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Production Pipelines for Creating a Cinematic Digital Matte Painting

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by

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Abstract

This writing covers concepts in the creation of a cinematic scene in digital matte painting. Digital matte painting is a visual effects process of the modern version of traditional matte painting, in which the artist paints several backgrounds to add to a scene. The digital artist uses software to paint, apply photo-bashing techniques, and/or utilize 3D models to create an exterior or interior environment. This scene incorporates 3D geometry in Autodesk Maya, brought to life through texturing and in-software lighting and animated cameras. The finalized scene includes color correction and additional visual effects.

Keywords: Digital Matte Painting, Visual Effects, Film Production

Introduction

Digital matte paintings are widely used throughout the film industry by means of allowing filmmakers to add to or edit a scene by ‘painting’ in what is not physically present at the film location. The filmmakers can customize their visions for environments to create the perfect scene. In older techniques of matte painting in the visual effects industry, several paintings would be created to replace backgrounds in the scene. As methods have evolved in digital media, using 3D software to make matte paintings has opened the possibilities for more superior visual effects because the task does not require one to be artistically inclined. This means technically inclined people, can create these scenes, too. Many scenes in films use this technique and have revolutionized the film industry by making scenes incredibly life-like as if it is filmed with a camera in the real world. After figuring out that many landscapes, buildings, and effects were added into a scene through digital matte painting, I dreamed of being able to create a realistic 3D scene. This document reviews the process required to create my first digital matte painting.

Project Outline

For this project, I describe the process of creating a digital matte painting. It begins with the design phase where I decide the type of scene I want to create. Then, basic 3D modeling in Maya helps visualize where objects need to be placed. Creating a camera in Maya to view the scene and animating the camera-view demonstrates how the final shot will look. Then, adding

textures, using Substance Painter, to the ground and buildings begins to make the scene look more realistic. Since the scene I chose to create is in a forest, adding trees was the next step, which was done by using Bifrost in Maya. Then, I used Photoshop to create mountains in the background as well as a sky using photo-bashing techniques. After it is rendered in Maya, everything is brought into the software, Nuke, to be composited together into the final scene. After touch-ups, the project is finally finished!

Concept

When I discovered that I could make a digital matte painting in my class, I envisioned creating a cinematic shot that flew over a forest to reveal a castle on a mountain. The anticipation of revealing the castle stuck in my mind, so I started with creating a basic mountain at which the castle would sit. As the camera slowly revealed the castle, I wanted the view of the trees to be the first thing the eye sees. I added layers of hills and mountains to the background to blend into the Photoshop composition of background mountains and sky.

3D Modeling

I used polygonal modeling, "Polygons consist of geometry based on vertices, edges, and faces that you can use to create three-dimensional models in Maya," for this project (Autodesk, 2017). For the mountains, I used a plane and the soft select tool to raise sections of the geometry to create the illusion of hills and mountains shown in Figure 1.

