The Good Stuff

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Abstract

This report describes our animation project for 6.837. We created a cartoon animation about a couple of rednecks watching mosquitoes. We addressed several issues including character design and animation, camera location, and lighting effects.

Introduction

In this 6.837 project we produced an animation in which we modeled three-dimensional objects and characters and animated them through our scene. The most interesting piece of this project was the fact that we used characters of very different sizes and needed to explore how to capture all of them with the appropriate visibility.

Our animation takes place one evening with two redneck men sitting on a front porch during a sunset, drinking beer and other alcoholic beverages. Mosquitoes bite Jed, the larger guy, and become drunk from the massive quantity of alcohol in the blood that they just sucked from him. One by one they fly into the bug zapper. The rednecks keep drinking more and more until the last mosquitoes have been so filled with alcohol from Jed's blood that when they fly into the bug zapper, the whole house explodes.

At this point, we still have to do some rendering , composition of our animation from the rendered scenes, and overlay the soundtrack and voices on the animated scene. We have worked out most of our animation issues at this point, but some might still come up during the final few days. We explain how we expect these items to work out.

Goals

Our fundamental goal was to create a humorous animation about two rednecks drinking and the mosquitoes flying around them. In order to accomplish this well, we intended to include certain effects.

We wanted to create cartoonish but plausible objects and characters that would be used throughout our animation. Our objects had to be fit to the appropriate scale for the scene and to each other. We aimed to model our rednecks so that they could be easily animated and incorporated in the scene later in the process.

Another issue was the lighting of our entire scene. The animation takes place at dusk, so we needed to create a realistic sunset with the correct lighting for that time of day. We also needed to consider the light from the bug zapper and a light source that could serve as an ambient light once the sun was down.

One of our main goals was to frame the mosquitoes properly so that they would be very noticeable in the scenes. We needed to create them with appropriate sizes and colors so that they would show up well against various backgrounds in our scene. We also had to carefully consider camera angle and placement for the scenes in which the mosquitos were focal, and manipulate the cameras appropriately through the scene.

Achievements

There were several divisions of work for this animation. We first modeled the objects in our scenes: the house, the characters, and other objects such as a truck and a beer can. Next we had to get the lighting correct for each scene; this was especially important since we were modeling the sun setting. We then had our animations to consider. There were several types of animation that we used. We had the cameras following certain objects in the scene or zooming into various areas of the scene. We had the human characters and the mosquitoes to animate also. Finally, we animated the house exploding into a large fire. Our approach to the whole project was very much a bottom-up approach: we created all of the items separately, then created all of the motions and lighting we could in the more simple items (e.g. mosquito wings flapping, chairs rocking, etc.), and finally merged items into the overall scene.

Construction of house

The house was constructed through extrusion of curves to generate the outer shells. Later inner spaces were created by boolean subtraction of similar but smaller volumes from the outer shells. Windows and doors were placed into position after additional subtraction of volumes from the outer shell. The outhouse was created similarly but without windows.

Particular issues involved choosing the right material for wooden house texture to show that the characters were rednecks. The map selected was adjusted so that it could tile without revealing the joints. The door to the house was rendered with a texture to make it look rusted.

Construction of other objects

We had quite a few smaller objects in our scene such as the truck, the bug zapper, and bottles. Many of these were quite simple to model.

The truck was made using many box shaped pieces for the outside. Curves were extruded to create the bumpers at each end. The windows are transparent and tinted to a shade of purple. The truck (which has no wheels) is sitting on four cinder blocks in true redneck style. The cinder blocks were created with multiple curves joined together and extruded to give them depth.

The bug zapper was created with cubes and cylinders. The cylinder was given a color and a glow. We created two different glows so the element could light up even more when a bug hit it. The wire cage around the cylinder used a transparency map with a grid pattern. The cubes had to be tapered for the angles along the top, the base, and the wire cage. The taper is a warp around the cubes. We ran into the problem that when we scaled the whole zapper together, the warped objects would not scale properly. We finally found that we had to scale the warp effect factor by the same factor in a separate property box.

There were several other small objects we had to model in the scene. They included the cap with the John Deere logo on our characters' head, the beer can, and the liquor bottle and jug. The shapes of these were quite simple. The bottle and jug merely involved revolving a curve, while the cap was half a sphere plus a curve extruded for the brim. The interesting piece of modeling these was the placement of the logos the we needed for he cap, the can, and the jug . We borrowed or created these logos and used the shader editor to place them as projections on our surfaces. We used a single planar projection for most of these, but we used a cylindrical projection with several repetitions for the Budweiser logo around the beer can.

