Exploring the Blending of Ancient and Modern Chinese Culture through a 3D Model

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Abstract. In recent years, the rapid evolution of Three Dimensional (3D) technology has led to the exploration of its broader applications, particularly in the realm of visual representation, making it a new medium for cultural display. This research paper aims to provide a comprehensive description of the entire process involved in creating a 3D art project centered around traditional Chinese culture. The process encompasses various stages such as modeling, texturing, animation, and rendering, all implemented using software tools like Maya and Blender. The chosen model for this project focuses on the theme of Koi fish and salted fish, as they symbolize the fusion of both traditional culture and modern internet language, thereby highlighting the concept of unity. Additionally, the paper presents a logical framework for the overall program and provides clear details of each stage of the creative process. To enhance understanding, visual aids such as images have been incorporated throughout the paper. Overall, this study sheds light on the entire process of creating a 3D art project, encompassing software tools and technical applications.

Keywords: 3D technology, project process, koi fish salted fish, fusion.

1 Introduction

3D modeling technology is a collision between mathematics and computer science. The very beginning mathematics knowledge of the technology can be traced back to the concept of Euclidean 3D space, which was introduced by ancient Greek geometers about 2000 years ago [1]. In the 20th century, computer technology improved and in the 1960s, the first Computer Aided Design systems(CAD) appeared in aerospace industries and some big companies [2]. The system is used for 2 -dimensional engineering drawings. Since the 1980s, CAD has became supportive of 3D modeling as well. At the same time, 3D rendering technology was starting to develop. Between the late 1960s and early 1970s, simple simulation was able to be achieved but special hardware and software are required. But about 20 years later, Pixar's RenderMan and other rendering software appeared, and modeling software like 3D Max and Maya

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encouraged the progress of 3D technology. 3D design technology stepped into commercialization and is being used in media.

Nowadays, 3D technologies have widely permeated into different fields. CAD systems are still frequently used tools in visualizing industry design, scientists are approaching 3D printing organ technology,Virtual teaching and medias are possible to be achieved by 3D technology[3,4]. These signs show that 3D technologies have walked from the shadow of computational tool to public view.

As 3D technology gets mature, new collision happen between 3D and culture. Kung Fu Panda, which is one of the most well known 3D cartoon movie, has a deep Chinese tradition background. The texture of characters closing, buildings and world view designs referenced ancient Chinese's culture and knowledge. Chinese medias also constructed good quality 3D movies, such as Monkey King: Hero Is Back (2016), Ne Zha (2019), which both related to Chinese myth. Before, virtual myth and legends only existed in people's imaginary. Nowadays 3D technology not only make it possible, but also gives people an opportunity to achieve their own imagination and understanding.

This paper will show a 3D program which is a fusion of traditional culture and modern technology. In the program, a traditional Chinese lantern with the theme of fish will be constructed, with rendering process and a final display.

2 Design of the lanterns

We will construct a fish lantern based on different concepts. The design of the lantern is based on two key words. The first word is Koi fish, a type of fish with colorful patterns usually formed by red, yellow, black, or white color blocks. In some Chinese traditional poems, the Koi fishes that jump over the dragon gate will become real dragons [5]. Nowadays internet language also means good fortune. The second word is salted fish, which has the meaning of being an ordinary person or losing the will to do anything in the Chinese internet language [6].

The lantern was based on a reference image (Figure 1), which is a koi fish lantern. The lantern model will be more detailed and complicated than the first one, to differentiate salted fish from koi fish. The texture will mainly be gold and red to match with Koi fish. This topic will be talked about in the texture section.

Figure 1. Koi fish lantern reference [7]

3 Modeling of the koi fish lantern

The koi fish lantern model is constructed by modeling software Blender and Maya. Blender is an open-source software with comprehensive functions and high accessibility [8]. The software is capable of modeling, sculpturing, animation, rendering, and so on. As a software that can support the majority pipeline of a project, no matter a 3D animation or a game design project, blender is highly suitable for individual small studios.

Maya is another 3D software, which is professional and widely used in media industries. This software can handle creating realistic characters, complicated modeling processes, and realistic effects. Well-known movies such as Ice Age (2002) and Spider-man (2002) are made by Maya.

3.1 Process by parts

Starting the process, it is decided that the model's part will be constructed separately with different geometry, then eventually combined together in the render as a whole lantern then its accessories will be constructed separately. After the modeling process is completed the combined model will be exported for 2- dimensional texture (We will call it UV, where the letters "U" and "V" denote the axes of the 2-dimentional texture) layout and rendering.

