Digital Matte Painting: Supplemental Material

Supplemental material for the paper "Digital Matte Painting – An Effective Undergraduate Assignment"

Adam Redford and Eike Falk Anderson
National Centre for Computer Animation: Bournemouth University
{aredford@bournemouth.ac.uk}

Figure 1: *A student submission of the "Digital Matte Painting" assignment, showing the original backplate on the left, the final 2D digital matte painting in the middle, and a still frame from the final 3D shot on the right.*

Assessment Brief

You must take a single photograph of your chosen subject (environment or still life) and augment it with 2D matte painted elements taken from extra reference images (either photographed yourself, or otherwise acquired e.g. via the internet), as shown in the workshops. This could include adding things to the image, or removing things from it, it could also include the cleaning up or minor repositioning of elements. This should be achieved in Photoshop or Nuke making use of the tools taught in the workshops, but you are free to use any software tools you see fit.

You must convert the 2D matte painting into a 3D shot using 2.5D projection techniques as shown in the workshops, this must include a camera movement that shows the seamless three dimensionality of the scene. This should be achieved in Nuke or Maya making use of techniques taught in the workshops, but you are free to use any other software tools and techniques you like.

The shot must be between 5 and 20 seconds in length. You are not permitted to create your 2D backplate shot by stitching together other images, it must be one single backplate image that has been augmented as described above. This means you must photograph, or acquire, a single backplate image, add things to it and/or remove things from it, then create your final 3D scene from the resulting augmented image. It should be possible to compare a before and after version of your image to be able to easily see what you have added and/or removed.

You are not permitted to add any textured and rendered assets to the shot that don't exist in the original matte painting, only geometry for projection purposes. For example, you can't add a statue to your scene if it has been modelled, textured, lit, rendered, and composited in. You can add a statue by painting one into your 2D image and projecting it onto dummy geometry.

You should ideally make use of the techniques shown in the workshops to create a seamless polished result, but you are free to use any techniques you wish. The final aesthetic of the piece has to convey photo-realism; therefore, no stylization is allowed.

The students are instructed to submit the following components at the hand-in stage: - A full screen, landscape, high definition (1920 x 1080 resolution) video of the final shot, between 5 and 20 seconds in length and compressed using a suitable video codec. Additionally, a jpeg image file of the original photograph before any manipulation or painting was applied to it, as well as a jpeg image file of the final 2D digital matte painted image. The submission also had to include the Autodesk Maya scene file, containing the dummy geometry and animated camera.

Additional Guidance Given to Students

The students need to be strategic in choosing the initial environment to be photographed for their shot, therefore they are encouraged to choose an environment that does not contain elements that are not considered hard-surface, such as water, fog, or smoke. They are also encouraged to choose an environment that does not contain elements that the viewer would expect to see moving independently, for example trees or long grass waving in the wind. They are also advised to pay close attention to the depth-of-field continuity between the elements in the photograph and any matte painted elements added or removed, as well as the lighting continuity between the elements in the photograph and any matte painted elements added or removed, correct perspective, accurate camera line-up, believable camera movement, realistic parallax, and the quality of image compositing techniques if used.

Exemplar analysis

The overall quality of the student work resulting from this course is generally high, but the project presented below is exceptionally outstanding in its final level of photo-realism, image quality, and aesthetic composition. There are aspects of the final shot where it is difficult to tell what is real and what has been digitally augmented, added, or removed from the initial photographed backplate.

Figure 2: *Before (left) and after (right) the addition of the cobblestone floor sourced from a supplementary image.*

The environment chosen to be photographed for the project presented here (figure 2, left image) contained several elements that needed removing that were particularly challenging. There were some large elements such as trees and bushes that, once removed required large amounts of the background building to be painted back into the image (figure 2, right image). The student also had to source supplementary images, either by photographing them herself or downloading them from freely available online repositories, to use as donor images for the digital reconstruction of elements of the backplate that were either obscured by unwanted aspects of the image (for example

the leaves and bushes) or were absent from the backplate completely (for example the cobblestone floor).