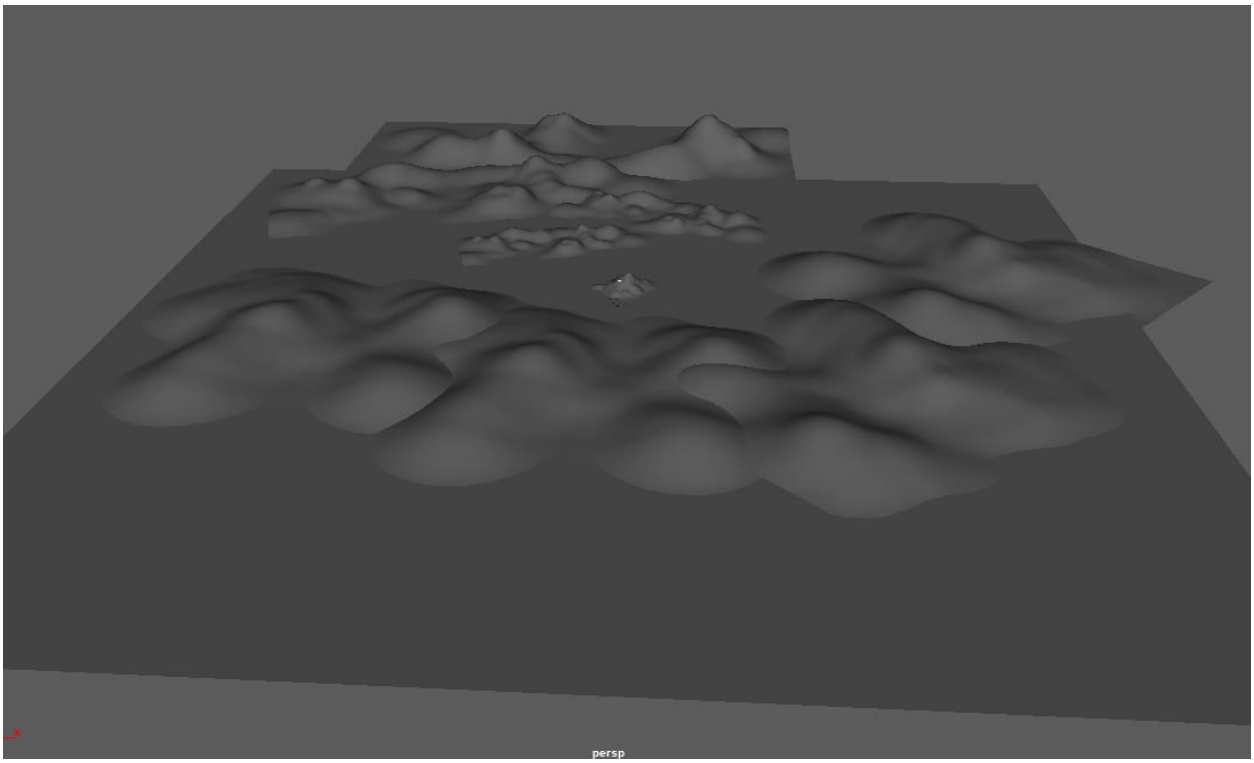

Figure 1 - Above are multiple ground planes; the largest being the main ground. The other ground planes are for the mountains, which I created using the soft-select tool in Maya. This allows me to pull up pieces of geometry to create a hill. The tool's strength is higher in the middle and weakens toward the edges. This makes the soft contours of the raised sections.

Since most of the land would be covered with trees, the detail of the ground did not need to be intricate. Due to the parallax of the moving camera, the motion blur would not allow the viewer to see detail in the ground and trees. Since the intricate details of the ground were not required, the time to create the matte painting was decreased.

For the castle, I created a series of cubes as place holders to help figure out the position I wanted the castle in shown in Figure 2.

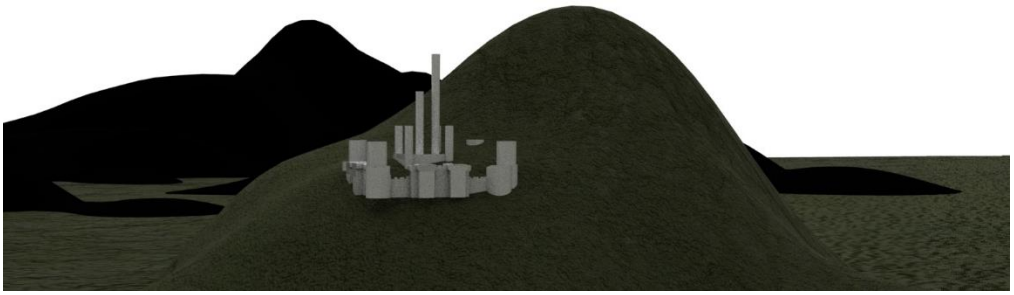

Figure 2 - The castle placeholder in the scene.

I purchased a kit from Kitbash. The kit, Dark Fantasy, included several medieval style buildings that were ready to use. I used some of the buildings in the kit that resembled a castle to replace the placeholder cubes shown in Figure 3. I placed several pieces of the castle parts on the mountain, until I got the look I desired.

Figure 3 – The buildings from the Kitbash Dark Fantasy kit.

The tree models were a free, downloadable resource from Turbosquid. I chose a pack of three trees because I thought it looked the most desirable for mountains as seen in Figure 4 below.

Figure 4 - The free tree model resource package I downloaded for the scene.

Animating the Camera

The next step was to animate the camera to help envision how I wanted the scene to be introduced. In Maya, the camera was set to an Angle of View, of 54.43 degrees, and a Focal Length of 35.00. These settings helped set the camera to see everything I wanted visible in the scene. Since the scale of this scene was large, I had trouble viewing the entire scene. The Far Clip Plane, under the camera Attribute Editor needed to be set to around one million to ensure no clipping in the 3D viewport. The Far Clip Plane made everything in the scene viewable from a

far distance. I began the animation by animating the camera to look at the trees. As the camera flies over the forest, the direction of the camera will slowly tilt up to reveal the castle.

