Shading Dory's New Friends

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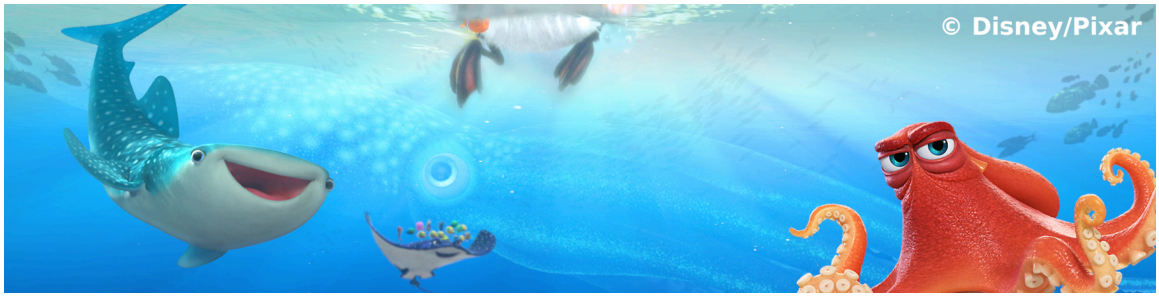

Figure 1: *New characters from Pixar's Finding Dory.*

Abstract

In order to fill the ocean and other settings in Pixar's Finding Dory with new life and meet the visual requirements for its new characters, we were faced with many challenges in shading these characters that lead to creative and interesting techniques. Here we have chosen to highlight several of those challenges that best represent the variety of both artistic and technical solutions we employed to make these characters successful.

Keywords: camouflage, pointillism, glow, pipeline, grooming, feathers, shading

Concepts: • Computing methodologies~Texturing
• *Computing methodologies~Non-photorealistic rendering*

1 Camouflage Octopus

Hank, one our new main characters and an octopus, was both a technical and artistic challenge. The first difficulty was finding a balance of realism and stylization, trying to find a way to make Hank have the visual interest of a real octopus without ending up looking as disgusting as a real octopus (like a slimy sack of flesh). Pushing scatter to its limits gave Hank an appealing, gummy look, while finessing the roughness of his clearcoat layer and allowing the clearcoat to lay smooth over a bumpy surface beneath helped in making Hank have the visual complexity of an octopus while maintaining the appeal of the other, simpler characters.

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SIGGRAPH '16 Talks, July 24-28, 2016, Anaheim, CA,
ACM 978-1-4503-4282-7/16/07.
http://dx.doi.org/10.1145/2897839.2927440

But establishing Hank's default look was only the beginning- as Hank's shader dynamically changes throughout the film as the character camouflages into his environment. We had to develop a system that was versatile and streamlined for downstream departments. To mimic the actual look of an Octopus camouflage, colors and patterns had to traverse the skin in an organic, non linear manner - having hank fade homogeneously from one pattern to another was not a viable solution.

A series of cells was created on Hanks surface to offset each transition - then used these same channels to blur and offset any arbitrary texture supplied by FX downstream. Similar to the behavior of actual cephalopod chromatophores, the pigment transition would grow outward from the center of each cell, and this effect could be rippled across Hank?s body, driven by either a 3D primvar created in FX or a painted ramp texture.

This technology was later picked up and utilized on the Squid to animate the glowing spots on his surface.

2 Animated Glowing in Squid

The Squid on Finding Dory presented a unique problem in that it needed to be shaded more like an effect rather than a typical character. The main visual feature of the Squid was to be an organic collection of thousands of glowing spots that would animate on and off in particular patterns during a dark chase sequence. The patterns of the glowing spots would take two main forms: either random pulsating patterns or in specific art directed patterns along up and down parts of its body to portray particular emotional states. In both cases, the spots had to grow and shrink in size to a different timing than its neighbors. To do this, the spot fade technique used to transition Hank among his various camouflage looks was used as a starting point for the Squid, and then adapted to allow the spots to pulse up and down in size in a sine wave manner. Since the Squid's pattern required thousands of spots and each needed it's own set of masks and gradients,

Illustrator was used for its ability to easily create vector shapes and program scripts to iterate over those shapes to modify color, shape, size, and opacity for each texture maps needed by the shader while maintaining spatial consistency amongst each map.

