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"The Elephant's Year"-3D Animation

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My faith of Islam and the Holy Qur’an guides my design creativity. I like to teach others about my faith, and I found 3D animation is a great way for that. The Holy Qur’an is full of lessons, wisdoms, scientific facts, advising historical stories, future predictions, social solutions, etc. The Holy Qur’an asks people to believe in God and the Prophet Mohammed. I chose a story from the Holy Qur’an that talks about the Holy Kaaba, which was the first religion place for God.

This story has a lot of wisdom for people, such as not misusing power. 3D animation brings viewers more into the story than any other medium except real life. It has proven to be excellent in storytelling because it engages and teaches in a way that makes the viewer want to learn more. It is not easy to challenge yourself, especially if you think that you might not achieve your goal in a short period of time. I had two years to complete the Master of Fine Arts (MFA), Computer Graphics, which is generally a three-year program. Since I always enjoy a challenge, I chose to work in 3D design, and I selected difficult software to learn and use in my projects. The software is Autodesk Maya. For the MFA, I wanted to design either a video game or an animation. I went toward animation, and I chose a story that has many characters to design and animate. The story is from the Holy Qur’an, and it is known as “The Elephant’s Year” and “The Elephant’s Owners.” This story expresses the idea that weapons cannot make peace, and governments can’t force people to change their beliefs. This is an idea with which I agree. Indeed, I used other software programs such as Photoshop, After Effects, and Final Cut Pro to present the story. I challenged the story’s characters, Maya software, and the other software, and I achieved my goal in a short period of time.

The story of “The Elephant’s Year”

It is important to know what is going on in the story to create the right characters and environments that are appropriate to the story and make it real. Even though the story is from the
Holy Qur'an, it happened before Islam and before The Prophet Mohammed was born. The story took place in the Arabian Peninsula in Makah (Mecca) city around the year of 2000B.C. God (Allah) told The Old Testament Prophet Abraham to build The Kaaba, which is the house of God. God gave an order to Abraham to ask people to do their pilgrimages in Mecca and walk seven times around The Holy Kaaba. However, at that time there was nothing in this place except sand and rocks. So, The Prophet Abraham asked God to provide a livelihood for people who would live there and protect them with the Holy Kaaba.

Before the year 569- AD, Arabic people who had different religions visited Mecca to do their pilgrimages around The Holy Kaaba. At that time, people’s religions were Christianity, Judaism, and Abraham’s religion. However, The majority of people worshipped idols. Mecca was important to all Arabs for both worship and business.

In Yemen, in the south Arabian Peninsula, Abraha came from Ethiopia to be Yemen’s Aksumite Christian representative of the royal government. Soon he appointed himself king of Yemen. When he heard how famous Mecca was because of the Holy Kaaba, Abraha built a church, called it Quilise, and asked people worship there instead of at the Holy Kaaba. However, no one went to his Quilise, so he decided to destroy the Holy Kaaba to force people to go to the Quilise. Abraha’s army included 60,000 warriors and between nine and thirteen elephants. He gathered this huge army to make sure that he would destroy the Holy Kaaba.

On Abraha’s way to Mecca, Arab people gathered to face the army, but they did not succeed. There were some battles between them. When the army arrived at Mecca, the biggest elephant refused to destroy the Holy Kaaba. God (Allah) sent huge groups of birds with stones in their legs
and beaks, and they dropped the stones to conquer the army. Later, in the same year, the Prophet Mohammed was born, and after forty years, God sent him to the Arabs. Also, the Holy Kaaba became the direction that Muslims prayed. Now, millions of Muslims visit the Holy Kaaba every year.

The Challenge of The Story

For me, the challenge was that I had to model the Holy Kaaba as it looked in the year 596 -570 AD and in the present. Also, I modeled the African king and two different warriors for the African army and Arab fighters. Indeed, I made a giant warrior for the African’s army. Then, I created horses, elephants, and birds. The challenge of the story came with the number of characters that I had to model and animate. As I modeled more characters, I gained more experience because each character needed different techniques. Each character has a different shape, size, skeleton, and motion. Also, the time that I took to create, apply texture, make a skeleton, connect the character with the skeleton to control the character’s body, and animate the character was much less in the
The last character I made, which was the “Bird,” than the first character that I made, which was the “African Warrior.” Also, if I would like to remodel the same character, I will remodel it more quickly because I learned from the previous model. For example, in the elephant’s character, I found that when the legs moved, big stomach areas moved. So, in the next elephant’s model that I would like to create, I will add extra parts between the legs and stomach that connect them and move with the legs instead of the stomach parts.