Texturing

For texturing the ground, I used Substance Painter to give the ground a grass and rock texture. There was no need for intricate ground-cover detail because trees would be placed on top of the ground plane, which would cover up most of the ground texture. For the trees, a basic shader in Maya is used to give it color. The textures for the buildings were already created and included from the Kitbash kit. The kit was not available for download for Arnold, "an advanced Monte Carlo ray tracing renderer built for the demands of feature-length animation and visual effects movies," so I had to assign each material in the kit to an ai-standard-surface to make it compatible in Arnold (Griggs et al., 2021). This solved the issue of the textures on the buildings not showing up.

Adding Trees

To create a populated forest, at first, I downloaded a free resource pack from https://mantissa.xyz/pages/free.html. This resource provided 4 different tree models that I could use in my scene. Unfortunately, every time I used these trees, Maya would eventually crash. I navigated to Turbosquid, a free downloadable models' website, to download a free pack of trees. These trees worked because they had less detail in the geometry and would not overwhelm the program.

To scatter trees across the ground, I used the Bifrost Extension plug-in in Maya. Bifrost is "a node-based framework for building custom effects, including smoke, fire, explosions, sand, snow, instances, and more" (Autodesk, 2021). I opened the Bifrost Graph Editor and created a new graph. I inserted the ground plane into the editor, and plugged it into the geometry section of the '*Scatter by* "*Number*" node. This scatters points across the geometry, which is where the trees will be positioned on the ground plane. To add the trees, I then added a 'create_instances' node. I connected points on the '*Scatter by* "*Number*"' node to points on the 'create instances' node. Underneath points in the 'create_instances' node, is 'instance_geometries.' This is where I plugged in the four tree models. In a separate Maya scene, I opened each individual tree and saved them as an ASS File. Then, in the Bifrost Graph Editor, I inserted a 'render_archive_instance' node. In that node, under 'archive file,' I inserted my first tree file. I repeated this step two more times with the other trees. Back in the '*Scatter by "Number"'* node, I unchecked the 'Set Orientation' box to make the trees stand straight up, instead of being angled out with the curves of the ground plane. After the 'create_instances' node, I plugged in a 'randomized_point_scale' and 'randomized_point_rotation.' This changed the scale and rotation of the trees, so they would not all be the same size and position.

Creating A Sky in Photoshop

I gathered free, non-copyrighted photos from the website, Unsplash, to begin. I needed a sky and mountains for the background. In Photoshop, the canvas size is set to 16:9 inches at 300 resolution. First, I imported a picture of a sky into Photoshop.

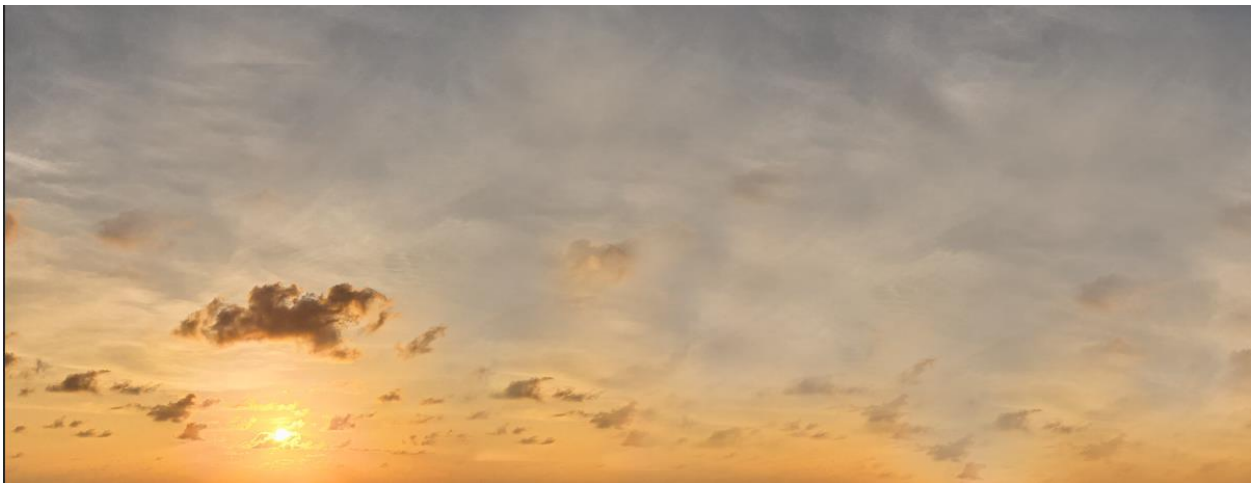

Figure 5 -The edited image of the sky.

