Collaborative Costume Design and Construction on *Incredibles 2*

Aimei Kutt
Pixar Animation Studios
aimei@pixar.com

Fran Kalal
Pixar Animation Studios
fran@pixar.com

Beth Albright
Pixar Animation Studios
balbright@pixar.com

Trent Crow
Pixar Animation Studios
tcrow@pixar.com

Figure 1: Costumes in *Incredibles 2*.

ABSTRACT

When *Incredibles 2* moved into production, we knew it would look bigger and better than the original film, with the improvements in technology since 2004. Costumes are important in this stylish world, and it was a challenge finding consensus on the look and deciding how to apply our technical advances. Director Brad Bird was driven by 2D animation and interested in graphic character shapes. Costume Designer Bryn Imagire preferred a natural cloth look, knowing that the world would be rendered realistically. The character tailoring and shading teams needed to resolve the dichotomy of stylized yet realistic form, shading, and movement, dress a large number of distinctive characters with clothing that enhances their story arcs, and make the costumes perform well in shots. This goal necessitated an extremely collaborative workflow and greater trust between people and departments, also empowering technical artists to have more ownership over garment design and look in the film.

CCS CONCEPTS

• **Computing methodologies** → **Animation**; **Rendering**;

KEYWORDS

costumes, tailoring, cloth simulation, shading, collaboration

ACM Reference format:
Aimei Kutt, Fran Kalal, Beth Albright, and Trent Crow. 2018. Collaborative Costume Design and Construction on *Incredibles 2*. In *Proceedings of SIGGRAPH '18 Talks, Vancouver, BC, Canada, August 12-16, 2018,* 2 pages.
https://doi.org/10.1145/3214745.3214790

SIGGRAPH '18 Talks, August 12-16, 2018, Vancouver, BC, Canada

ACM ISBN 978-1-4503-5820-0/18/08.
https://doi.org/10.1145/3214745.3214790

1 FINDING OUR DIRECTION

To quickly solve our design questions, typically linear departments had to start working in parallel. Rigging delivered first passes at character modeling and articulation, and tailors tested cloth setups while the bodies were changing daily. We presented rough supersuits and civilian outfits with shading for Bob, Violet, and Helen, and had open discussions with Art, Animation, and Shot Simulation. By seeing characters in clothing, we discovered where we needed body proportion changes and rigging deformation support to hit silhouettes and maintain stable simulations. Tailors simulated cloth on early animation cycles, revealing useful information about how these characters should be animated as well. Loss of work and staying in sync with other departments were problems during this experimental period, and we had to find ways to adapt, such as automating our collision body setups. These tests opened up the conversation between departments, established our pipeline, told us what to request from Software Engineering, and proved we had an eye for design. By the time the bodies stabilized and we received costume packets, we had initial direction and a foundation to build upon for the Super and Civilian worlds.

2 SUPER VS. CIVILIAN WORLDS

Most characters were designed for the Super world, with giant muscles, sharp angles, and extreme shapes. The supersuits had to highlight the contours of these bodies and create tight folds like spandex or neoprene compression garments. Because our cloth could not affect the shape of the body, we worked backwards to mimic compression. To do this, we needed to target a cloth rig with kinematic springs (kinsprings) and pose-based scaling (dynamic 3D alterations). A simple cloth-to-body warp had projection problems in the armholes and legholes and could not slide over the body topology, so we collaborated with Rigging to create rigged guides for these regions. This cleaned up our simulations and gave the suits nicer lines. To minimize distortion of key areas like chest logos, belts, and briefs, we kept these regions stiff and allowed the rest of the cloth to stretch and compress around them. We requested a new spring for our simulator, Fizt, that keeps cloth on the collision body surface but allows it to slide, and used it on Bob's supersuit chest to keep the logo flat and graphic. To further clean up this area, we used a geometric relax post-simulation, which can relax a mesh while preserving shading. In shading, we projected the logo graphics based on how they were intended to move in simulation, and created shot-specific UVs for suit stretching.

The civilian world dresses in upscale mid-century inspired fashion, and making clothing like this takes skill, patience, and attention to detail. Our early garments were stiff, with stylized folds and sharp motion. But after seeing them in shots and lighting, our costume designer pivoted us toward a natural direction, celebrating draping, dynamic simulation, and realistic shading. We still wanted structured shapes and clean silhouettes, but motivated by the construction, fit, and fabric type. We used realistic tailoring with semi-flat-panel construction and physical details like pockets, rolled cuffs and simulated lining, but manipulated proportions to achieve a stylized look. To maintain good fit during body stretching, we applied dynamic 3D alterations and 2D panel scaling based on body lengths, as well as kinsprings to create appealing wrinkles in regions like the back knees. For messy and rumpled clothing, we could bake in wrinkles, intentionally create a poor fit, and apply less dynamic scaling. Shading helped get much more costume variation by adding different colors and patterns to the basic garments. This was especially true on BGs and primary characters like Evelyn, whose story arc was told by the patterns of her clothing.

3 OPTIMIZED WORKFLOWS

When simulating clothing on characters with non-physical body deformation, cloth rigging is important for out-of-box performance. However, it is often difficult to set up. On this show, Tailoring found a few fast and simple cloth rigging methods that helped many characters. We built low-res cage meshes for structured garments like jackets and shirts. These were warped to the body and modified with delta mush, relax, and quasi-static cloth deformers, giving us better shape preservation in regions like collars, armpits, crotches, skirts, and belts. Fizt was upgraded mid-show to allow layered regional and directional dynamic 3D alterations, which helped preserve the flat-panel look and give us more control.

Tailoring and Animation worked simultaneously, so we often had a wide variety of production shots for testing. By knowing the shot contexts and running simulations, we could strategically improve performance on garments where it mattered. Animation ran out-of-box simulations, helping them adjust their acting to account for cloth and giving us clues on how the materials were behaving. This was often done while garments were still in progress, on costumes like Edna's kimono, Underminer's outfit, and Bob's robe. Due to the speed of production, problems with the garment setups were sometimes discovered in shot simulation before we could address them. However, most tailors later joined the simulation team and helped create overrides for recurring shot-specific situations.

Figure 2: Bob rolled-cuff shirt and design

Shading worked to get representative surface and lighting response on costumes early, helping tailors fine tune the simulation properties, geometry thickness, and catch problems like pattern stretching. It gave context in reviews for garments like a metallic supersuit, terrycloth robe, and patterned pajamas, which would otherwise be hard to judge. The back-and-forth between teams could be time consuming, so when shading artists were unavailable, tailors set up hardware textures in Presto. This often helped the director decide what colors and patterns he wanted as well.

4 COLLABORATIVE DESIGN

Using the knowledge of what was possible with our tools and time constraints, tailoring and shading artists were empowered to experiment with design ideas and present their own suggestions. Art gave us loose model packets - usually one rough drawing and garment photo reference - which meant the specifics of fit, detail, and construction were defined through our iterative exploration, and often modified with Art approval. The loosest packets were the Wannabe Supers, Brick and Screech, who were hard to design in 2D and had many technical challenges to consider. The rigging and tailoring artists presented sketches and 3D mockups for possible solutions, helping us find the best look more efficiently. On Helen's new supersuit, shading artists had the idea of combining scales with a knit pattern, and decided on a carbon fiber logo material to feel futuristic. We also pushed the fuzziness of Violet's sweater, which was so appealing that we were able to get the support needed to render fuzzy garments on this show. These details and more, brought by the technical artists and coached by the costume designer, helped increase the quality and unique look of our costumes.