The challenge of Maya software

Maya is a software produced by Autodesk, which is used for 3D modeling, 3D animation, rendering, visual effects, “matchmoving”, simulation, and “compositing.” “Matchmoving” is a visual-effects technique that moves the graphics into live-action footage with correct orientation, position, scale, and motion. “Compositing” is combining visual elements from separate sources into single images. Maya software allows its users to make 3D animations and 3D video games. Also, designers, who know the basic levels in the program, and advanced designers can produce good films at their different levels. Basic users can make children’s films of high quality, while advanced designers can create movies with good dynamic effects.

To model objects, characters, buildings, and other things, I go to the “Polygon” window in Maya software. This window allows me to create “NURBS primitives,” “polygon primitives,” “subdiv
primitives," curves, lights, cameras, and texts, and make changes in them to create a scene. "NURBS primitives" means non-uniform rational basis spline, and is used to generate and represent curves and surfaces, which offers great flexibility and precision for handling both analytic and freeform shapes. "Subdiv primitives" creates a subdivision surface that represents a smooth surface. In modeling my characters, I always start with one of the "polygon primitives": sphere, cube, cylinder, cone, plane, or torus. By modifying edges, vertexes, and faces in each polygon, I model my objects. The software allows me to move, rotate, scale, add, remove, or merge the edges, vertexes, faces, and the whole polygon to achieve the final shapes of the objects. Maya offers four view windows that help users to see the object at different angles: top, front, side, and perspective. Also, I have the ability to combine two or more polygons into one polygon. For example, I started with "polygon sphere" to model my horse’s body. Then I created another sphere and modeled and positioned it for the left leg. After that I duplicated the leg and mirrored it then positioned it to be the right leg. To combine any two polygons, I deleted their faces, through which they should connect. Then, I merged their edges one by one. So, by combining polygons that were for legs, arms, and head, I modeled the horse. After that, I smoothed it. "Smooth" in Maya means adding more faces to the polygon, so the shape looks more round.
Wireframe of image map of the king.

Colored image map of the king.

The king after being textured.

Different horse textures.

The horse before texturing.
and has no hard edges.

Texture in Maya

Maya allows users to give an object colors from the Maya library or import an image as texture for an object. The Maya library has effects that can be used as texture to make an object's colors look real. There are two ways to apply color and texture: Blinn and Lambert. Blinn is for shiny reflected objects like plastic, glass, silver, gold etc., and Lambert is for non-shiny objects like clothes, skins, walls, woods, etc. Also, users are able to put more effects into Blinn and Lambert to be realistic. Indeed, there is an option to make 2D images for the 3D objects that show all colored faces, then use the image map to color and put real pictures in the images in Photoshop, which allows me to paint more than one texture for the same image map.

In the "Rendering" window, there is an option called "paint effects" that allows users to add paint objects in 3D effects, and it builds 3D objects as painting. Some 3D paintings have motion in them like fire, cloud, explosion, ocean, and plants. However, some 3D paintings do not have motion, like stars, hair, glass, etc. Using “paint effects” gives designers great opportunity to shoot effective scenes.

To make realistic characters I explored the "Dynamics" window, which offers ways to give the characters real hair, clothes, muscles, and skin or fur. Also, it gives them realistic motion to characters' movements, air; and gravitation. Indeed, in the “Dynamics” window there are options to create air, fire, lightning, shatter, water's flow, and water in an ocean or pond. There are more realistic dynamic options to add to objects that control the objects like drag, gravity, Newton, radial, turbulence, uniform, and vortex. Skilled use of all these dynamic effects lead to technically good movies.

Challenge in Animating the Characters

The important and difficult part of making a movie is letting characters move realistically. So, Maya offers the “Animation” window to help users succeed in their animations. In this window,
users are able to build skeletons for any character, even if this character does not have bones in real life. The skeleton is a group of joints. These joints are connected with each other as child and parent. The first joint is a parent, and the next joint is a child of the first joint and a parent of the third joint if connected with the second joint. For example, the first joint is the hip for the character, the second joint is the left hip, the third joint is the left knee, the fourth joint is the left heel, and the fifth joint is the left toe. Any move, scale, or rotate for the parent joint affects the "child" joints. So, the hip controls the left hip and the right hip, and the left hip and the right hip control the left and right knee, etc.