Then, by using a layer mask, I cropped out the land in the sky photo, so I could replace it with the mountains I specifically wanted. I repeated the same process for the mountains, by using the Quick Selection Tool to easily select the mountains from the entire photo and hide the sky portion.

Figure 6 -The mountain image I used in my composition.

I placed the mountains into the new sky photo where I thought they looked best. This was the finalized background image that I would be putting into my scene in Figure 7.

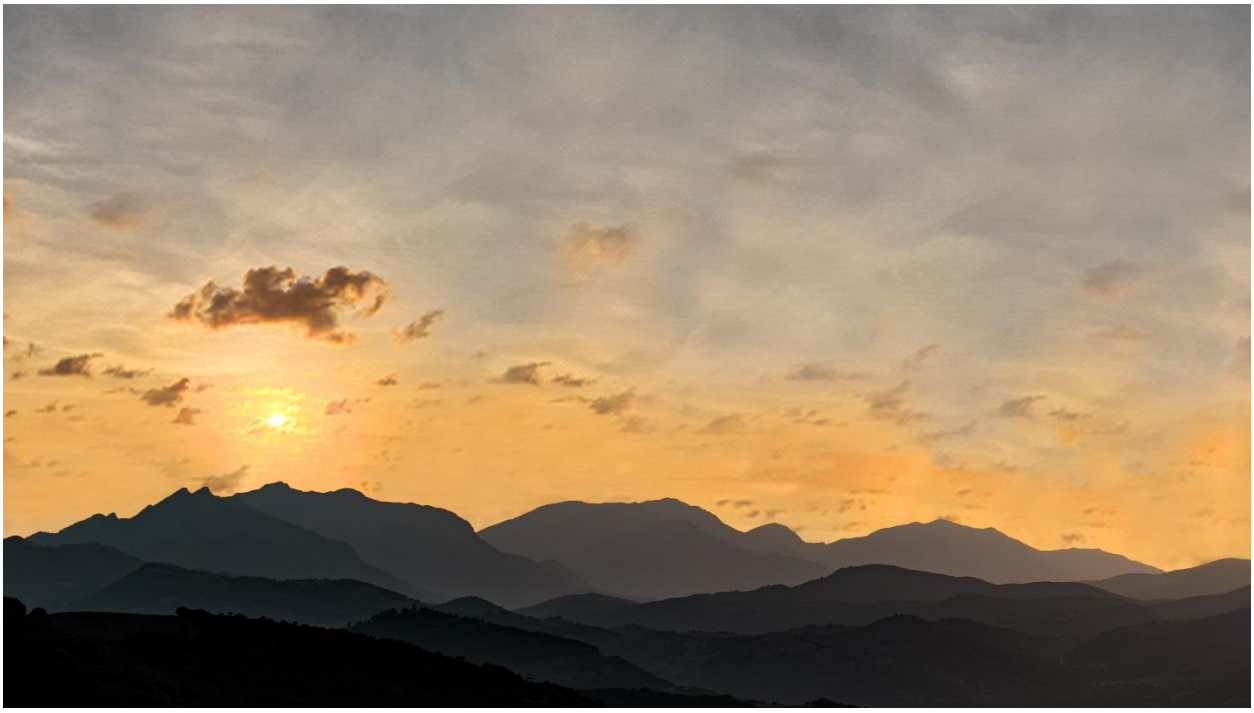

Figure 7 - Final image for the background

Animating the Flag

I added a flag flying in the wind on top of the castle to bring the scene to life. The more objects that move, the more convincing the scene. In Maya, I created a simple flag by using a cylinder for the pole and a plane for the flag as seen in Figure 8.

The flag needed more subdivisions for its width and height to make the rippling movement smooth. First, I made the plane an nCloth; “nCloth is a fast and stable dynamic cloth solution that uses a network of linked particles to simulate a wide variety of dynamic polygon surfaces″ (Autodesk, 2014). For example, using nCloth simulates how cloth, or other materials

such as beachballs, concrete, lava, water balloons etc., are affected by gravity, air, and how they react with other objects. I made the pole a passive collider, which is a “non-simulated nCloths that participates in Maya Nucleus system collisions” (Autodesk, 2014). This makes the flag collide with the pole, instead of going through the pole. The Maya Nucleus system contains the nCloth and passive collider and more, as well as the Maya Nucleus Solver which affects the simulation.

Next, I selected the vertices along the left side of the flag that connected to the pole. I navigated to nConstraint and selected Transform Constraint.