Because the Squid's visual form was defined mostly by the glowing spots, a method was developed to allow the animators to view the same spots pattern on a hardware shaded version of the Squid in their real time animation system and author a primvar to animate the spots that could then be used in the actual Renderman shader to drive the glowing spots in the exact same manner in final rendered shots. This one primvar is a black and white mask that defines the on/off state of all of the spots on the squid mesh on every frame.

3 Shading 50 Fish at One Time

To populate Finding Dory's vast underwater sets with ocean life, over 50 shading variants of reef and ocean background fish were required amongst over 15 model variants. Each shading variant would have it's own unique paint patterns while at the same time many variants would share similar illumination parameters, thus allowing all of the Bg Fish to be shaded by a common shading network. A common challenge with such crowd shading projects is the time spent opening, closing, and otherwise organizing the many files needed to contain the settings of all of the shading and modeling variants. By leveraging a shading pipeline built around Katana, it was now possible to use one file and session to author, test, and tweak the shading amongst all of the variants. This was made possible by using graph variables in Katana, which are a form of session variables, to define which model to load, which shading material to apply, and which set of shading parameters to use unique to a particular model and shading variant of fish. This system and organization of shading greatly increased the speed at which the shading could be authored amongst all of the variants, as well as making inevitable multiple iterations of changes from addressing notes and feedback from art directors quicker and more efficient.

4 Grooming Feathers on Loons

Shading and grooming the Loon bird was very challenging. Loons have very elegant and stylized patterns that grow on their feathers. The art department created the patterns that look very graphic and have different styles when the wings are opened and closed. To match those graphics perfectly on the groomed feather and modeled feather was extremely challenging. We developed a few sets of the graphic patterns as stencils that can be used on the actual groom feather and model feather. Loon has at least 150 modeled feathers. To make the workflow easy, we created two UV sets to serve different purposes. One set had many shared UVs and was used to create the details on each modeled feather. The other UV set was used to create the bigger graphic pattern and to create variation across the body.

Another challenge was to create a shader that blended our new Marschner hair model with our primary shading material on the modeled feathers together and look cohesive. This had to be done after the actual groom was finalized. We baked out the different parts of the feather styles from the groomed feather and input these signals into the shading material for displacement and opacity to match the regular modeled feather.

5 Stylized Painting Up Close with Destiny

Destiny was the biggest fish who interacted with Dory. She needs to have visual complexity both close up and far away yet maintain a certain stylistic quality that is consistent with the other characters. The approach we used to shade Destiny was similar to a traditional painter's approach of capturing the character on a canvas.

The first step was blocking the pattern in big strokes. Getting the basic material with light response was crucial because it had to work with the pattern and local colors (applying the base color with basic skin material and scatter). Then a pattern was designed as a secondary visual element to integrate with the basic blocking patterns, establishing half-tones (applying cellular patterns with variations of specular and displacement responses). Lastly, the most important aspects of the character would be painted in a decisive manner, such as in the eyes, face, and mouth areas in the shots where Destiny is shown next to Dory the most.

The painting method used in these close-up areas was a technique inspired by the Impressionists called Pointillism. Pointillism was developed in the 1800s and takes advantage of ocular tendencies to blend adjacent dots or shapes of colors into a cohesive and complex tonal image. This technique was used in painting all the transitions between blending areas to avoid the "air-brushed" or undesirable de-saturated gray tones, which usually were created by soft brushes to blend tones of colors. Painting in this doted method with the right values and colors as a final touch added visual abstract interest to the close-ups. Occasionally, a digital "hairy" brush was used to add more visual interest to the blending areas as if to simulate the vascular structure of the skin textures, another way of adding complexity to the overall look.