Fish head. The general modeling steps of the head part is, first, laying out the points which can describe the fish head structure. Use the three dimensional views of the object to construct an outline. Then, fill up the structure with grids. Finally, add thickness to the surface, so the fish head becomes a solid object. The process requires the editor to be sensitive to three-dimensional space, meanwhile familiar with the use of modifiers [9].

In the first part, we constructed an outline of the fish head based on the features of a koi fish. Using the three-dimensional views of a koi fish, we drew the shape of the head from top, side, and front directions (Figure 2). To make the fish head symmetrical, we used a modifier called Mirror in blender, this will copy the points from one side and paste them on the other side.

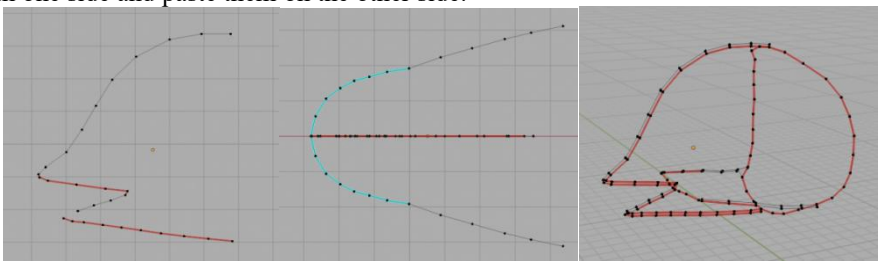

Figure 2. Outline points process (Original)

In the second part, we built the surface of the fish head. This can be simply done by extending points from the outline. To make the points smooth and tidy, after filling up the surface, we swapped to sculpturing mode and use the smooth brush to tidy the points (Figure 3).

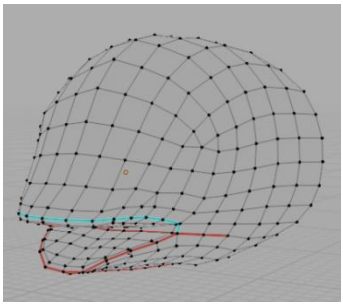

Figure 3. Surface construction (Original)

The third part can be done by a modifier called Solidify. Applying solidify modifier on the fish model will give it thickness, so the head part is a solid object instead of a plane. Since it is a part of the lantern, the surface should be thin enough, so we chose 0.08 units as the modifier parameter (Figure 4).

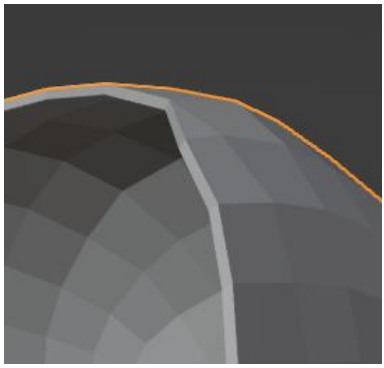

Figure 4. Model with thickness (Original)

The Fish Body part. The fish body was divided into two parts.

The anterior part of the body is based on a cylinder. First, import the reference picture and adjust its position to make it easily observed and not in the way of modeling. Create a cylinder and adjust its position and size using the reference picture as standard and during the process, open the front view for easy comparison. In order to simulate the real fish's body, the loop near the cylinder's center was stretched to simulate the fish's belly. The top and bottom surfaces were squeezed and rotated. Then to make a smoother surface, we chose the loop we just stretched and applied Chamfer. Since what we wanted was a fish lantern, the lantern needed to be hollow. So the basal planes were deleted and the rest part was extruded.

The anterior part of the fish body is connected to the dorsal fin and the pelvic fin of the fish (Figure 5). To create these two parts, we used the Create Polygon tool and did a tracing of the counterpart of the reference picture [10].

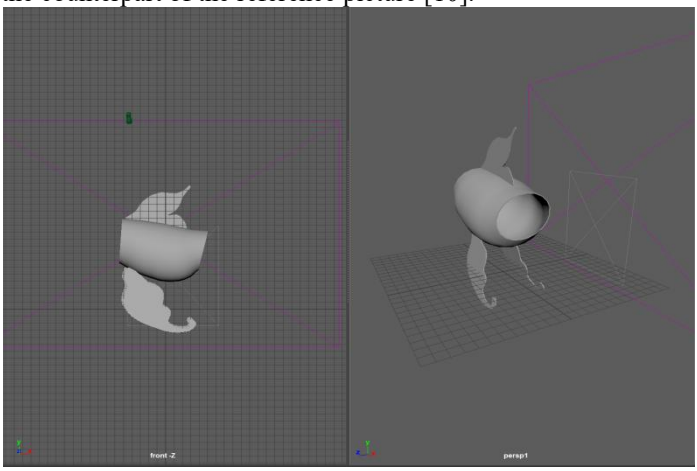

Figure 5. Fish body (Original)

