The Fashionista Twins: Conjoined Hair in *Trolls*

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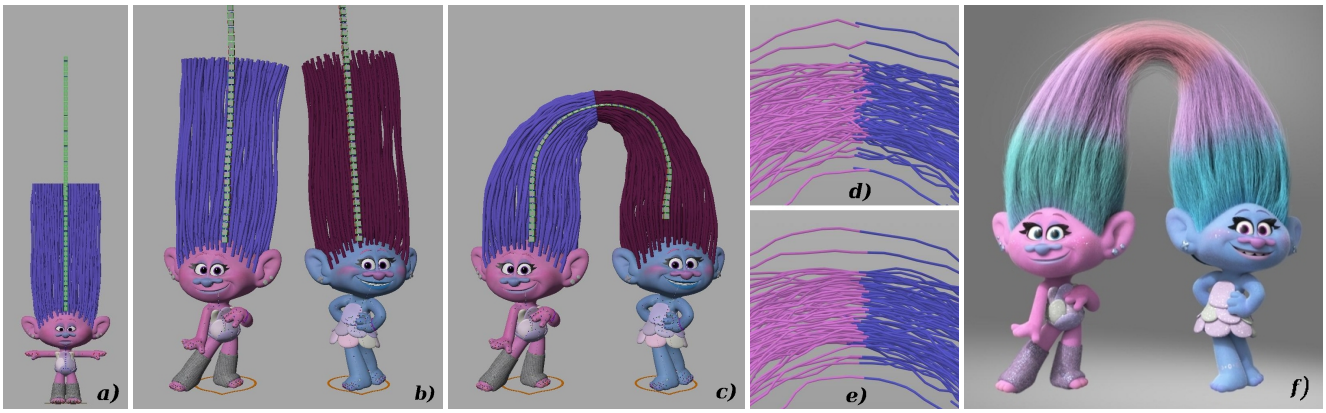

Figure 1: *The Fashionista Twins*: a) Library hair asset containing: a scalp, guide curves, follicles, and hair joints. Two instances of the library hair asset in a shot with b) unconstrained joints, c) constrained joints, d) Render hairs disjoint in the middle, e) Applying *MatchEnds* styler at render time to seamlessly connect hairs, f) Posed seamlessly connected rendered hair.

ABSTRACT

This talk presents the techniques used to create the hair for 'The Fashionista Twins', *Satin* and *Chenille*, from the film *Trolls*. The conjoined twins are uniquely connected in a loop by their brightly colored hair. The seamless connection of their hair posed unique technical challenges in grooming, rigging, and the shot pipeline and it required a collaborative effort to bring their hair to life.

CCS CONCEPTS

• **Computing methodologies → Animation**;

KEYWORDS

hair, grooming, rigging, animation, constraints, seamless, conjoined

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1 INTRODUCTION

The *Fashionistas* presented an unusual challenge because of their conjoined hair that needs to appear connected and seamless across the twins, both in groom and motion. The artistic direction also needed some of the hairs to be smaller in length and not connected in a loop. Our hair rig pipeline is not optimized to have two characters as a single asset as that would duplicate the process of rigging within an asset. Hence, despite appearing as a single character on-screen, *Satin* and *Chenille* are treated as 2 variations (or asset instances) of a single character asset definition in our pipeline. The challenges during the grooming process were to, one, achieve an exact mirrored look between each half of the hair, and two, seamlessly join separate render hairs so the final result is a single strand from scalp to scalp. The shot pipeline also posed challenges in managing the hair asset that required input from two separate characters.

2 GROOMING

2.1 Library Hair Asset / Custom Reference Pose

The library representation of the hair consisted of a set of deformable guide hairs, a set of points (follicles) whereby each point defines an interpolated render hair to grow, and a scalp from which to grow each render hair. However, that meant the library hair asset only represented half of the full production hair style as seen in Figure 1a. To solve the challenge of achieving an exact mirrored look between each half of the hair, we first groomed and styled the *Satin* half of the hair. Next, we established a customized reference pose imagining the full length hair unfurled in its relaxed state as it would look as a single combined asset by rotating the *Chenille* variation about the midpoint of the full length hair. However, this demonstrated three issues: this wasn't a mirror of the hair style, it complicated the render hair association required for the *MatchEnds Styler* described in Section 2.2, and it would result in an unpleasant seam in the middle once the render hairs were merged. The final solution was to instead mirror each deformable portion of the hair (guide hairs and scalp) about the vertical Y-axis (left to right) and then rotate them into the relaxed state. While this correctly mirrored the groom and styling, there were still limitations on achieving exact mirroring because shader stylers such as *Kink* and *Curl* would produce slightly different results due to variations in the noise space. Any deviations in the render hair shape at the connection points were managed with the *MatchEnds Styler* described in Section 2.2 and as seen in Figure 1d and Figure 1e.

