Joshua Houser

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Oval Office Case Study

I have recreated the Oval Office as a three-dimensional, interactive environment for the purpose of studying 3D modeling and texturing. My recreation of the Oval Office, which depicts the August 31, 2010 redesign, contains more than 30 unique pieces of furniture which use over 100 texture maps. The final project is designed for the Unreal 3 Engine, and still image renders were created with the Mental Ray renderer from within Autodesk Maya. The software I used to complete this project included Autodesk Maya, Autodesk Mudbox, Adobe Photoshop, Quixel's nDO2, XNormal, and the Unreal Development Kit 3 (UDK) by Epic Games. The Oval Office scene had a final triangle count of 375,649.

Modeling and Texturing Methods and Challenges

I decided to use a "Low-To-High, High-To-Low" modeling workflow for the vast majority of these assets. This approach allowed me to create and retain clean topology and an accurate silhouette early while maintaining high-quality details without excessive polygon counts. When baking a Normal map from a higher-polygon mesh, I also chose to bake an Ambient Occlusion pass. By integrating baked Ambient Occlusion details into my diffuse texture, I could effectively and efficiently add self-shadowing and accurate details to each object.

Modeling Challenges

1. Resolute Desk

After creating the base mesh, I had to determine how to recreate the detailed trim of the Resolute Desk in Mudbox. I first created a stencil from a few of my source images, overlaid the stencil on my sculpting brush, and etched the details into the desk directly. The result of this process was blotchy, and the details were still too low resolution. Instead of using stencils for this process, I elected to recreate the desk by hand, using the source images solely as reference. This method cost fewer polygons and yielded cleaner, crisper results.
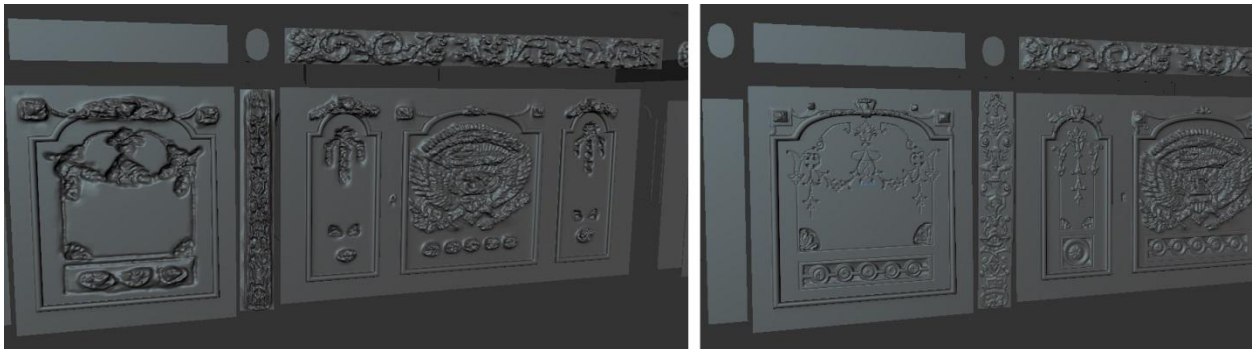

Figure 1: The stencil sculpting method (left) and the by-hand sculpting method (right).

2. Bust of Abraham Lincoln

I decided to create a base mesh of this bust in Maya rather than work from a premade head model because I wanted to define the complicated silhouette of this bust and make the retopology process quicker. Creating my own base mesh allowed me to integrate Lincoln's shirt and collar into the sculpting process with greater ease and control as well as define the very specific, complicated silhouettes of the bust's hair.

Figure 2: Development of the high polygon, sculpted mesh from within Autodesk Mudbox

3. Recreation of Frederic Remington's *Bronco Buster* statuette

The *Bronco Buster* statuette was one of the project's more ambitious recreations. The bronco and rider were created separately, and then the rider was rigged and skinned so that it could be posed on the bronco. The rider was initially modeled in a "T-pose" for easier rigging and allowed me to create half of the rider's body and then mirror that model, cutting my work in half. Since this statuette was so detailed, its UV coordinates were separated into two sheets so that I could use two sets of texture maps for this model. This functionally doubled the model's texture quality and was half as expensive as increasing the model's texture size.
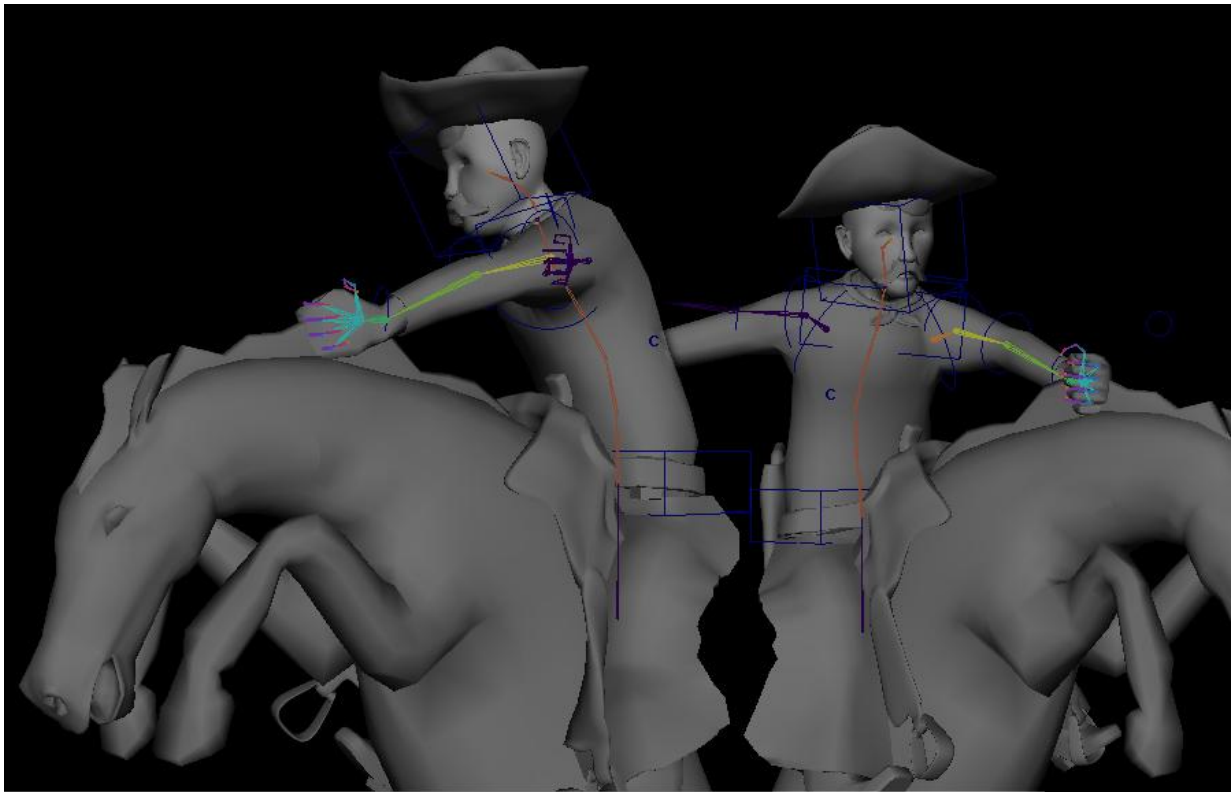
Figure 3: The rider posed on the horse with its skinned skeleton and rig controls visible