Lighting

Since house was located in the middle of a farm, the sky background was a key feature in the scene. We wanted a sunset scenery that would give a nice background for the animation. We used the sun environment in Alias wavefront to generate the sunset. We located the sun in the direction the characters were facing so that it looks like they are gazing at the sunset. The sun was rendered as the combined effect of a glow and halo. We kept the actual size of the sun very small so that the glare was more realistic.

We generated clouds by adding a noise map to the sun environment with values that permitted the clouds to appear natural, haphazard, and in motion as the animation played. After adding the clouds, we had to add a spotlight that would light up the scene. Though the background correctly simulated the sun, it didn't illuminate the scene and therefore a spotlight, SUN, was added to generate the sunset effect.

It is important to note that since the environment only appears when rendering, locating the spotlight was a bit tricky because we had to make its lighting effect correspond with the sunset environment which a viewer would perceive as the source of light. To facilitate this, we placed a camera directly facing the sun from the porch of the house and located the SUN spotlight's target position very close to the eye position of the camera. While in that camera's viewport, we moved the SUN spotlight position to match the environment's sun position.

We later animated both the SUN's elevation and the sunset environment, such that the light intensities and the elevation above the ground lowered as time progressed in the animation. At about the middle of our animation the sun completely disappears from the background, so the light intensity of SUN is very low, at which time a point source light on the ceiling of the porch provides most of the lighting for the scene. Using the action window within alias, we co-ordinated the lowering of the sunset light and the increase of the point light source.

The lighting can be seen in screenshots shown in other sections below.

Camera motion

We wanted the mosquitoes to stand out since they were so small. Our human characters are especially large and no mosquito would show up if we captured the redneck and the mosquito in the same scene from afar. We used several techniques to make the mosquitoes visible.

The first was that we colored them brightly. We used a bright purple color for the bodies and the wings. Originally we kept the wings as black wire meshes, but the purple stood out much better against the dark wood. The wing mesh was not completely realistic since the mesh wires were thicker than one

would expect in an actual insect, but it's quite appropriate for the cartoonish effect we were striving for. With the bright color and thick mesh, the mosquitoes and their wings show up well against all the other materials in our scene.

The next technique that we used on the mosquitoes was the camera motion. We used several different types of camera motion with respect to the mosquito motion. We had the mosquitoes flying toward the camera early in our animation. The next time we show the mosquitoes flying around we show them against the background. The camera follows them from the side. Later we show the mosquitoes taking off from Jed's arm and flying toward the bug zapper. Here we begin by following the bugs from behind and end up following one into the bug zapper.

Finally, we focused on the mosquitoes by blurring the background when they were flying. We accomplished this by changing the camera which was following them so that it had "depth of field" and "auto-focus" turned on. With the background blurred and the mosquitoes in focus, the mosquitos were strongly emphasized. The scaling factor for the depth of field was adjusted to different values for the right amount of blurring in each scene.

We also worked on scenes with camera motion which did not include mosquitoes. There it was a bit simpler since we did not have to keep one single object in focus throughout the entire motion. One example of this was the initial zoom from an aerial view down to our view of the porch.

Figures 1 through 4 below show some of the effects we used with the camera and the mosquitoes.

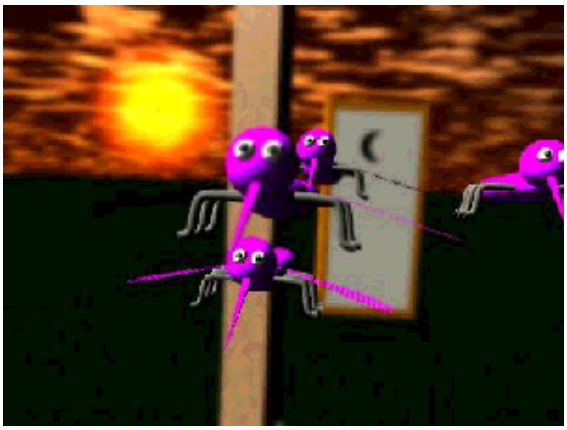

Figure 1. Mosquitoes are chasing the camera with the background blurred.

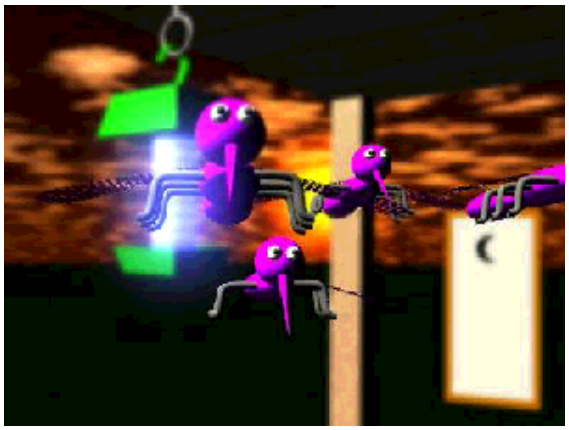

Figure 2. Transparent wings with blurred background showing through.

