Designing an Interaction with an Octopus

Jeremie Talbot* Mark Piretti Kevin Singleton Mark Hessler
Pixar Animation Studios

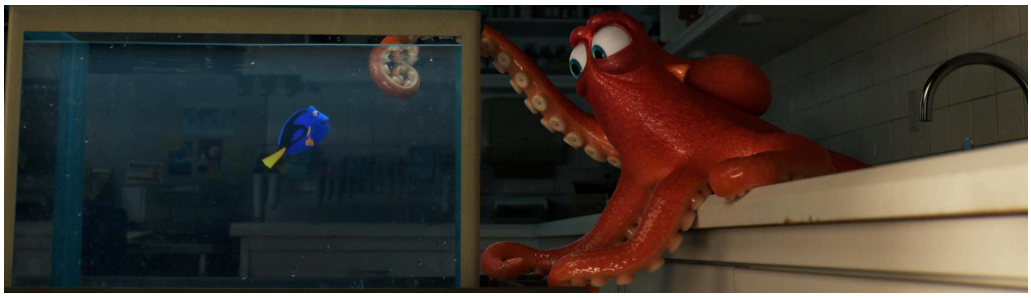

Figure 1: Hank the Octopus with Dory ©Disney/Pixar. All Rights Reserved

Abstract

In Pixar's *Finding Dory*, we are introduced to a new character: Hank the Octopus. This is a very different character than Pixar has been asked to animate before.

Our directors demanded both precise control and graceful, clean silhouettes. The reference artwork we were given showed complex curves between arms and body without any disjointed shapes or breaks in form. Video of Octopus in motion reveals an infinitely malleable creature capable of an enormous shape language. This art direction required a small group of TDs to create a control scheme that was sensible, flexible and with a new level of control in order for animators to bring Hank to life.

We had to think deeply from the tips of the fingers all the way through how the tentacles connect to the mouth corners, and eye sockets. Each of this issues raised concerns around design, deformation and finally how the end user can manipulate such complexity effectively.

Keywords: animated spline, octopus, tentacle, rigging
Concepts: •Computing methodologies → Animation

1 Tentacle Design

Our past approaches to 'tentacle' rigs have been limited in their ability. Interacting with/constraining to objects or surfaces in the world had been restrictive. Creating complex shapes intuitively, that could slide, stick and grab at arbitrary locations was a design challenge. For this project we attempted to create a more universal system to solve these problems.

With our approach, the user poses 'knot objects' in 3d directly rather than repurposing bones, or hierarchy traditionally used in rigging. We attempted to create controls better representative of how a tentacle moves. These interactions borrow workflows from animator's 2d curve editors giving them consistent language in a 3d viewport. We are able to switch various behaviors at each knot including constrainability, smoothing, and shaping controls. Each knot can slide, constrain and interact like any other knot so that the interface is learnable and provides intuitive shaping.

2 Construction

Octopus arm deformation does not appear at fixed locations along its length. Rather, shape change needs to be able to float through the geometry without being locked to any particular set of points. In addition, animation requested varying levels of detail along the arms to create and refine appealing poses.

Using a hierarchy of our specialized curves and constraints, we were able to provide animation with varying levels of control over Hank's arms. Our deformation centered around these curve 'knot' locations as parameterization sites. From there we could map weights from site to site achieving a wide variety of deformation.

3 Integration

Continuing the gestural shapes of the tentacle animation into the body required a layered arrangement of rigging curves and meshes of increasing topological density.

Hank's body was designed to float between the seven tentacles and stretch organically to the position of the head. Using those points of reference, curves pass from the tentacle into the body. These curves transfer the arc of the tentacles into the body preventing the sense of a break or discontinuity.

The deformation of these curves is progressively transferred between various proxy geometries to the final topology. This allowed topological detail to be optimized for each stage of deformation. Broad based shaping, for instance the webbing and the points where the tentacles meet the body, used the simpler meshes while more detailed refinements such as facial controls were done using the more complex meshes. Further corrections

*e-mail:jtalbot@pixar.com

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were applied via PSD solvers driven by relative angles of the body to each arm.

4 Beyond Dory

Through the construction of this complex character, we have developed a new system with which to animate complex tentacle like objects with maximum flexibility. We hope to leverage this system for rigs that demand complex rope-like behavior and animator driven shaping.