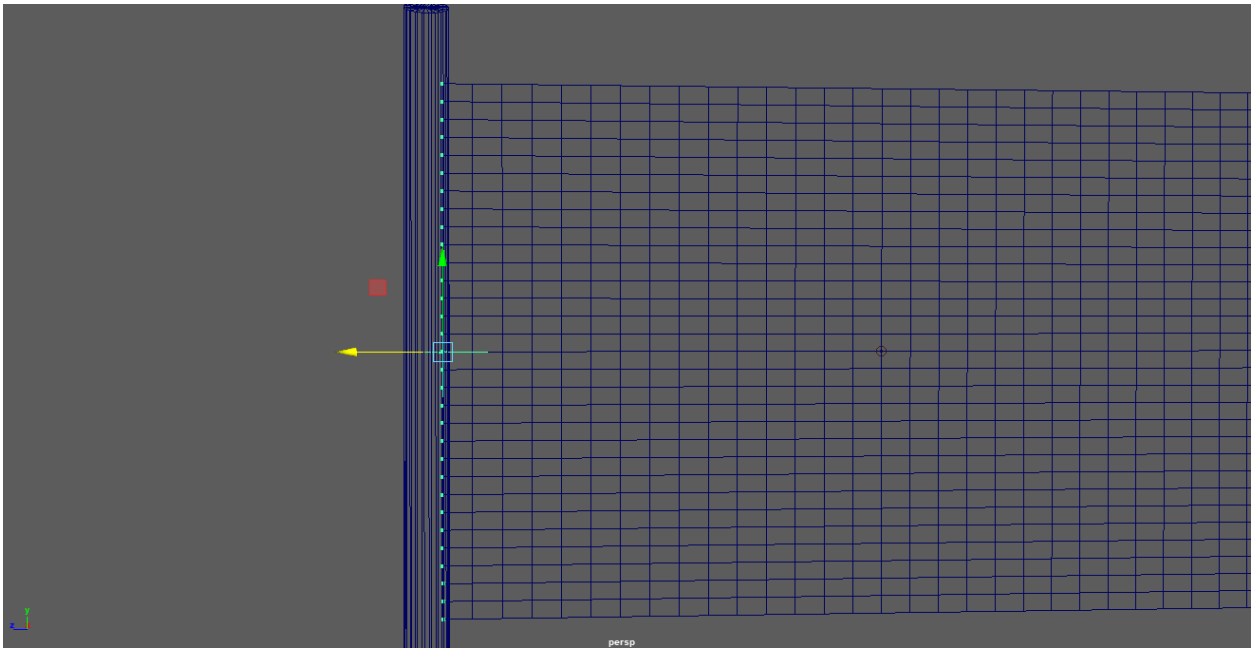

Figure 8 – A cylinder and plane shape is used for the simple flagpole model. The points selected were the edited points.

This fixated these points on the flag, making them stationary at their current location. This made the flag look attached to the pole, otherwise, it would fall to the ground due to gravity. The next step was to adjust the nucleus settings. Under Gravity and Wind, I decreased the Air

Density to 0.700, so I would have bigger ripples in the flag. I increased the Wind Speed to 10.000 because it was the perfect amount to make the flag spread all the way out, which allowed the viewer to see the logo on the flag clearly. The logo was created in Photoshop.