The latter part of the fish body is connected with the tail fin. The modeling in this part is basically the same as in the previous part. A cylinder was created and adjusted to coincide with the reference picture. The top face of the cylinder was adjusted to fit the bottom face of the anterior part. The bottom face of the cylinder was adjusted to simulate the upturned fishtail. To make the body lifelike, the Insert Edge Loop Tool was used in the middle of the cylinder and Chamfer was applied to the loop (Figure 6).

The tail fin was created the same way as the other fins were created.

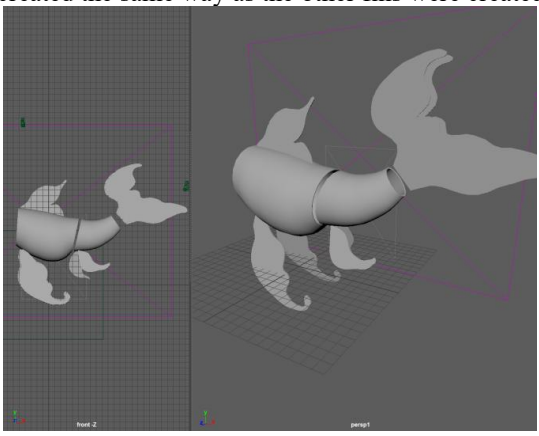

Figure 6. Fish tail (Original)

The Fringe Decoration part. The fringe decoration of the fish lantern is a fringe pendant. This pendant is made up of the cord, the beads, the fringe, and a decoration that connects the cord and the fringe.

The curve tool was used to create the cord and the fringe. First, use the CV curve tool to draw an arc to simulate the shape of the cord.Create a cylinder with the axis division an 8, and delete its other faces except the top face. To better simulate the rope, quadruple the top face and overlap them to present the following effect (Figure 7). Select both the top faces of the cylinder and the arc just drawn, extrude them, and set the divisions 50. The orientation of the top face should be noted, the front must face the arc.

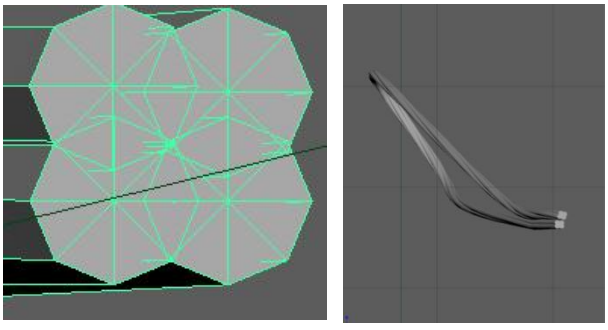

Figure 7. Cross section and Rope overview (Original)

A thread of fringe was created in the similar way except it's thinner. One thread got duplicated 16 times and combined to formed a bundle of thread. The bundle was duplicated 18 times to make a fringe.

The beads strung on the cord were made of a sphere and three torus, their size, angle and position were adjusted to fit the string. The decoration that connects the cord and the fringe was made based on a cylinder. First, a cylinder was created and the bottom face of it was stretched to make it a circular truncated cone. To make it more decorative, 5 edge loops was added to make it easier to adjust. The faces were divided into 6 parts from top to bottom. The second part of the faces were extruded inwards and the fourth and the sixth parts were extruded outwards. Then we applied Chamfer on every edge to smooth the surface. The Figure 8 shows whole fringe decoration.

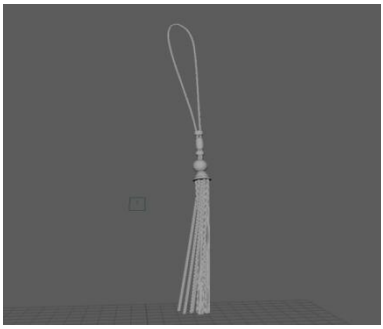

Figure 8. Whole fringe decoration (Original)

Holding the lantern. This modeling part was done by blender.

We want the fish lantern to be hold by a string and a stick. The string can be easily modeled by cylinders, so we focus on the holding stick more.

