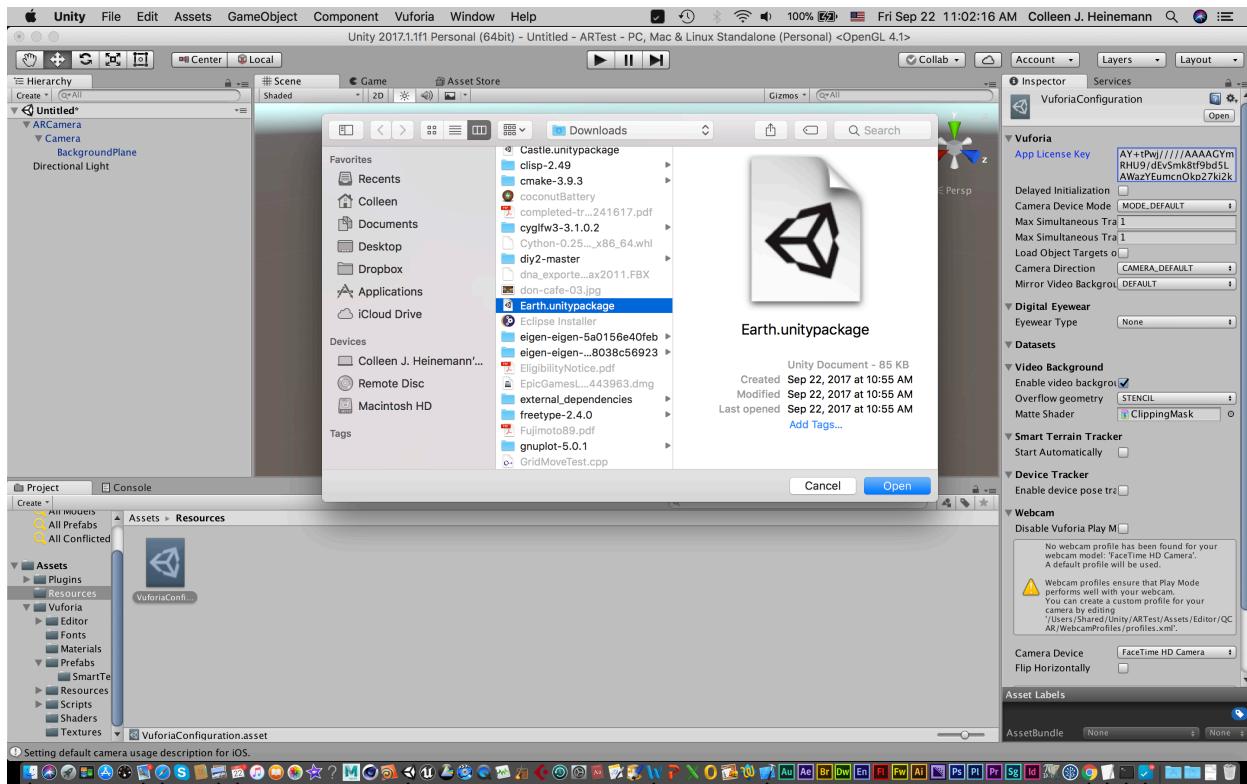


Figure 16: Steps to import the database from Vuforia that contains the image target specific to this AR application. See Step 3 for more information on how to download the database