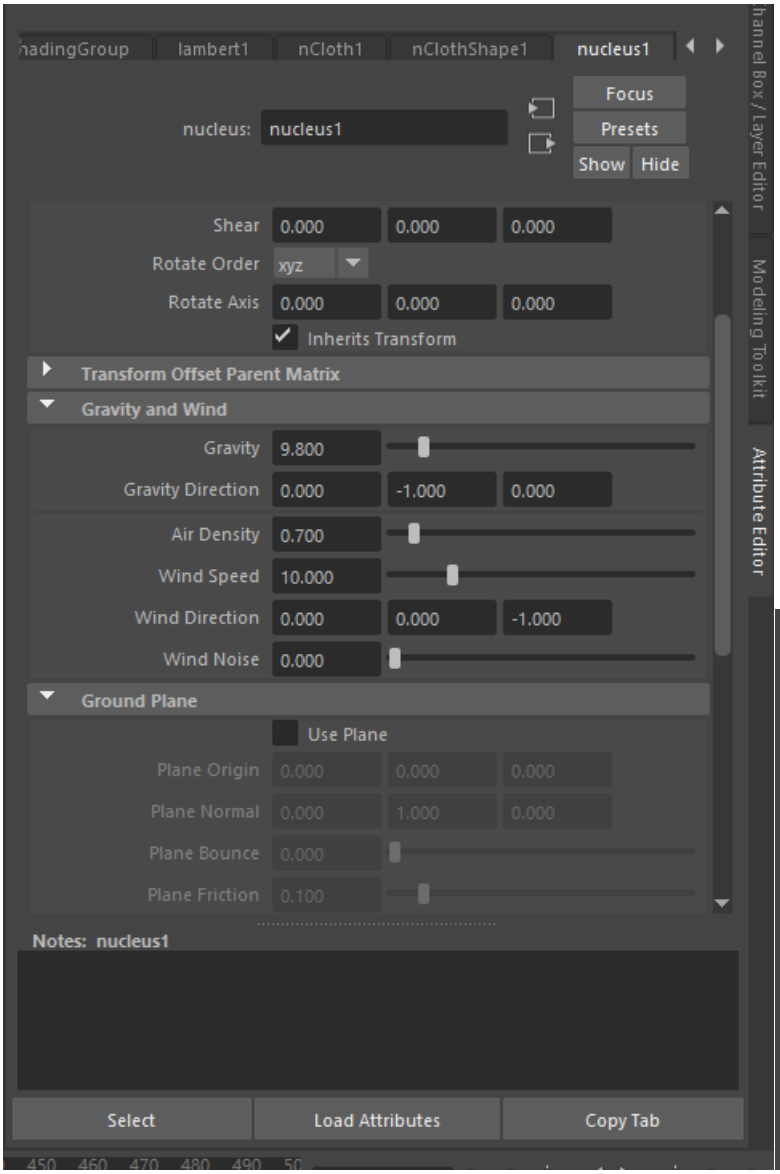

Figure 9 – The nucleus settings.

Figure 10 – The XYZ axis.

The Wind Direction needed to be adjusted. Since my flag was on the z-axis, I needed to change the Wind Direction to -1.000. This made the wind blow to the right, which was the

negative side of the z-axis. A positive 1.000 would make the wind blow to the left. Figure 11 shows the flag I created.

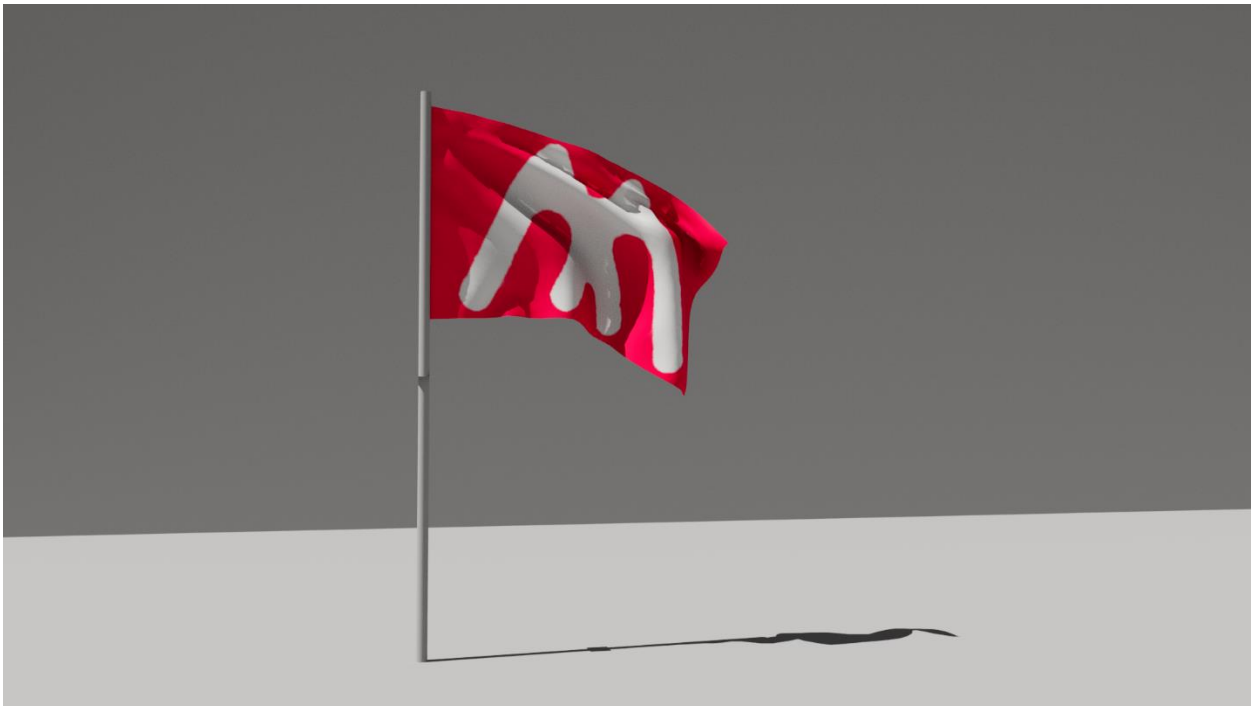

Figure 11 – Flag created in Maya.