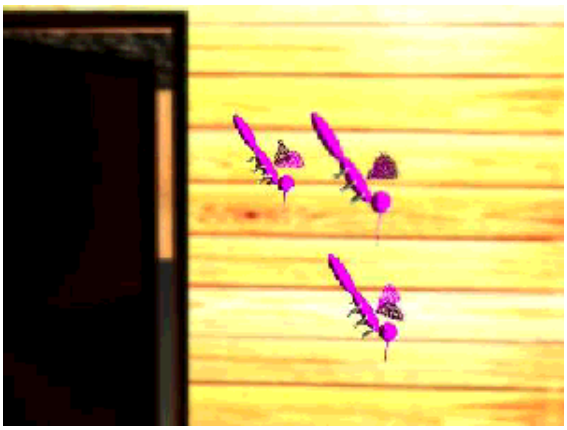

Figure 3. Camera following mosquitoes from side. Blurred background.

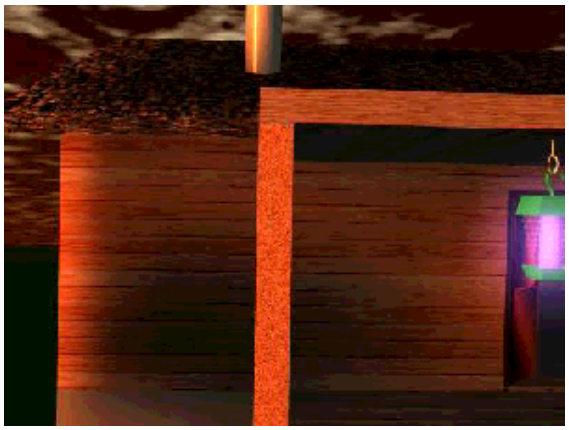

Figure 4. Scene from zooming into the porch of the house around the bug zapper.

Character modeling

The modeling of the characters (mosquitos, Jed, and Earl) was done by first building skeletons in Studio. For the mosquitos, it involved just a body, wings, and a head. For the humans, the skeleton was more complicated, because we had to create arms and hands that moved and could hold things, although the rest of the skeleton only needed minimal construction; in reality, legs, feet, a backbone, and a head were all created, just to keep a better sense of perspective.

The mosquito construction was fairly straightforward from there: the body, head, "mouth", and eyes were all made of scaled primitives (spheres and cones) and attached to the skeleton. The legs were created by extruding a circle along a path, then just attaching six copies to the skeleton at appropriate places, and the wings were just planar shapes attached to the wing "bones". IK handles were then added to the wings and head to allow for easy manipulation and movement in the animation.

The construction of the humans used a lot of different tools. The feet, palms, and torso were created by making skins and then altering the curves that made those skins to the proper shape. The head was made out scaled primitives. The arms and fingers were created by revolving a shape around an axis, then closing the shape off. The legs were made by extruding a deformed circle along an L-shaped path. The shoulders were created by tracing a curve on the torso, then creating a blended fillet surface to join the arm and the torso. These parts were attached to various joints of the skeleton, and deformation control was set to allow for semi-realistic deformation of the arms and hands, while IK handles were added for easy manipulations of the arms and hands.

There was almost no trouble in creating the mosquito, although a little trick was needed for the wings: there can only be one IK handle per node in the skeleton, so we had to create two nodes some epsilon away from the node where we wanted the wings to pivot from to simulate wings attached and flapping in the same place.

There were many problems in creating the humans. The biggest problem, and one which was never completely solved, was attaching surfaces together. The arms, torso, and fingers were created with no difficulty, but the wrists, shoulders, and palms were extremely problematic. The recommendation of Alias documentation is to project curves on surface from the arms to the torso then from the torso to the

arms. The problem is, the curve that was projected was a very poor projection, and would only make a bizarre surface if connected. We finally just traced out a curve on the surface of the torso and connected that to the arms; the results were unusual shoulders, which were sufficient for the cartoonish representation we were trying to achieve. The disadvantage of this method is that whenever an arm is moved, this surface is reconstructed, causing all manipulations of the arm to slow work down. We attempted to use the same approach for creating the wrist, but because of the way the arms and the palm were created, the wrist would always end up twisted, so that method was implausible. The wrist joint problem and the finger joint problem were never truly solved; we created a surface that seemed to cover the wrist gap to create the wrists, and simply stuck the fingers into the palms to create those joints.