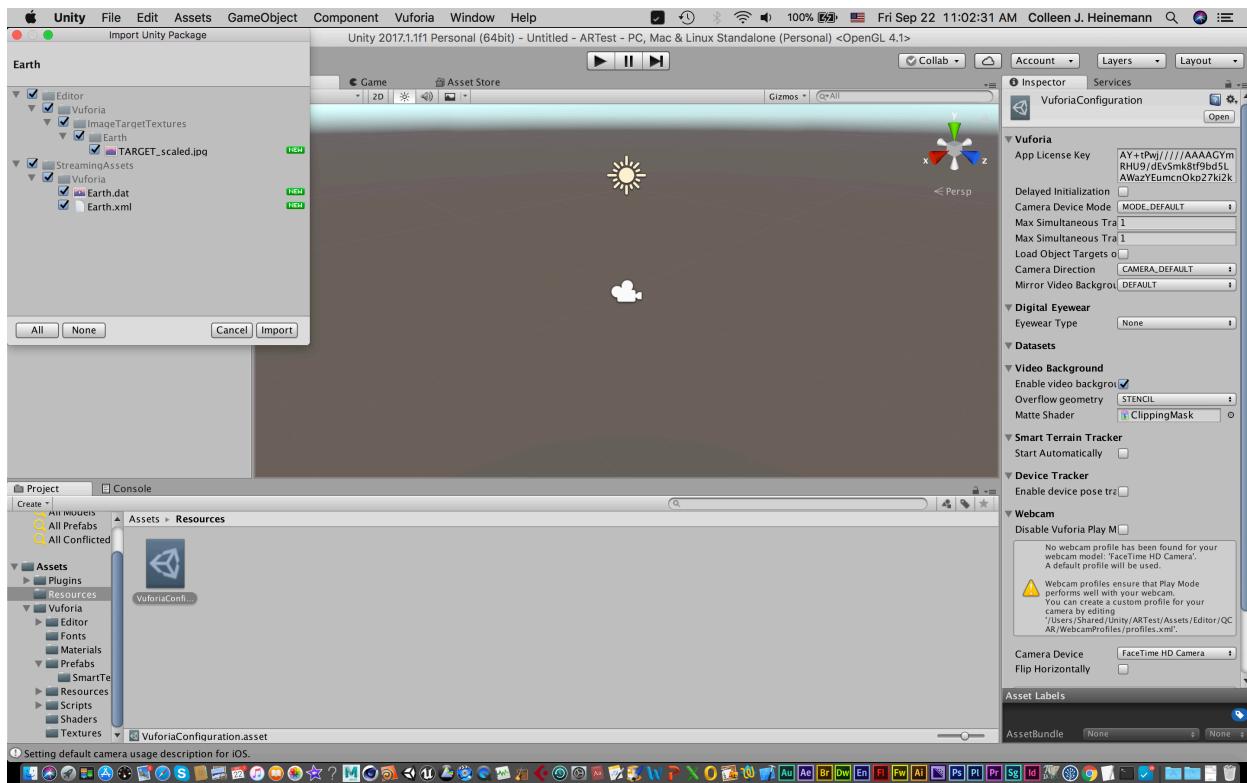


Figure 17: After selecting the database that you want to import, you will be given options on which portions of the database you want to import. After doing so, select ‘Import’

Your database should appear on the bottom left side of the screen under Assets under the Vuforia folder. There should be a folder inside of the Vuforia folder titled Image Target. In here, you should see a folder with the title of your database. For this tutorial, remember that the database was titled Earth.

3.3 3D Object and Image Target for AR Application

Now that Vuforia has been imported into your Unity project and your database has been downloaded, it is now time to actually put things into your window so that there are things in your AR application.

First, we will bring in our 3D object. This is the model that will appear when running your AR application. In this case, the 3D object is a globe.

To place your 3D object into your application, simply drag it into your Hierarchy similarly to how you placed your ARCamera in the hierarchy. If your 3D object is not already in your Unity project, you can either use the File→Open option or drag and drop your 3D object into the project.

Once your 3D object is placed in your Hierarchy, you should be able to see it in your Game View window (the large screen in the center of your Unity project). The Inspector window on the right side of the screen should be specific to your 3D object as well if your 3D object is the one that is selected. You can tell whether or not it is selected if there is an orange border around your object in the Game View or not. In this case, as seen in Figure 18, the globe is selected and the Inspector window shows the properties specific to the globe, such as its rotation, position, and scale. In a later step, we will need to adjust these properties, but for now the default is fine.