Lighting & Rendering

For the lighting, I wanted the scene to feel dark, so I added lighting to resemble dusk. I still wanted to be able to see detail in the trees, so I did not want it to get too dark. I also added some lights inside the windows of the castle to make it look more active. I added in a Physical Sky under the Arnold tab, so I could adjust the lighting to resemble the time at sunset. Under the aiPhysicalSky tab, I adjusted the elevation and azimuth. This adjusted where the sun's position would be located. I added a blue tint to the sky, since it would be near nighttime in the scene, and then made the sun tint yellow. I added an orange-colored light behind the castle to reinforce the

ambient color from the sun that bounced off the castle. For rendering, I rendered the sky image in Maya separate from the land, so they could be put together properly in Nuke.

Compositing

To put everything together, I used Nuke. First, I added the render of the sky by hitting ‘r’ on the keyboard. I navigated to my sky image sequence, every frame that was rendered, and opened it. I connected my image sequence into the viewport in Nuke as seen in Figure 12.

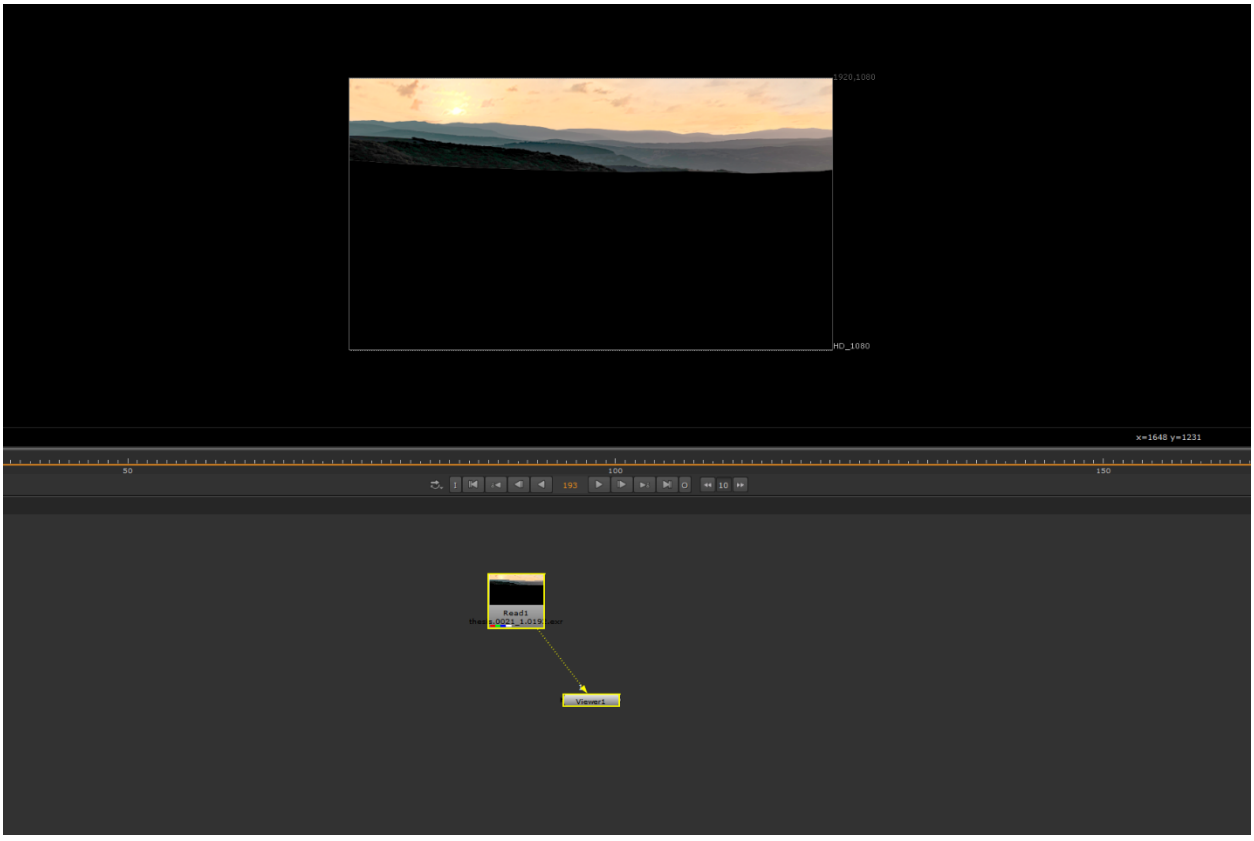

Figure 12 – Sky connected in Nuke.

