

Silhouette Sketching on “Inside Out”

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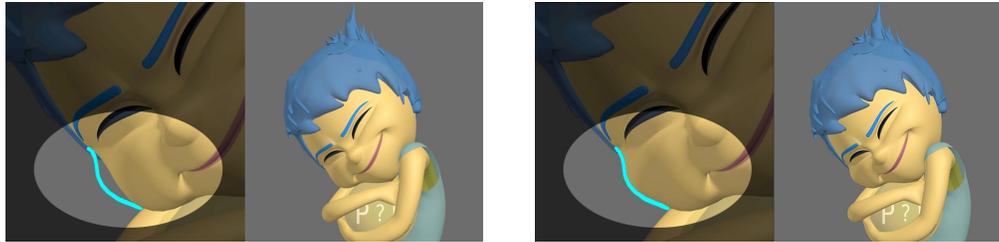


Figure 1: Left: Animator draws a stroke (in blue) to indicate desired cheek bulge. Right: Deformation has been applied. From *Inside Out*, ©Disney/Pixar 2015.

Abstract

In hand-drawn 2D animation, artists have direct control over the image. Silhouette lines are drawn with a specific intent, e.g. an elbow might be drawn as a curve, or with a sharp angle. By contrast, in 3D animation, direct silhouette control is often lost. Animators pose a 3D model with an abstract control like “elbow bend” and the resulting silhouette is whatever the character rigging provides.

Our goal was to create a tool to enable our animators to be able to sculpt the silhouettes quickly, in context, without requiring special expertise or assistance from riggers and modelers.

During “Inside Out” this new sketch-based tool saw heavy use for modifying silhouettes of hero character’s faces and bodies as well as for fine-tuning cloth simulation results.

1 What We Built

A few years ago when we were working on a stylized rendering project [Bénard et al. 2013], animator Sanjay Patel asked for more control of the silhouettes to get better shapes for the painterly look. This eventually led us to build a silhouette sculpting tool for our regular production pipeline.

Initially we followed the techniques described in the SilSketch paper by Zimmermann et al. [2007]. Their heuristics for determining which part of the surface to deform are a key part of making our UI simple and clean. However, experience with early prototypes led us to employ a different deformation function. Instead of using Laplacian Surface Editing we now use a spatial deformation, which allows underlying surfaces to be brought along in the deformation.

In addition to the underlying technology, we added several features to make it usable in animation:

- a method for interpolation over time,

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- an editor for moving poses in time, and breakdowns, etc.,
- methods to control how the deformation falls off spatially,
- a spline widget for editing the sketched curve,
- the ability to save and restore camera angles, and
- a formulation of the deformation as surface-relative offsets.

Involvement of production in the design and prototyping of the tool led to a workflow-based solution that was quickly adopted with few integration issues or bugs. Our interdisciplinary team included experienced people from many domains: riggers, animators, UI designers, as well as engineers with expertise in UI, graphics, model execution, and other areas.

2 Results

The sketching features were used by animation and simulation on hundreds of shots. Animators used it to make subtle but important modifications to fix cheeks, shoulders, wrists, necks, to smear-out for exaggerated motion blur, and to modify mouth shapes for some characters. It was used even more aggressively to sculpt simulated cloth to hit desired poses. We believe it saved substantial time on model fixes since many issues were solved per-shot by animation, avoiding last-minute rig changes.

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