

# Pixar’s Inside Out 2: Character Rig Challenges and Techniques

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The characters team on *Pixar’s Inside Out 2* shares some of the technical & design challenges on our character rigs and presents the techniques used to solve them.

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## 1 JOY’S EYELIDS & EYE AUTO GAZE CORRECTION

Joy’s iconic large eyes pose both artistic and technical hurdles in character design. Conventionally, our characters’ eyelids feature an inside and an outside corner connecting the upper and lower lids. However, during the production of *Inside Out* we encountered a significant challenge: whenever Joy’s lids were halfway open, her eyes appeared smaller rather than partially shut. Our solution on *Inside Out 2* was to equip Joy with four lid corners — two for the upper lid and two for the lower lid. We will present the unique technique we used that ultimately gave Animation the ability to choose any position along the lid edge’s topology for the corners of both the upper and lower lids.

On the original *Inside Out*, Animation spent a lot of time polishing the eye directions on the larger eyed characters to make it appear as if both eyes were looking in the same direction. The curvature of the eyeballs would often make the eye gaze appear different, especially as the eyes are angled away from camera and the amount of exposed iris/pupil was diminished or wrapped around the horizon of the eyeball. We will discuss the cheats we explored to unify the character gaze direction, some that are relative to the eye and eyelid shapes themselves, and others that are computed relative to the camera. In addition, we will talk about the process of preventing the pupils from becoming obscured under the eyelids when the neutral eye position is biased with minimal space on one side of the eye and significantly more on the opposing side.



Fig. 1. © Disney/Pixar

## 2 CURVENET USAGE

*Hand Curvenet Rig.* Most of our character’s hands in *Inside Out 2* are traditional hands — four fingers and a thumb. We like to share topology and weighting where possible but historically any character with unique topology has to be rigged from scratch. We wanted to change that. Over the past few productions Pixar has been developing new articulation tools called curvenet and Profile Mover. These tools allow us to deform our subdivision surfaces completely independent of shape or topology. On *Inside Out 2*, we used these tools to create, for the first time at Pixar, a fully

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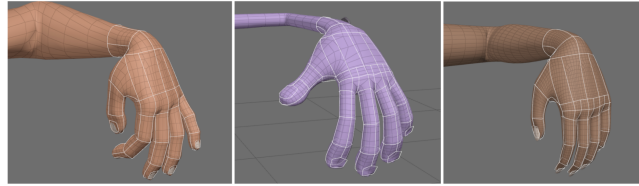


Fig. 2. © Disney/Pixar

articulated hand curvenet as a shareable rig. The result was fully rigged hands for all of our characters, out-of-the-box, without doing any rigging work on the geometry, regardless of shape or topology. We would like to share our setup, the results, and discuss the next steps for the use-case.

*Shape-N-Bake.* On *Inside Out 2*, we created a new workflow that uses curvenets as a shaping tool instead of a deformation tool. This gives the artist the option to interface with sparse point data on a curvenet but then to bake the shapes down into our traditional subdivision deformation stack. Curvenet enables artists to manipulate character articulation shapes with sparse points, particularly useful for maintaining volumes in various directional spaces. The Shape-n-bake approach leverages the strengths of curvenet while circumventing the weakness of the sparse topology (such as candy wrapping with twists) to create corrective shapes more efficiently.

*Character & cloth rigging.* The body deformations for some of the new characters were rigged using a curvenet and Profile Mover. There were also some circumstances where we applied the sparse point rigging approach to garments. While most characters typically don't require extensive cloth rigging, specific control over some of the garments was needed in shots due to their importance of the character's personality. This required fine-tuning aspects of the costume to enhance the character's performance and by using curvenets we were able to provide those controls to Animation.

### 3 CRAFTING ANXIETY'S EXPRESSIVE MOUTH: INNOVATIVE RIGGING SOLUTIONS

*Inside Out 2* introduces *Anxiety*, a character with a unique design akin to a cloth puppet, demanding specialized mouth rigging setups for flexible and precise control in Animation. *Anxiety*'s design required a rigging solution that could accommodate her unique features. Our team devised a mouth corner rig consisting of three layers of controls. The first manipulates the outer silhouette of the mouth and face, allowing for broad adjustments to shape and expression. The second focuses on moving the mouth corners within the face silhouette, and the third is dedicated to refining the outer silhouette without affecting the teeth placement. To achieve the desired wavy lip shapes, we added additional lip controls, providing nine sections on each lip. This enables animators to establish the base wavy shape. Additionally, we introduced a curvenet setup on both the lips and the head for detailed polishing, allowing control over the entire facial shape and thickness between the lips and face silhouette. This grants animators flexibility in shaping



Fig. 3. © Disney/Pixar

*Anxiety*'s facial expressions, enabling them to convey a wide range of emotions with precision. In developing the teeth setup for *Anxiety*, we used curves wrapped around the lips and constrained each tooth to follow the contours of the lips. Individual controls were implemented on each tooth to enable animators to toggle the constraint on or off, slide

the teeth along the curve, and pose them separately. The teeth constraint setup remained unaffected by the polishing curvenet. These rigging solutions provided animators with a comprehensive toolkit, ranging from rough adjustments to fine detailing, empowering them to craft dynamic and precise mouth movements that perfectly complement *Anxiety's* wide array of facial expressions.