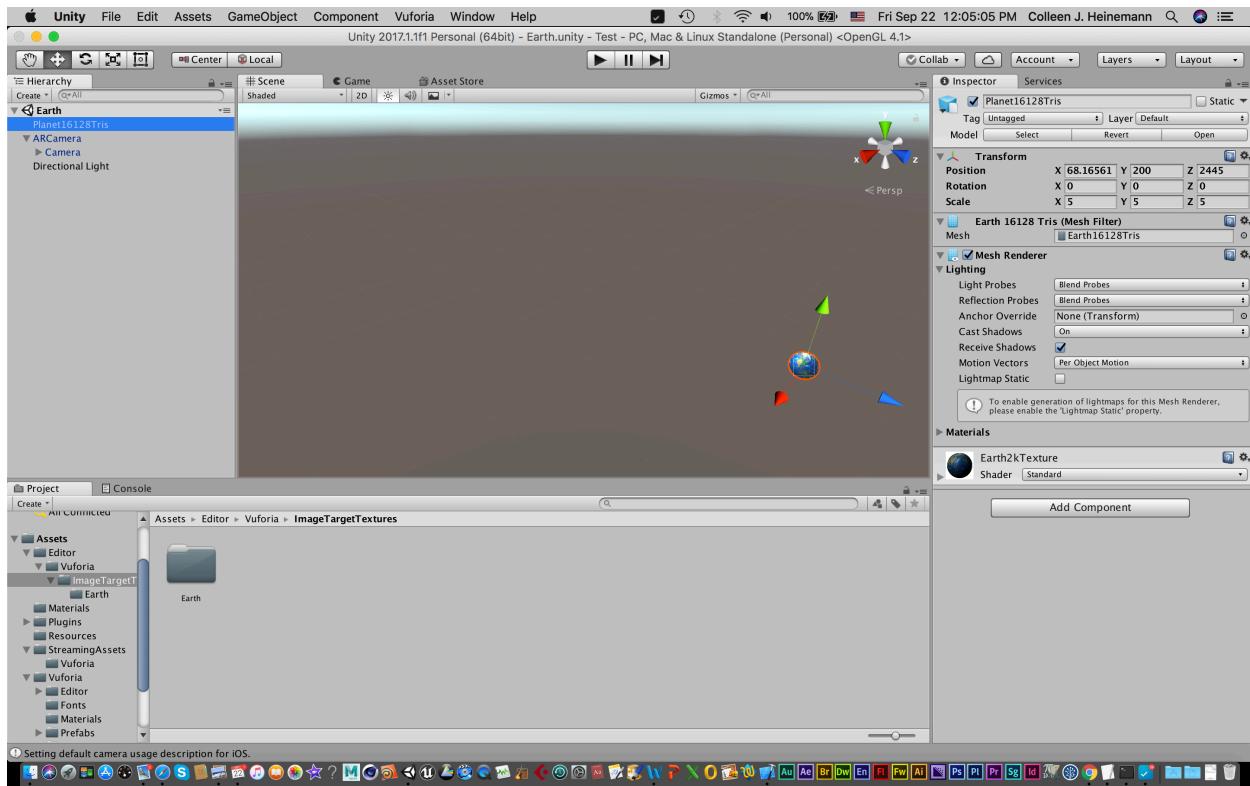


Figure 18: After opening your 3D object in your project, you can drag it into the Hierarchy on the left side of the screen. You should see your 3D object in the Game View and its properties should be listed in the Inspector window on the right side of the screen

Now that your 3D object is visible in your window, it is necessary to bring in your image target. To do this, we will need to use an additional Prefab from the Vuforia Assets folder (similar to how we selected the ARCamera from the same folder earlier). There should be a prefab in the list called ImageTarget.

In the same way we dragged the ARCamera into the Hierarchy, drag the ImageTarget prefab into the Hierarchy as well. ImageTarget listed in the Prefabs related to Vuforia can be seen in Figure 19.

After the ImageTarget prefab has been dragged into the Hierarchy, it is necessary to make your 3D object a child of the ImageTarget prefab. Your configuration should be similar to the one seen in Figure 20. For the Image Target and the ARCamera, make sure that your Vuforia database is activated as well as imported. If it is not activated, it will not be seen in your AR application.