Another main problem with the humans is scaling. The connection of all the parts to the skeleton worked fine with arm and hand movement, but we have been unable to this point to directly scale the object (the complete body) to insert it into the main scene. The arms and fingers keep flying off when we scale, a somewhat undesirable property. We have been setting the position of our man, rendering it into polygons, and then shifting and scaling it; this is something of a time-consuming workaround, but it does end up getting the desired results.

Figure 5 below shows our character Jed as created originally, but not scaled. Figure 6 below, from the beginning of our animation, shows our characters from polygons sitting on the porch with the orange sunlighting effects on them and their chairs.

Figure 5. Character Jed object as designed originally. Not in scene.

Figure 6. Characters rendered from polygons in bright orange sunlight.

Explosion

At the end of the animation, the house explodes when a mosquito flies into the zapper. To simulate the explosion, we zoomed out of the scene and looked at the house from above. At this point we made sure that the sunset was over so that we could get maximum effect. A bomb space warp in Kinetix 3D studio MAX was used to generate this effect. The bomb was placed on the perceived center of explosion (the zapper). The objects that would most likely get blown off, e.g. the roof, were heavily tessellated. We added a noise factor to the bomb space warp so that the fragments flew off in a random manner. It was also important to adjust the power of the explosion and apparent weight of the fragments so that the fragments flew off in the desired direction.

We also added fire to the explosion to accentuate the effect . This involved placing a combustion atmospheric apparatus with the scene embracing the area of the scene where we wanted to explosion to occur. The apparatus can only take the a hemi-spherical or spherical shape so enclosing the fire was not easy, but nevertheless we got a good approximation. The timings were adjusted such that there was a big fire ball at the start of the explosion and this graded back to a fire towards the end of the explosion just before the animation ended. The fragments were blown off the house just after the fire ball flashed and toward the end of the explosion the bomb fragments appear to be burnt also. When rendering the animation, we used motion blurring to accentuate the motion of the bomb fragments and to reduce their triangulated appearance.

Figures 7 through 10 below show the explosion occurring from start to finish.

Figure 7. Aerial view of house before explosion.

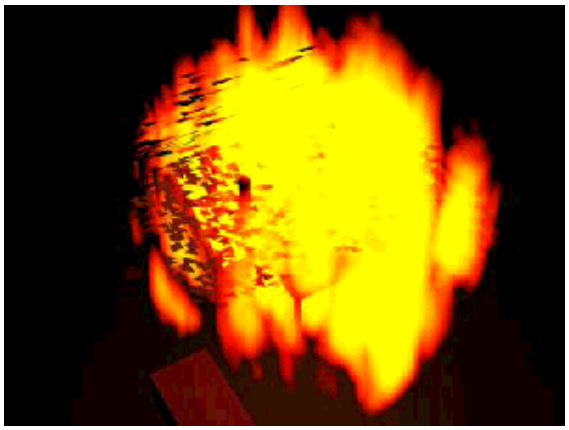

Figure 8. Aerial view of explosion beginning.

Figure 9. Aerial view of house during peak of explosion.

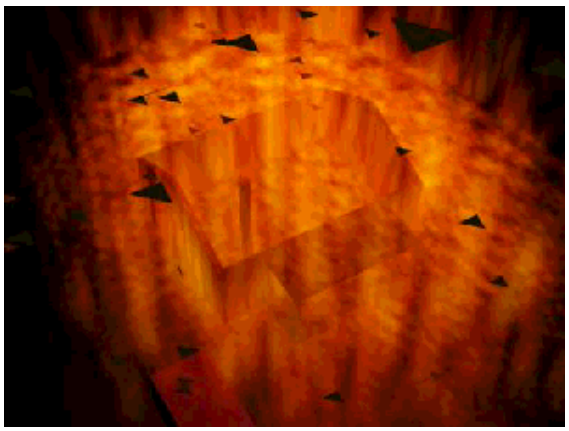

Figure 10. Aerial view of house nearing end of explosion.

Compositing

After rendering the movie and recording the voice-over, we will composite the animation using Adobe Premiere. Matching audio and video will be a challenge especially in this very short scene where some audio is necessary. We will import the frames into a timeline where we can control the sequence of frames and the transitions between the different animation clips rendered. We will make titles and

credits frames using Adobe Photoshop which we can add to the ends of the movies.

