Case Study: Visual Effect Implementation on *Life of Pi*

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The film *Life of Pi* tells that young man Pi had a shipwreck and all his family lost his life. He and a Bengal tiger drifted on the lifeboat for 227 days. People and the tiger established a strange relationship and eventually defeated together and could not be reborn. The film was a huge success since it was released. The incredible fantasy visual effect was accomplished by the leadership from visual effects supervisor Bill Westenhofer from Rhythm & Hues (R&H), the top special effects studio that won the Oscar for Best Visual Effects twice. Several behind-the-scenes production techniques of the video's visual effects will be analysed in the following content.

CG visual effects

In the movie, most of the scenes were in the sea and using Chroma keying. The technique implementing on the of seawater is the most difficult technology in visual effects technology. There is one of the world's largest fully automatic wave device sinks built for the movie water scene in Minamata Airport, Taiwan, has. It is 70 feet long, 30 feet wide and 4 feet deep as Tao Zhou, 2015 mentioned. It can hold 1700 gallons of water in the sink. The crew was able to create a variety of water waves. They built the world's largest fully automatic wave device sink, which simulates a variety of marine environments, including calm seas and rough sea storms. The best way to complete a special effect is to make your own sink and design it to the size you need for your movie. The three sides of the sink are walls made of five-storey stacks of containers, and one side is a movable wall.

To bound the fake surface of the sea to the realistic video-shooting scenes, they applied every blue screens to create traveling mattes in order to show a beautiful and varied sky in the film. The production team used HDRI equipment to view the scene in South Taiwan. The shape of the clouds in the ocean is usually distinctive and dramatic, so the production team built a library of materials to take advantage of the artists' materials in resorts like Hawaii.

The R&H team invented a flat layout system specially for this movie. The function of this plugin is to program the geometry into different wave shapes. When pi escaped from the shipwreck and began to drift in the lifeboat, R&H Tong Houdini software simulates the water drop function, the bear operates the ocean to adjust individual water droplets, and even water mist and other details, the team developed

more than 60 different waves for different The lens is selected for use. The synthesis of the production of stereoscopic movies has become extremely complicated.

Figure 1: CG implementation on sky and sea surface water

3D modelling

Most of the animal elements are visualized using 3D modelling and animating techniques. One of the most impressive modelling visualization is on Richard Parker. In the movie, according to Yonghong Cheng, 2014, there are 4 real tigers involved in the shooting, but the shots of these tigers only account for about 5%. The remaining tiger lenses rely on the special effects to complete the real tiger's lens and the virtual tiger's The lens is perfectly docked, and R&H's special effects staff spent a whole year designing the tiger's bones and muscles. R&H collected a large number of tiger references to simulate the tiger's movements and expressions. The tiger's facial expression took most of time on animator's energy. The small texture and structure of the tiger's jaw will automatically sag when the tiger screams. These subtle movements and expressions are based on relevant references. The animator accurately makes the most vivid modules according to these standards, and then artists handle it artistically and process it. When you are animating the tiger, you must have a special set of muscle system and fur setting tools. When making the tiger, we set up two layers of fur to solve the channel, one layer is close to the muscle, and the muscles are pulled back and forth; The first layer is dynamically settled. This layer of fur is only hung on it, so that the tiger skin can slide freely on the surface, with the twisting of various actions of the tiger, and twisting or squirming together.