In Chinese traditional culture, clouds patterns have the meaning of auspicious and good luck, so they match the meaning behind koi fishes. We designed the stick's shape based on clouds patterns (Figure 9). Again, use Mirror modifier to ensure the stick is symmetrical. At the end, apply a modifier called Subdivision Surface, this modifier add extra points into your model, which automatically refine the object shape (Figure 9, last image).

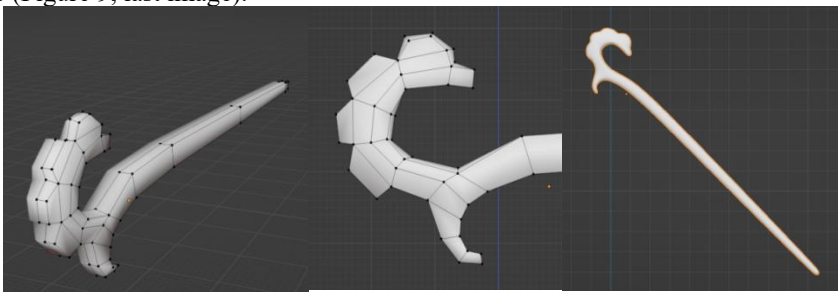

Figure 9. Holder (Original)

Then, simply add the string and a ring holding the string to finish this part (Figure 10).

Figure 10. the Final effect of Holder (Original)

Now we can combine all the separate parts of the lantern together to get the overview (Figure 11).

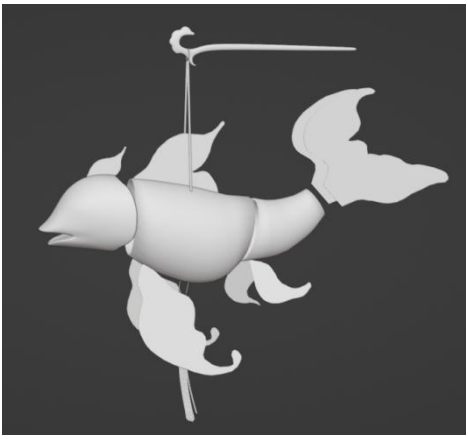

Figure 11. Model overview (Original)

4 Texturing

4.1 Conceptualizing the Texture

The focus on the conceptualization of the Model's textures, based on the first iteration of the lantern's conceptual designs, it was decided that the main body of the lantern would be textured using red as the main color and preferably having roughness and normal mapping that could reflect the materials of the lanterns as rough paper. The decorations would be made to be smoother and reflecting to give out a form of gold or brass foiled decorations.

4.2 Texture creations

The texture creation process is mainly done with the use of Substance sampler, using texture photos from the internet as main source for creating textures. The main process of converting images into texture materials are done by an AI powered function [11].

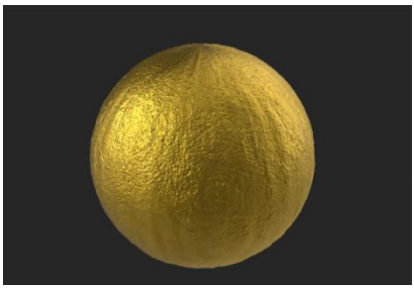

Figure 12. Texture creation (Original)

The process involves porting the texture photo into the software and then going through a process of adjusting displacement and ambient Occlusion of the texture to receive the intended look of the texture (Figure 12). Then, tiling and smoothing were Applied to the texture so as not to reveal obvious edges on the texture image by creating seamless connections between the texture image and itself so that the texture looks like a uniform texture without easily observed patterns [11].

4.3 Texture Making

After the Model had been completed, the Model was imported into Maya for UV layouts. The Model was cut through lines on the models to create a flat image that covers all faces of the Model so they can be painted properly with the intended color and patterns in Substance Painter. Depending on the texturing needs, some UV shells can be overlapped to save time from painting repeated texture patterns. After the UV has been laid out, the Model is exported as Wavefront OBJect(obj) files to be painted in Substance Painter.

Upon finishing the textures material and the mapping of the textures, they are directly sent to Substance Painter as paintable materials, where the textures are painted onto the imported Model's laid out UV with the brush tools. After the process of painting textures onto the models are finished, the painted Model are exported as obj files, and their different painted texture mappings are exported as Portable Network Graphic (PNG) files.