Individual Contributions

Each of our team members was involved in each major task of our project. We have all been participating in the modeling, animation, and movie making.

Fred Mburu modeled the house and the outhouse. Karen Kohl modeled many of the smaller objects including the truck, the bug zapper, the John Deere cap, the beer can, the bottle, and the jug. Bruce Applegate modeled the rocking chair, our mosquitoes, and both of our human characters. Fred also created the sunset background and the light sources for our scene.

Fred animated the dimming of the sunlight through time and the brightening of the front porch light. He also worked on having the house explode at the end. Karen animated the rocking chair and the mosquitoes flapping their wings. She also animated the camera zooming into the scene and following the mosquitoes flying around in our scene. Bruce worked mainly on the animation of our human character Jed bending his arm and fingers to lift cans or bottles to his mouth for a drink. We still have some animation of mosquitoes and characters left to complete, but we will probably all be working together on these scenes.

At this point we have not started the process of compositing our frames into a video file. We plan to all work together to accomplish this part of our animation. We will also all participate in recording the audio into our animation and in producing the title and credit frames of our movie.

Lessons learned

This project gave us many hours learning how to model complex three-dimensional objects. We used Alias Wavefront on the SGI machines at Athena. We have learned how to use one complete package for modeling and animating our objects. It was easier for us that all our tools were in one package so that we could model and then try out animation immediately. Between modeling and animating our objects and characters, we have learned to use most of the features of Alias.

Since we had so many different kinds of objects in our scene, we learned about a wide variety of the modeling tools in Alias. We learned how to use predefined objects, curves, warps, surfaces, and shells to create our objects. We learned the transformation and edit tools to manipulate our objects correctly. We also learned how to shade these objects correctly. We used solid shaders which were sometimes reflective. We used texture maps, transparency maps, and projection maps for other objects.

Our characters had to be modeled with appropriate skeletons if we wanted to be able to manipulate pieces of their bodies naturally in our animation. Then the bodies and clothes had to be placed around the skeletons and grouped with pieces of the skeleton so that the animation later would come out properly. The bodies and clothes were mostly created by revolving curves or by creating curves to be skinned together into a surface.

Not only did we learn how to model our characters and objects in Alias but we also learned how to animate them. We used several techniques depending on our object we wanted to model. Some motions were easier to accomplish using motion paths while others were easier using keyframes and having Alias calculate the motion between keyframes. In particular, we used keyframes for the repetitive motions such as the chairs rocking and the mosquito wings flapping. Motion paths were used for the mosquitoes flying, the arm motion, and the camera motion.

We learned also how to model our light sources for our scene. We used a nice changing background for the sunset, but we needed to add lights to our scene since the background sun did not produce any light. We used spotlights, glows, and ambient lights at different points during the animation to achieve the lighting effects we desired.

We addressed the issue of camera placement in each scene since we did not want our whole animation to be viewed from one stationary point. Since we wanted our camera to follow the motion of the characters and to frame them properly so that they stood out in each frame, we needed to learn about various kinds of camera motion. We learned about animating each component of the camera: the eye, the view, and the up direction. Each of these components can be animated along different motion paths. The other options for the camera motion involved timing. We needed to change the timing of each of these components for the effects of the camera following the mosquitoes from behind, the mosquitoes flying into and chasing the camera, and the camera following the mosquitoes exactly from the side. The difference among these is the timing of the eye and up motions relative to the view motion.

Since we had the camera follow motion paths at times, we needed to make sure that the rendered frames from these paths came out in a smooth sequence. It took us many attempts to get some of these curves correct. When the curve had a tight bend, the frames did not transition smoothly from one to another so we had to correct our curve for a slower transition.

In order to get the blurring background during mosquito flights, we needed to learn a bit more about the camera options. We learned about the depth of field and auto-focus options available to us. It took some time to get the amount of blurring correct for each scene of mosquitoes flying around.

The task that was certainly more difficult than we ever expected was the correct modeling of the human characters for animation in our scene. We should have spent more time early on with the task of modeling our redneck characters. At this point, we still have not corrected our model and are trying to determine the best work-around option for this.

Some of the camera animation was easier than expected. Alias provided us with good tools for using the camera to follow some object which was also moving in the scene. One difficult part about the camera motion was having to adjust the motion path curve repeatedly to keep the right objects in the viewing area. It was also difficult to find a good curve that did not change the view too much between frames throughout the whole motion path. We needed to make sure of a smooth transition between frames.

Acknowledgments

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We also thank Michael Decerbo for letting us use a large amount of storage space on his Linux machine. We could not have done saved our output frames without it.

Bibliography

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