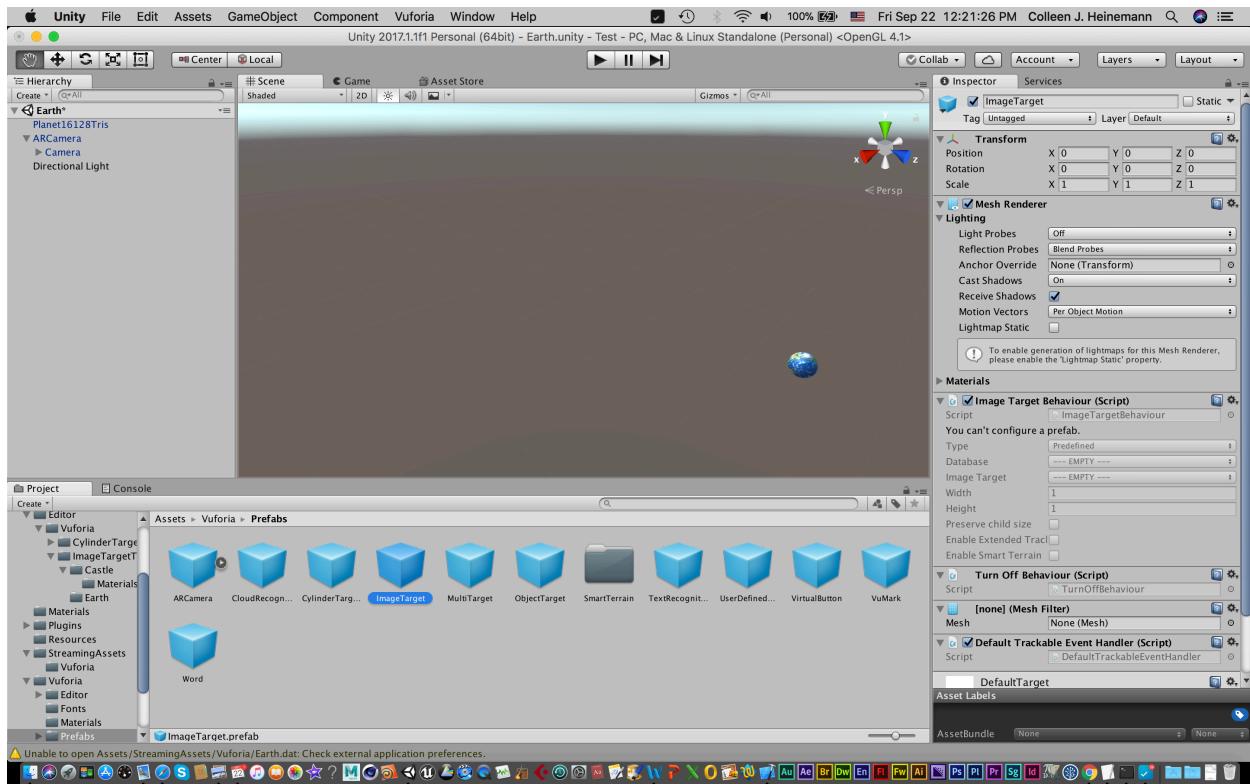


Figure 19: The ImageTarget prefab listed in the Assets window at the bottom of the screen

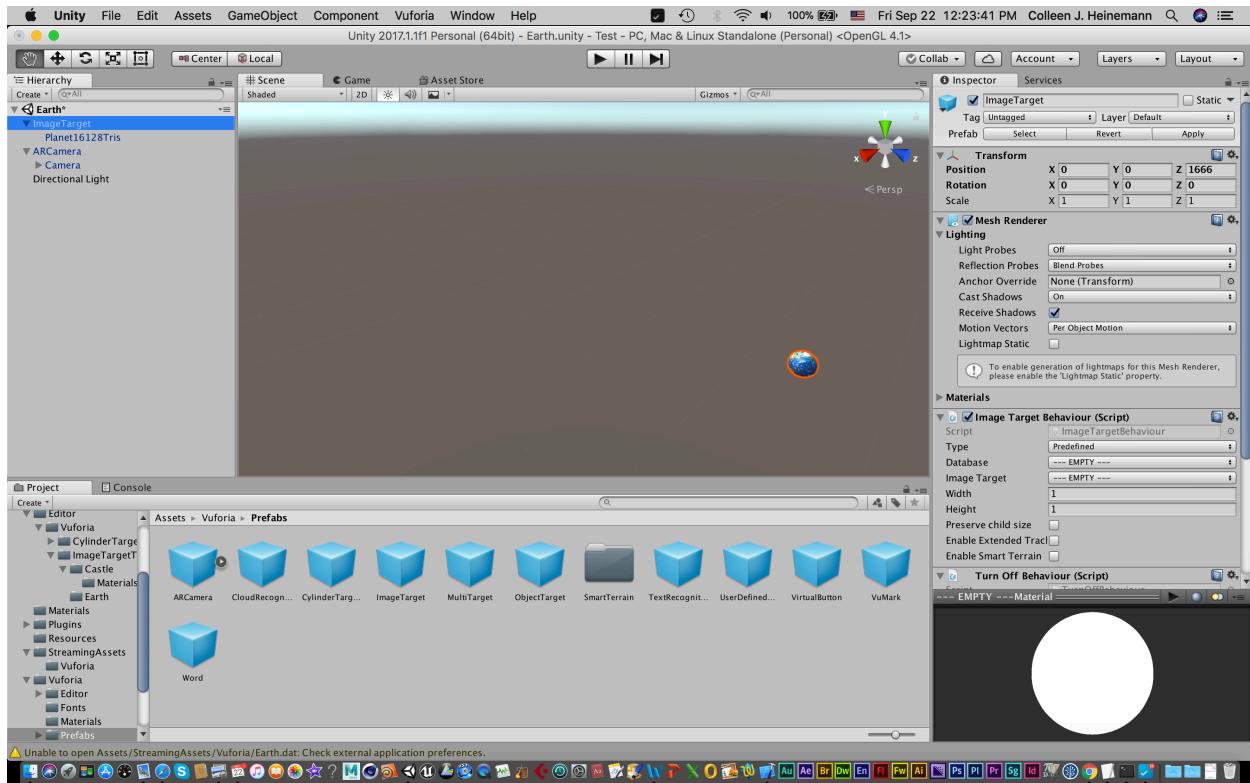


Figure 20: After dragging the ImageTarget prefab into the Hierarchy, your Unity project should look similar to the one here

3.4 Adjusting Your Coordinates

Now that all of the necessary objects for your AR application have been placed in the project, it is important to adjust the position, rotation, and scale of your 3D object as well as the camera. Your camera should be pointed at your 3D object, but it might be necessary to adjust the position and scale of the 3D object so that it can be seen.