After building a skeleton for the character, I had to rig the skeleton. Rigging a character is assigning the right amount of rotation and movement for each direction X, Y, and Z in the joints, and creating locators that control the skeleton in easy ways. Users can use "Set Driven Key" to build connection between more than two objects, and let one object control the other object. For example, users can set a sphere to control the character's hand. If the sphere is rotated in X direction, the hand should be rotate in X direction, and if the sphere is moved in Z direction, the fingers should make a fist. Each character should have different rigging depending on what the character does. For example, children do not walk as adults walk, and the way that men walk is different than the way that women walk. Also, each animal has different rigging because of its different motion. To rig my characters I had to study their skeletons and motions and watch them at different angles in different
activities. To have the character react to the skeleton action, I had to connect the character's body to the skeleton. In the "Animation" window, there are two options to connect them: "Smooth Bind" and "Rigid Bind" to connect some parts of the body to individual joints. "Smooth Bind" connects the whole body with the whole skeleton, and the system assigns, from the character's body, "skin weight" for each joint of the skeleton. Each joint controls some parts of the character's body (skin). The Maya system divides the character's skin between the skeleton's joints. Sometimes, the system involves more than one joint in the same part of skin. That, in some cases, affects realistic motion. For example, the elbow joint affects part of the stomach. When the arm moves, the stomach part moves with it. So, I had to reassign "skin weight" to give each joint its right skin weight. Assigning "skin weight" took a great deal of my time, and I had a difficult time fixing such problems. Sometimes, I had to add extra joints to the skeleton, so they took care of skin parts that were affected by joints that should not affect these parts. For example, in the horse's character, when I rotated the horse's shoulder a big part of the horse's chest moved with the arm because the closest joints to the chest were the shoulders' joints. So, I added joints for the chest, and that took care of this problem.

After I added "Smooth Bind" to the character, the character was connected to the skeleton, and the character moved correctly. However, I had to connect the helmet to the head, so it moves with the head. I did this by "parenting" the helmet to the head joint. Also, I did the same for the sword, shield, armor, and gloves etc. Indeed, for the warrior to move when the horse moved, I had to "parent" the warrior skeleton's hip joint to the horse's hip joint.

Challenge in Animation

At this point, I had modeled, textured, smoothed bind, and rigged characters: "The King," "African Warrior," "Arabian Warrior," "African Giant Warrior," "Horse," "Elephant," and "Bird." I rigged three models for both of the "African Warrior" and the "Arabian Warrior": the fighter, the archer, and the spearman. Then, I built motions for each character and saved them in different files. Then, I imported each character into a new file and recorded its motion in the "time line." The "time line's" frames were different due to the scenes' length.
Two groups of the army are ready for rendering after saving their locations.

After that, I imported the characters which were for the same scene into a file, and I positioned them. For example, I imported walking elephants, walking horses, and walking warriors for the army-walking scene. However, importing too many characters into one scene loads too much data, and that makes it difficult to control, render, and even open the file. So, I had to clean unused data like repeated colors and textured images, and I cleaned the characters' unused data by "Delete by History" and "Delete by Non-Deform History." I had to reduce the characters' geometries. Reducing the geometries took some of the characters' quality. To solve loading data problems, I had to divide the scene into different files after assigning a location for each group.

**Challenge in Rendering**

Rendering is converting Maya's files format, which can be read only by Maya, to formats that can be read by different programs. To render, I had to create lights and set light balances to fit in the scenes timing to complete them. Maya offers different types of lights that are used for different purposes. Also, I had to create cameras to shoot the scenes. I used the same environment: sky, ground, lights, and cameras in the different files that were for the same scene. However, since my characters are in real sizes, the army needed a big area. And when I rendered the scene, the camera's result was black images. So, to solve this problem I had to create a "Stereo Camera" that is
used to create 3D motion blur and uses two cameras: left and right. However, I rendered only the left camera of the "Stereo Camera" to save time and effort.

To render, I had to choose a format from the different formats that Maya offers for images and movies for my scene. Also, there are options to select the cameras that I wanted to render. I used two computers to render one scene that was fifteen seconds and it took more than three or four days even when I divided the scene into five files because each file had five cameras. Each file had a group of the army in a different position.

After rendering the scene files, I took the rendering files to Adobe After Effects to combine them in one scene. Then, I took the scenes to Final Cut to edit them, add texts and sounds, and export them in DVD format.

Conclusion

In conclusion, I loved working in Maya software, and I took thirteen months to learn it and do my project, which itself took me three months. Maya is a great program that models 3D objects, animates 3D characters, renders, adds visual effects, and more. Also, I found that making a movie requires teamwork, and the expert in Maya must be an expert in photography, architecture, video making, math, anatomy, 3D designs, and graphic design software. I explored Maya’s different great sub-programs, but I feel that I did not learn everything about them. Maya offers tools to do effects that you cannot imagine. It is like the ocean and everyone could take something from it. The skilled users could get treasures, and children could have fun in the water. I am pleased with my work, but I did not do what I would like to do because of limited time. Indeed, I challenged myself in the time I had, with Maya’s functions, and the story’s characters. By working in these characters I gained experience that leads me to become an expert in Maya. Indeed, I will continue working with Maya in future study and work, and I will add more effects to "the Elephant’s Year" story and become a professional in Maya.
Images from the film.