Oscar Worthy Science And Engineering

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When audiences watch a movie, they know that what they are seeing is an illusion -- and making the images appear as real as possible can be a major undertaking for any filmmaking team.

Creating those realistic-looking illusions is the job of the film's cast and crew. Making sure that colors look the same throughout a film, creating animated scenes that look real, and reproducing the same highlights and shadows as those created by natural light is only a sample of the accomplishments of the 15 scientists and engineers who will be honored during the Academy of Motion Picture Arts and Sciences Scientific and Technical Achievement awards hosted by actress Elizabeth Banks on Saturday, Feb. 20.

Keeps Colors Consistent

Best picture nominee "Avatar" would have lost its ability to immerse movie audiences in a fantastical world on Pandora if the Na'vi's trademark blue skin color had changed shades from scene to scene.

"Computer displays have a different color space compared to film; colors that I can see on a computer, I can't always reproduce on film and vice-versa," said Mark Wolforth, an electrical and biomedical engineer who specializes in imaging with FilmLight Limited. "Truelight is a color management system that keeps the colors the same so whether you are looking at a scene on film or you are looking at the same scene on a computer screen, the colors will look exactly the same."

Before the first scene of the film is even shot, the Truelight system is used to determine how the cameras and lights for the film will work together. The crew is told to make a film print using their normal camera and lighting settings.

"They make a film print and send it to us with their [camera and lighting] settings," said Wolforth. "By looking at the film print, we will give the crew specific instructions to make sure that their settings will give the same colors."

Makes The Animated World Look More Life-Like

The life-like scenes in the animated film "Up", which has also been nominated for best picture, captured the attention of children and adults alike. Creating a believable room without the use of a real stage or lights presented a substantial challenge to the scientists and engineers at PIXAR.

Point-based rendering is how each of the objects in an animated scene is mapped out. Each object is made up of a group of colored dots called a "point cloud" that shows the object's position and color in a scene. This

same technique is now being used for concepts called indirect illumination and ambient occlusion.

"Indirect illumination is when a surface that is illuminated by a light source reflects that light onto other surfaces," said Per Christensen, electrical engineer and computer scientist specializing in computer graphics at PIXAR animation studios. "One indirect illumination effect is known as 'color bleeding;' if you have a red carpet next to a white wall, some of the light shining on the red carpet will be reflected onto the white wall, giving it a pink hue."

On the other hand, ambient occlusion is related to shadows.

"Think of it as a super-soft shadow as on an overcast day with no direct sunshine," said Christensen. "Ambient occlusion also makes creases and wrinkles in surfaces more visible and darkens objects near other objects; this is an important effect to capture in order to add realism to computer-generated images."

Lighting Faces

Whether an actor in a scene is real or digital, capturing the way light shines the actor's face is crucial to a scene.

"There are lots of technologies to capture the shape and some get a texture map of the face, but, what you need and want -- is how to reflect light," said Paul Debevec, Associate Director of Graphics Research at the University of Southern California's Institute for Creative Technologies in Marina del Ray, Calif. "You need to see how models change, how their face reflects the light, the color and shine of their skin, and you want to see where their skin buckles or creases when they smile."

LightStage captures a realistic computer model of the human face. The actor sits in an arc of 32- strobe lights that flash one right after the other while the images are recorded by high-speed video cameras resulting in hundreds of images of the face.

"We have been surprised to find that sometimes, our digital version of the actor was lit better and looked more realistic than the live footage for the actor, so the director chose to use our digital version for specific scenes," said Debevec.

While progress in science and engineering continues to revolutionize the way we live, do not forget that these advances also revolutionize the way we are entertained.