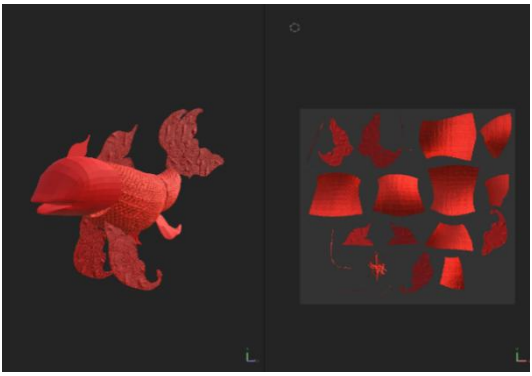

Figure 13. Texture painting (Original)

After the texture painting and exporting process, the Model was re-imported into Maya for the rendering and animating process, but texture mapping must be applied first onto the Model (Figure 13). To apply the textures of the Model, a new material must be assigned to each of the models and within which PNG mappings for Base Colour, Roughness, Metallic, and Normal Mapping are applied to the material. Then, the material is applied to the Model for rendering.

After the Model has been imported into the Maya scene and materials applied, A plain is put into the scene, extruding one side of the Model, then beveling the edges for a better background image for the scene when rendering (Figure 14). To properly have a rendered image, lighting must be present to show the rendered image, or else the scene will be black. As such, a Directional light and an ambient light are applied to the scene.

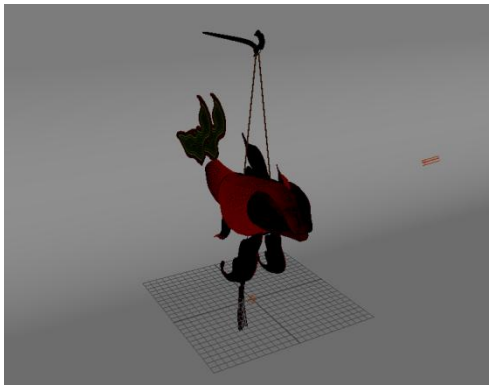

Figure 14. Model with no lighting (Original)

5 Animating and Rendering

After the light has been applied to the scene, the animating process begins. To animate the Models in the scene, keyframes are set up in the frame's times line by

changing the rotation of the textured Model in each keyframe to have the rotation effect. The Model will slowly move into the position of the next keyframe, intern creating a rotating animation that can show the Model in different faces without moving the lighting of the scene. The animation is set to 30 frames per second and the model will complete it's rotation every 5 seconds.

The Rendering process begins simply by confirming the beginning of the rendering process. Due to the length the of the video, the rendering of each frame takes quite an amount of time. Then, the images are put into Adobe Media encoder to connect each frame to a video, and thus, a rendering demonstration was completed (Figure 15).

Figure 15. Rendering display (Original)

6 Past difficulties and Limitations

Though the process is completed successfully, it is obvious that there are many unexpected difficulties throughout the process, one of the main issues was that during the first iteration of the model, the combined fish lantern's head was missing its UV layout, same was for the handle of the lantern. There was also the issue which the first iteration of the model has many Ngons (which means surfaces that has a side more than 4) which could complicate the rendering and shading processing during renders, though the Ngon problem was fixed it would be more productive should that the problem is avoided in the first place.

There are also some limitations regarding the modeling process to UV processing transition, mainly that blender and maya are two different model and animating software. Switching between the two has caused some complications when blender models are being put into Maya for UV processing mainly that unless explicitly cut beforehand there are chances that some object simply does not has any UV, so it should be noted that during export process it is at least more productive to at least but up a basic UV layout before hand.

7 Conclusion

In this paper the process from modeling the lantern to creating rendered animation was explained in detail together with how the modeling and texturing process of a

model is done. The Process, though with many mid-process fixes, is completed with not many compromises. The result achieves a high completeness and the goal of blending ancient and modern culture. The design of model and texture of the project, even though based on a reference, shows creation and novelty. In general, this project is successful.

However, it can be pointed out that the modeling and texturing of the model is not to a high industrial standard that there are many additional processes and artistic improvements that can be made. Looking ahead to the future, with continuous technological advancements, 3D technology will have a broader application prospect in cultural display and creative fields. The modeling and texturing process will become more efficient and precise, allowing for better presentation of details and textures.

In terms of blending ancient and modern culture, further possibilities can be explored through deeper research and creativity. By introducing more elements and concepts, we can create more imaginative and unique 3D projects, realizing the diversity and integration of cultures. Furthermore, with hardware improvements and enhanced computational power, the quality of rendering and animation will continue to improve, resulting in more realistic and outstanding visual effects. Emphasizing artistic and innovative elements, finer material and lighting treatments, as well as smooth animation and expressive movements, will provide viewers with more immersive and awe-inspiring experiences.

Authors Contribution

All the authors contributed equally and their names were listed in alphabetical order.

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