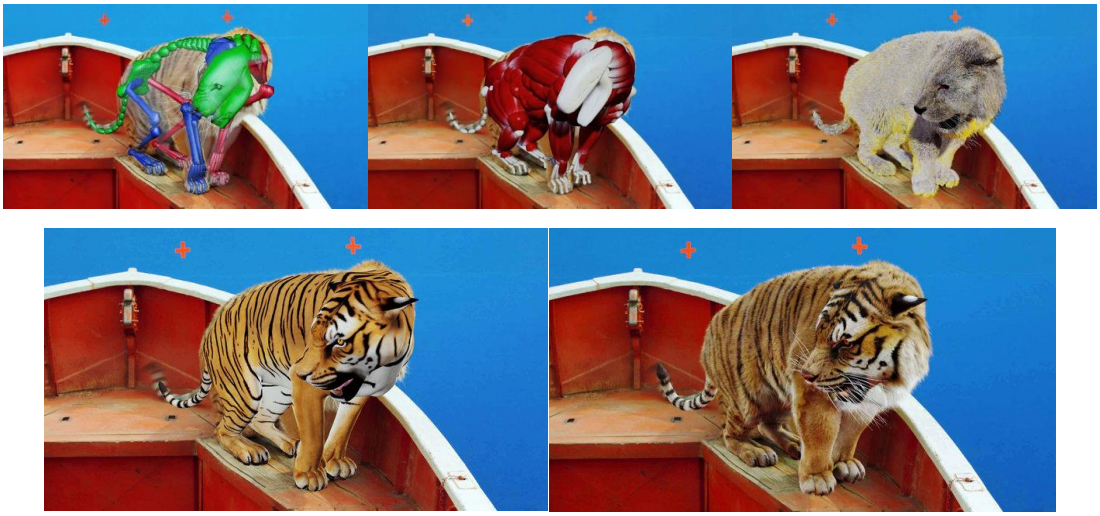

Figure 2: 3D modeling achievement process on Richard the tiger

There is a shot that thousands of flying fish flew from the sea, squatted on Pi and Richard. This is the most difficult scene that R&H has ever dealt with because there are so many flying fish in the scene. Many fishes were initially applied by fake rubber fish and tracked by 3D trackers to replace by realistic 3D models. Producers have to perform a massive sim of 120 frames per second, so that a sample can be obtained throughout the picture, so that the fish hitting the ship can bounce off the water. Fish can't just pass through the waves, so the producers have to make waves and the fish's undulations on the waves.

Figure 3: flying fish scene

The giant shining whale that breaks through the calm sea is one of the most spectacular scenes in the movie, in which the lighting technique is especially important. (@WildBamboo, 2013) the action of whales breaking through the sea is a slow motion. To enhance the dramatic effect of this lens, producers need to highlight the height of the whale as it jumps up, so that the whole body jumps out of the water. The glow of

the organism needs to illuminate every part of the scene, but it doesn't necessarily use light when it is made, but most of the whale's body and mouth need to be illuminated by the same fluorescent beam in the scene.

Figure 4: shining whale visualization

At the end of the story, Pi drifted to a mysterious island inhabited by thousands of foxes. The biggest challenge in making this part is the geometry problem. In this shot, it is necessary to deal with the roots and trees of the roots, the numerous foxes and the fluid simulation. The producer must create an instance of a geometric model and then place many of the trees and staggered roots into it.

Figure 5: visualization of island and millions of fox models

Camera and motion tracking

The depth of field visual effect is extremely complicated in the production of 3D movies. One of reason is that in the 3D viewing environment, the reflection of the

water surface is different in the left and right eye images, and the light perceived by one eye is slightly stronger than the other.

The 3D tracking method is to record each camera position using a synchronous time code surveillance camera, and then track the lifeboat in this two-dimensional acquisition to simulate the movement of the lifeboat in a large environment. Red trackers are used for 3D model tracking including matching the body parts and motions.

Figure 6: comparison of raw scene and finalized scene in using camera tracking

Another implementation on this is rotoscoping to mark and place the of the 3D models. For example, when Pi interacting with Richard the tiger, visual effect processor manually cut out the tracing elements in the shot to add the 3D tiger model.

Figure 7: before and after rotoscoping and adding tiger model

Conclusion

Even through the budget for this movie on special effects and 3D visualization is so expensive that let R&H go to bankrupt, the great achievement that they have accomplished in artistic effect. The visual team won the Oscar, the British Film Academy Awards, and the Critics' Choice Movie Awards for the Best Visual Effect, because of the dedication on this movie. The film represents a high level of global visual effects, providing a high reference level and learning program for practitioners and enthusiasts of visual effects all over the world. At the same time, the pursuit of high art and high vision is more in need of learning. It is necessary to maintain a learning heart to explore and discover the valuable techniques of art.

References

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