4. Oval Office Curtains

The most significant challenge with the curtains was recreating the folds in the cloth and crumpling the bottom of the curtains. I attempted to use Maya nCloth to simulate hanging curtains, but I discovered how difficult it is to control nCloth folds and deformations. I decided to draw the folds by hand as NURBS curves. I duplicated those curves, lofted a NURBS surface between them, and adjusted it so each curtain gradually lost its folds as it approached the floor. After converting the NURBS surfaces into polygonal meshes, I increased the polygon density of the curtain bottoms and imported them into Mudbox. By increasing the polygon density for just this section, I could sculpt the scrunching effect of the curtain bottoms without increasing the entire mesh's polygon count as much. The low-polygon meshes together had less than 3000% of the high version's polygon count and still retained the original silhouette.
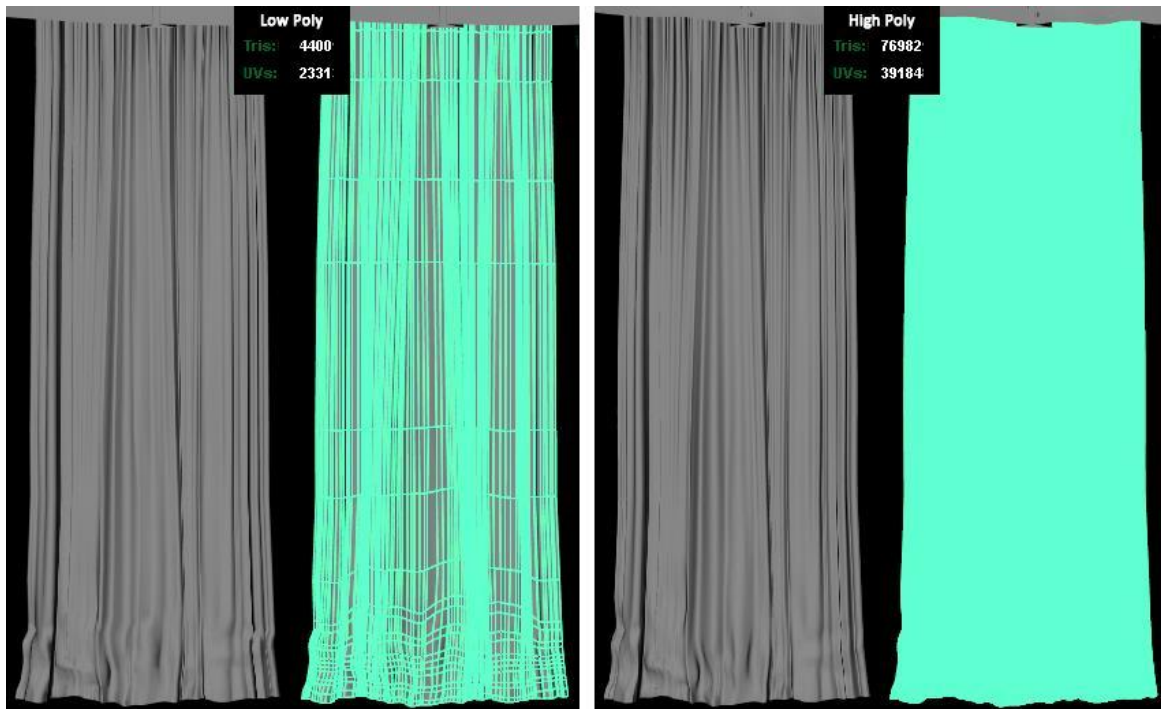
Figure 4: The final, low-polygon curtains (left) and the high-polygon curtains (right).

5. Other Challenges

Because the Oval Office cannot easily be toured, I resorted to using 120 images found on the internet for my source material. I found the dimensions of the office and used them as my starting point, estimating the scale and location of each asset based on my source images. Determining the consistency of asset proportion among images was challenging because the images were taken by various photographers using different cameras, lenses, and focal views that were not specified within the original image files. I accounted for image variance and ensured that my models matched up with as many references as possible.