A Versatile Skin Material for "The Good Dinosaur"

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Figure 1: *Apats, Pterodactyls, and Raptors are among the characters that used the Global Skin Material.*

1. Abstract

The major challenge to character shading on *The Good Dinosaur* is variation and scale. We have numerous Dinosaur species, each with multiple members, each member with varying skin properties on different regions of their bodies, depending on the age and character personalities. Also, the ultra realistic environments and stylized characters dictated the need for intricately designed details to bring them together. We knew the dinos were going to interact with characters of a much smaller scale (namely humans). We would not be able to paint this complex detail, given our time and multi-scale constraints.

The skin details were not modeled because our shader is more art directable, flexible, and efficient. Our shader is also easy to prototype for all species and variants, and gives artists the freedom to mix and match the specific qualities as needed per character.

Synthesizing the signals and not the painted texture itself was the key since it allowed us to decouple all the different qualities, and gave us control over adding them in or fading them out independently. Our shader with texture synthesis determined the overall color passes needed and the detail and specific variations of each character. It consists of a small patch of the cells and encapsulated many signals that were used in the shader to vary color, illumination, displacement, textural components and detail. We were able to layer what is needed to shade individual variants. This layered approach allowed us the artistic freedom to create complex characters that shared painted components, while textures synthesis allowed us to create variations in materials quickly.

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In the following sections, we describe the process (Fig. 2) for creating our shader.

Keywords: shading, layering, texturing, global skin materials, cell exemplar, texture synthesis, artistic freedom, pattern detail, procedural artistic integration, material versatility, variants, aging.

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

2. Targeting Artistic Freedom

Initially, we created a synthesis exemplar, which is a small texture with a pattern of cells (*Fig. 3*), that specifies the shape of the cell, how they interacted with each other, what kind of rhythmic pattern they defined overall, what was the negative space in between, a ramp from each cell center to the edge of each cell, a cellular ID for each of the cells, a detail pattern inside each cell and other extra passes needed for the specific character.

We would also create a scaled groom for the character, which combined with the exemplar, drives the synthesis. The shader consumed each of the synthesis-produced signals in a layered manner. This stage drives the look for the character and provides the basis for all the signals for the shader.

Next, we crated painted passes such as:

BaseColor pass*: the overall color of the skin as you would see it from afar and would be displayed inside the cells of the synthesis.*
RingColor pass*: the color that you would see in between the cells of the synthesis.*
FlowerColor pass*: the color that would be revealed inside each cell and would be defined by the synthesis pattern inside each cell. (We also label this pass the flower pass, since originally our dino skin cells would contain a pattern like a flower inside each cell).*

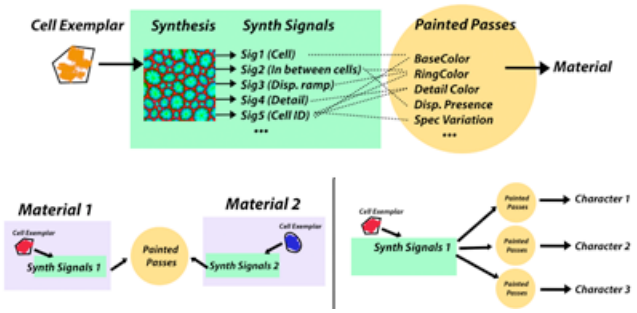

Figure 2. *Top: Description of the process for one Material. Bottom Left:Shared paint with different synthesis. Bottom Right: Shared Synthesis with multiple paint passes*

The BaseColor painted pass would be revealed in the areas where the cells were displaced outwards. In the negative spaces, we would reveal the RingColor painted pass.

We could adjust illumination qualities and displaced the surface based on the same synthesis signals. We could use the cell ramp to change the profile of the cells displacement for different parts of the body. Changing the profile of the cells on the fly after the synthesis was really powerful to determine the skin qualities.

We could also reveal the FlowerColor pass, based on the synthesis signal. We used the cellular ID to vary each signal to give a more organic look. Each of these qualities were controlled by presences that could be switched on, off or painted as masks. We had lots of ways of adding variation and complexity.

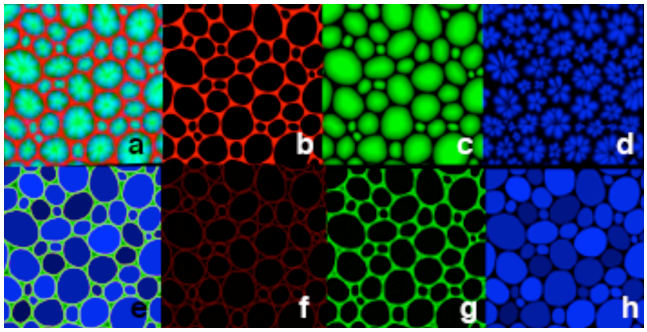

Figure 3. *Texture exmplars and signals. a. Composited. b. RingColor signal c. Ramp for displacement. d. Flower pattern. e. Composited. f. Edge of cell ring. g. Detail for the negative spaces. h. Cellular ID*

3. Targeting Complex Layered Materials

Using the same core shader but layering it, we were able to accomplish more complex Materials.

For example, in the Raptors, where the skin consisted of different layered materials (like chicken skin, and bird like legs), we were able to share the painted color passes and used different synthesis and illumination properties for the different areas.

For groups of characters that shared topology such as the Pterodactyls, we were able to reuse the synthesis as well, and we found that just changing the painted passes and masks afforded great variation for the look we wanted.

4. Defining Age and personalized characteristics using synthesis.

The creation of the texture synthesis exemplars involved adding lots of carefully chosen information that proved to be very powerful as a design tool as well as a shading workflow. For instance, for younger character, we chose rounder shapes for the cells and the displacement components would be rounder as well. Older characters had more angular features for each cell and flatter profiles for displacements. We may vary differently the rhythmic pattern of the groups of cells for older dinos vs. younger ones. Skin that was younger might have a different subsurface quality around the cells edges vs. older drier skin, were we would vary perhaps the color properties and specularity in those areas. A small shift on the exemplar texture would produce a significant look change, which was very useful for creating variations quickly.

Another powerful feature of this approach was it also allowed changes and refinement of the cellular patterns throughout the shading process. This would have not been possible if the patterns had been modeled in or painted. The process also simplified aging characters from model to model.

For older characters we were able to make the synthesis follow the wrinkle pattern and "grow" the cells around them. Having the cellular and wrinkle integration provided another level of complexity that was very pleasing.