Next, I repeated this process with the land render. I added a color correct node to adjust the saturation of different parts of the scene. Lastly, I added in a write node to be able to render my scene as shown in Figure 13.

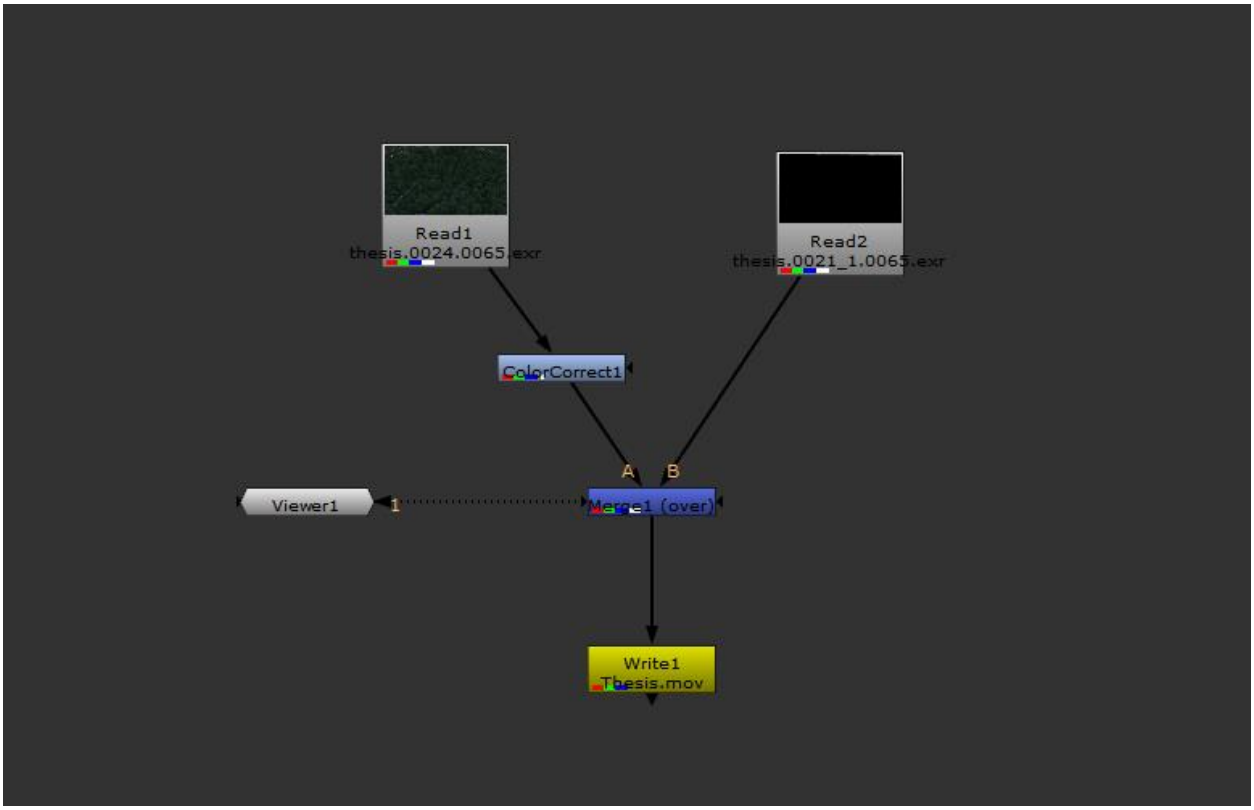

Figure 13 – Set up in Nuke.

Conclusion

Digital Matte Painting is a long process but is very effective in making a film successful by making landscapes, such as the one above, look as if it is a real place on Earth. By doing this project, I got to revisit things I have done before, such as the modeling, the flag animation, and lighting and rendering. However, I did get to experience more of what Maya can do through adding trees with Bifrost, and compositing in Nuke. It was helpful to study and watch other

people's methods and see what I could pull from their expertise. The final project ended up becoming more like a composite; a scene with individual parts put together into a single image. By completing this project, I have improved my knowledge in Digital Matte Painting, and will continue to create more in the future.

To see the final project, navigate to https://www.youtube.com/watch?v=8JOAxphiXw8.

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