Bringing Skeletons to Life for *Coco*

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ABSTRACT

What is a Pixar skeleton? Answering this question presented a significant challenge to *Coco*'s character team as we balanced our stylized production aesthetic with the desire to make realistic and believable skeletons. We discuss our challenges and decisions through character modeling, rigging, and shading.

CCS CONCEPTS

• **Computing methodologies** → **Animation**;

KEYWORDS

character, rigging, shading.

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Figure 1: The skeleton rig allowed visual gags like this. ©Disney/Pixar.

1 MODELING

These characters are critically important to the story and need to convey all the same emotions as a human to the audience. A simple eyeless cranium with a hinged jaw will not satisfy this need. Given the expressiveness and visual cues provided by eyeballs, eyes were a necessity for our skeletons. Finding a design for the rest of the face required significant thought as we blended between the acting limits of the anatomical model with a fully expressive human face. Through this process, the rules for the film's skeleton lips, teeth, cheeks, eyebrows/sockets, tongues, and mouths were discovered.

The design for the skeletal body relied heavily on anatomy however we stylized many aspects of a real skeleton. The spinal column, ribcage, hands, and feet were all simplified to create more graphic shapes while capturing the appeal of rigid bones.

2 RIGGING

Even though skulls are rigid, several regions were rigged to be malleable in order to create expressive poses. Bone "lips" were also included to give enough range in animation to emote. However, to preserve bony characteristics, we created a unique mouth setup that could generate angular shapes in the lips and gaps at the mouth corners to suggest a separate jaw bone.

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As pushing the physical comedy of animated skeletons was paramount, we developed a rig that allowed for complete disintegration (see Figure 1) but still functioned as a regular character rig that could be easily manipulated. For the spine, feet, hands, and shoulders we authored rigid or semi-rigid solutions that produced appealing shapes derived from smooth deformations but stayed true to the rigid material of bone.

3 SHADING

Figure 2: The procedural bone shader generated lots of detail. ©Disney/Pixar.

Due to the large number of skeleton characters (and the number of bones in each character) as well as the need for very detailed close-ups, we opted for a predominantly-procedural shading solution. UV-maps and vertex data that drove the look of each bone were embedded in the character's rig so every character inherited this geometric shading data. Once applied, the bone shader generated a believable-looking and visually-interesting skeleton out-of-the-box. This bone shader was used for the entire cast of characters which allowed us to push out global changes quickly and guarantee that any background character could be close to camera and still have as much detail as our hero characters.

The bone shader contains a library of appealing visual features collected from macro-photographs of a variety of different animal bones. Porous and non-pourous regions of each bone are identified by vertex data and the features are carefully applied in color and displacement to generate the desired look.

The "age" of a skeleton is an important story point in *Coco*. As a character is forgotten in the living world, they begin to degrade in the Land of the Dead. We leveraged the procedural nature of the shader to automate this. By adjusting a single parameter, the skeleton could transition smoothly (in camera, if desired) from well-remembered to almost-forgotten.

The flexibility and detail acheived in the shader came at the cost of render time. We developed baking tools that would allow us to render the skeletons effeciently and also keep certain procedural controls live for shot-lighters if needed.