# Creating a Monster: artistic and technical challenges

Michael Honsel
Pixar Animation Studios
mhonsel@pixar.com

## 1. Introduction

The development of Dean Hardscrabble was one of the major challenges for the Art and Character departments during the production of Monsters University. The design of this key character occurred late in the production, due to story adjustments, and necessitated a streamlined approach to the artistic and technical challenges accompanying this project, as well as exceptional collaboration between the departments and individual artists.
The short time frame, complex design requirements, and technical difficulties demanded an adapted approach to our traditional workflows as outlined below.

## 2. From sketch to sculpt

The development process for a main character at Pixar usually includes the production of a high quality clay maquette by our traditional sculptors to finalize the design and as reference for the modeler/articulator. Due to the tight deadlines and fluctuating design we opted for a more flexible approach, utilizing digital sculpting tools.
During the early stages we could quickly sketch out ideas with simple geometry and explore different character poses through a basic rig. It proved very helpful for the director and the designers to be able to see these concepts right next to the models of the main characters, to make informed decisions about design language and scale relationships. Extensive changes could be made at this point without losing much time. Repeated and intricate elements, such as the legs, were easily modified in contrast to traditional media.
The rough concept could be taken into a dedicated sculpting software to create a digital maquette. The layering capabilities of the tool allowed for quick iterations and nondestructive editing not possible with the traditional workflow.

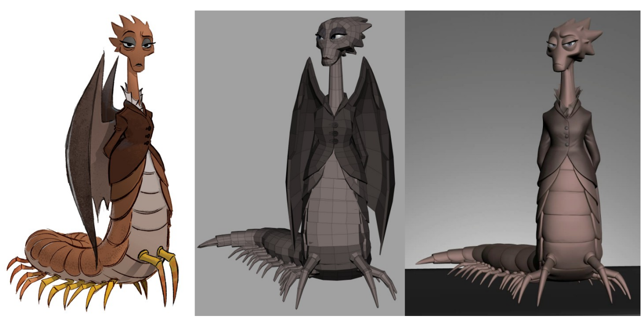

**Figure 1.** Sketch, Blocking, and Sculpt. © Disney/Pixar

## 3. Articulating a monster

Following the design process we knew Dean Hardscrabble would be the most complex character of Monsters University. The challenges of a believable facial performance with highly stylized features particularly manifested in establishing connectivity between mouth and cheeks, as well as brows and eyes. The design also called for a long, tentacle-like body with sliding plate segments, a total of 30 centipede legs, and dragon wings that needed to be able to fold up and disappear into the silhouette.

For all these problems we were striving to find solutions that were not distracting from the performance, but enhanced her physicality in a believable manner, rooted in the universe of Monsters University.
Subtly sliding skin over the cheek bones with jaw movement and compression wrinkles or crows feet forming with certain brow and eye poses created connectivity in the face, without taking away from the design.
For the plates on her back we developed a rigging solution that provided a balance between organic squash and stretch as well as a more mechanical sliding movement. In our in-house animation software Presto we use weight objects to store and retrieve vertex weight data. We were able to leverage weight objects that can dynamically measure the change in edge lengths occurring on the mesh during posing. We transferred these deltas to an intermediate mesh to use them as inverse scaling factors to counteract stretching or compression of the plates. The actual render meshes for the plates were scaled and deformed into place by a series of subdivision warp deformers. This was superior to a purely rigid solution because we did not have to fight intersections or large gaps, and visually more appealing than a purely warped result.
The large amount of legs was facilitated by employing our robust referencing pipeline and weight transfer tools. To create an easier means of animating the legs, path tools and animation propagation scripts were developed.
Integrating the wings required two different setups. When they were closed they needed to react similarly to the plates and bend and slide along the body contours. Once opened they could be independently posed. The rigging of the wing skin relied on our displacement accumulator technology which lets us execute several deformers concurrently and average their result.
Secondary articulation controls, like tendon accentuation and skin tightness, helped enriching the character performance and conveying age.

**Figure 2.** Plate sliding setup. © Disney/Pixar

## 4. Conclusions

By choosing a non-linear and adaptive design approach we were able to narrow in on the strongest design, without spending too much time on each iteration. It enabled us to effectively determine wether it was worth further exploring the current design or to go a different path.
The technical implementation was facilitated by employing a highly collaborative and systematic method. Complex problems were broken down to basic elements and explored using simplified scenarios before applying them to the rig.


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