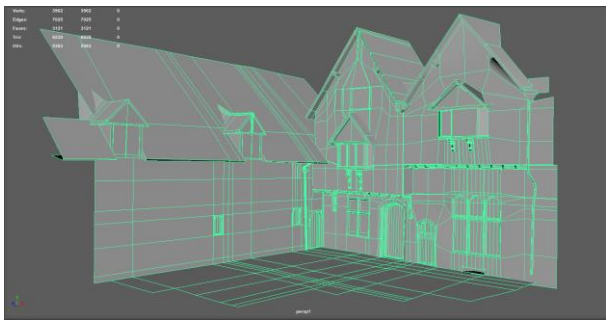

Figure 3: *A shaded wireframe display of the proxy geometry created by the student.*

After the student had completed the process of cleaning up and augmenting the original image, the next step was to model proxy geometry onto which the 2D image could be projected, ready for conversion into a 3D scene. This was accomplished using polygonal modelling techniques in Autodesk Maya, as shown in figure 3.

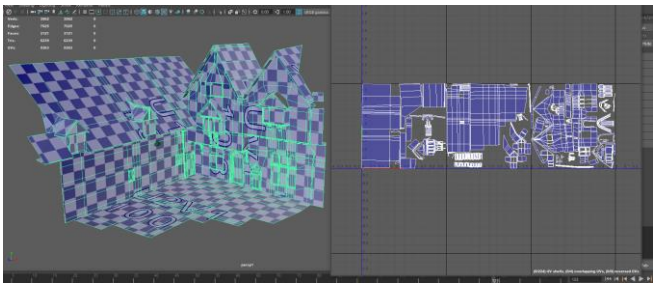

Figure 4: *The unwrapped UV layout of the proxy geometry.*

Once the 3D model of the scene was created, it was then necessary for the student to create a virtual camera in Maya to match the properties of the real-life camera used to take the original photograph. This involved matching the focal length, rotation, and position. Once the virtual camera had been created and lined up with the basic geometry, the student made further refinements to the 3D model in order to increase the detail and improve the accuracy when compared to the photographed scene. The next step was for the student to perform a UV unwrap of the 3D model, as shown in figure 4. This allowed for the projected 2D image to be baked out to texture maps, enabling the final scene to be rendered using a basic shader setup.

Once the modelling, UV unwrapping, and camera line-up had been completed, the student imported the 2D matte painted image and projected it through the camera onto the geometry, before baking it out as a three separate texture maps, based on the UV layout, as shown in figure 5.

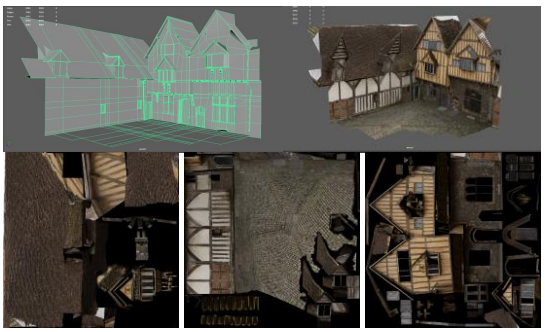

Figure 5: *Proxy geometry, projection, and resultant baked texture maps.*

The student then created a basic animated camera, that moved gently through the scene, with which to render the final shot. The baked texture maps were then exported to a suitable piece of 2D image manipulation software, in this case Adobe Photoshop, where they were manually fixed to remove areas of projection shadowing that were visible when the textured model was viewed though the final animated camera, as shown in figure 6. Once the textures had been cleaned up, the student mapped them back onto the model in Maya, using a simple Maya surface shader, before rendering the final image sequence through the animated camera.

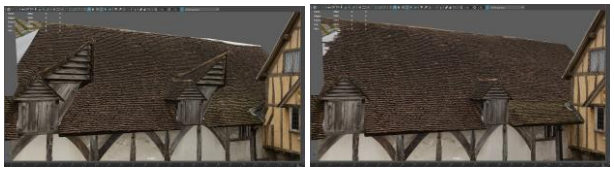

Figure 6: *Before (left) and after (right) the cleanup of projection shadowing.*

As the examples in figure 7 show, students chose a variety of base images upon which to create their final project, ranging from large exterior environment shots, to smaller still life scenes.

Figure 7: *An exterior environment (left), and a small still life (right) scene chosen by students as a base image for their project.*