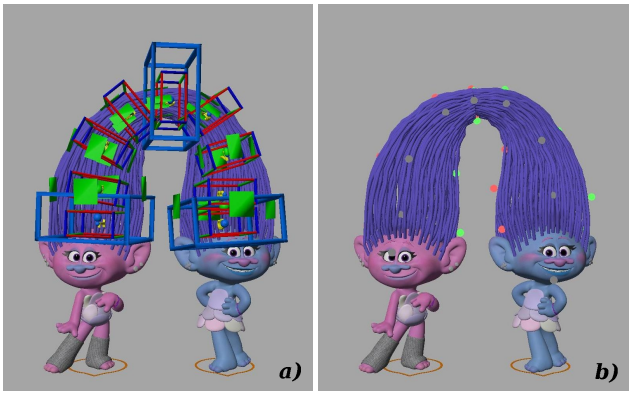

Figure 2: a) Hair joint rig with, b) surface deformer.

2.2 MatchEnds Styler

To implement the seamless connection of the render hair curves, a new Styler, *'MatchEnds'*, was developed for the in-house hair geometry generation library *'Willow'*. This styler operates at render time and seamlessly geometrically connects the two ends of the hair. The implementation of this styler is described below.

- A hair growing follicle on one head is matched to a follicle on the other head using the *'follicleMatch'* follicle attribute.
- The two ends of the curves that match are pulled equally towards one another with a falloff down the length of the hair from the connection point.
- The CVs across the connection are internally treated as part of one curve and are laplacian smoothed.
- Finally, tangency is matched at the last segment of each curve to avoid seeing a break in the render hair when lit.

For Level of Detail purposes in a shot, *Willow's* curve decimation algorithm was changed to pick both matching curves to decimate to avoid a break in the seamless connection of a render hair.

3 MOTION

3.1 Rigging

In rigging, the *Fashionistas* were set up as two instances of the same asset but had to behave as a single connected character. The primary character instance *Satin* was rigged with half the full length hair. The second instance of *Satin* (*Chenille*), was rotated about the midpoint of the full hair and rigged with the other half of the hair.

For animation, a rig was built with a modified version of the Spline IK system that we use for tails and ropes. Although each character only had half of the hair, they both had a joint chain that was the length of the combined hair as seen in Figure 1a. *Satin's* joint chain was controlled by the spline IK system, with the tip constrained to the scalp of *Chenille*. Each joint in *Chenille's* joint chain was constrained to a joint in *Satin*: let n be the number of joints with indices $0..(n-1)$, J_i^s be the i^{th} joint on *Satin's* joint chain, and J_k^c be the k^{th} joint on the *Chenille's* joint chain; J_k^c is constrained to J_{n-k-1}^s. The unconstrained joints are shown in Figure 1b, and the constrained joints are shown in Figure 1c.

3.2 Animation

Animators were provided with the following controls: 3 primary IK controls, 10 secondary IK controls, and scale controls to adjust the cross-section of the hair (Figure 2a). Each IK control had both translation and rotation functionality, and all controls had keyable attributes to specify their parametric location and their region of influence along the curve. In addition, fine tuning of the silhouette was possible with a cage-based surface deformer (Figure 2b). This hair was so performance driven that *Animation* had full control in its shape in shots that there was no need for simulation on top.

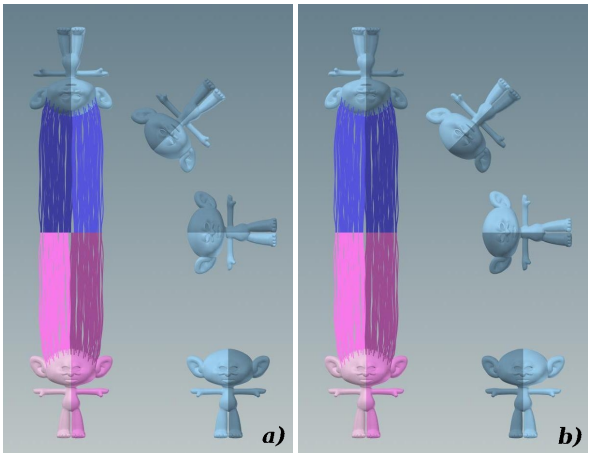

Figure 3: a) Rig output (unsymmetric guides), b) Mirrored output (symmetric curves matching at their ends).

4 SHOT PIPELINE

Managing the pipeline surrounding a hair asset that required input from two separate characters in a shot posed a large challenge. In shots, the representation of *Fashionistas* as two variations of the character asset *Satin* had two repercussions. First, the character asset *Chenille* was not mirrored as shown in Figure 3a. Second, this meant we had two instances of our hair asset, each with only half of the animated data needed to deform the full hair style properly. Hence, our two separate character assets needed to be aware of each other to assemble all the necessary mirroring and deformation data to properly package the hair asset fully together for rendering. Our solution was to output mirrored versions of *Chenille's* guides, render hairs, and scalp in the reference space of *Satin* as shown in Figure 3b. These were then bound to their respective *Satin* counterparts and deformed by the shots animation data from *Chenille* and packaged up into the single final full renderable hair asset within the shot.

5 RESULTS

The Fashionista Twins fashioned their conjoined hair in several shots of the film. The looped connection held up seamlessly under stretching and twisting of the animated hair. Though being a single hairstyle, the challenges imposed by its uniqueness required a tight collaboration between different departments involved in its grooming, rigging, and animation. The existing pipeline limitations had to be overcome to run the hair through in shots. New techniques including a render-time styler had to be developed to achieve the desired artistic results. The success of the results and the collaborative overcoming of the challenges is a promising example, both technically and artistically, of bringing new and unusual or unique characters to life on screen.