As seen in Figure 21, your 3D object should be seen on top of your Image Target. You may need to adjust properties of your Image Target as well in order to make this happen.

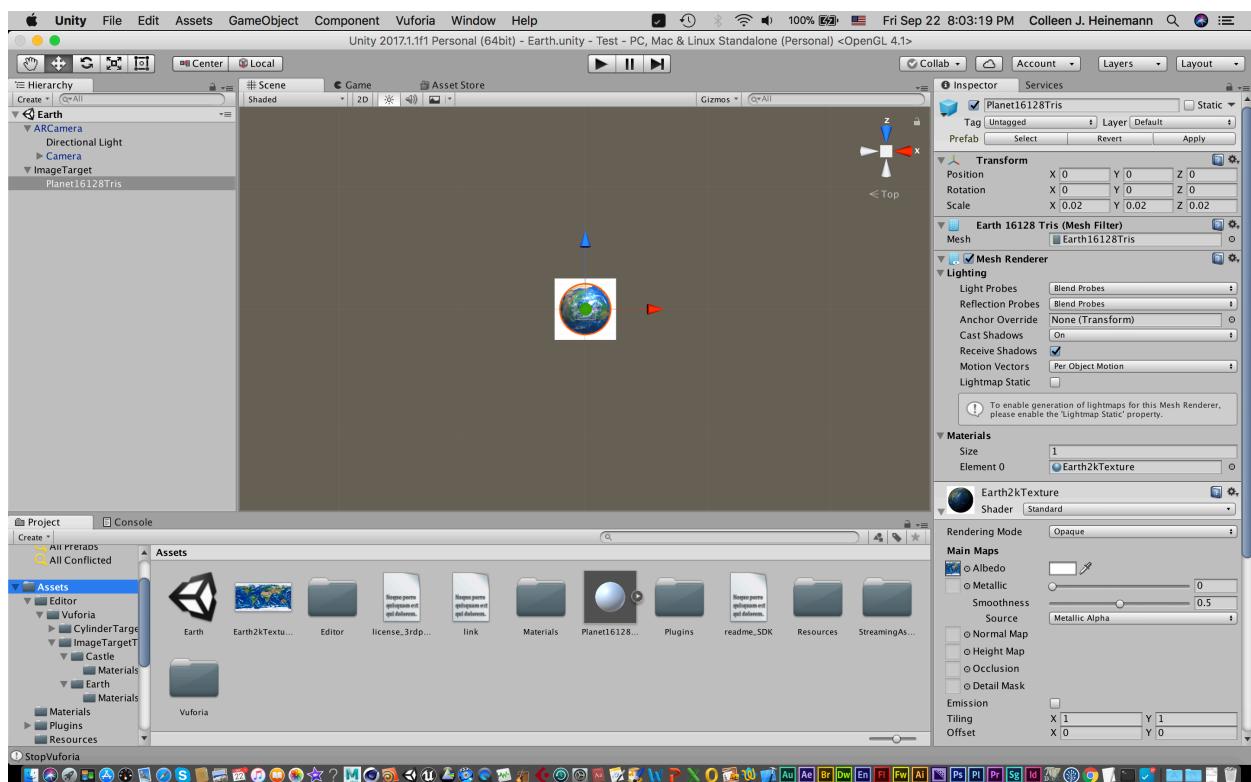


Figure 21: Adjusting the position, rotation, and scale of the 3D object and Image Target so that they can be seen by the camera and, therefore, seen in the AR application

4. Putting It All Together

Now that everything has been placed in your Unity project, you can test your AR application within Unity itself. Before you can do this, you need to make sure you have your actual image

target (in this case, the blue and purple galaxy image shown earlier) either on a mobile device or printed on a physical piece of paper.

To test your application, you can simply press the Play button at the top center of the Unity editor. This will open the camera on your computer. Here, you can then point your actual image target at your camera. If you have done everything correctly, your 3D object should pop up in the Unity screen on top of your image target. It may be necessary to go back and adjust position, rotation, and scale of your image target, your 3D object, or your camera.

If you have completed everything correctly, you should see something similar to Figure 22.



Figure 22: Final product