

Adding Style, Folds, and Energy to the Costumes of *Soul*

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Figure 1: Costumes from *Soul* ©Disney/Pixar.

ABSTRACT

The Human World of *Soul* takes place in a vibrant New York City, full of life, energy, and everyday people. Our character designers captured this in their expressive drawings, depicting clothing in a complex and artfully messy way. When creating costumes in CG, however, cloth TDs were accustomed to simplifying the designs to make cleaner, more graphic looks. These techniques have been established and refined on our previous films, such as *Incredibles 2* and *Up*. On *Soul*, we sought to develop a different look for costumes that would support the story, style, and energy of the film.

CCS CONCEPTS

• Computing methodologies → Physical simulation.

KEYWORDS

costumes, tailoring, cloth, simulation

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1 DEVELOPING OUR ART DIRECTION

The key to pushing for a new style was figuring out how costumes could reinforce the character designs and support the story. *Soul* aimed to distill and exaggerate the essence of everyday people - their humor, playfulness, relatability, grunginess, and idiosyncrasies. We wanted to contrast the ethereal and simple *Soul* World with a textured and complex Human World. We also wanted to differentiate our aesthetic from the characters of past films. For example, *Incredibles 2* [Kutt et al. 2018] idealized their superhuman world with clean sharp lines and few folds, while *Up* [Kalal et al. 2009] pursued a miniature feeling resulting in rounder folds and stiff cloth. *Soul* character designers used warbly lines on the clothing silhouettes, tight bunched folds in key places, large and small shape contrast, graphic silhouette breaks and flares, and an emphasis on unique human imperfections. In previous Pixar films, forcing specific folds and shapes with rigs and constraints often resulted in stiff motion. A major theme in *Soul* is jazz music, which has a free and chaotic energy. We wanted to express this visually by giving the costumes a heightened energetic motion, while still maintaining art-directed forms and folds.

2 TAILORING

Our main character, Joe Gardner, had such a wide array of clothing, that he served as the perfect test subject. The techniques we developed for him were expanded upon and applied across all garments on the show. Joe's pants were drawn loose-fitting with elegant draping over his bony physique. Our default cloth setup produced large stiff folds that tended to smooth out like tubes when at rest. For all garments, we experimented with increasing geometry resolution, reducing the stiffness and damping of the cloth, and removing all constraints and autoscaling that held or minimized folds. This softer cloth created silhouette warbles naturally, draped well in most

poses, and highlighted Joe’s underlying bone structure. Looser garments could wrinkle and flow freely, resulting in more energy and unpredictability in the simulation, mimicking the improvisational nature of jazz.



Figure 2: Joe garment tests ©Disney/Pixar.

For tight-fitting garments, like Joe’s turtleneck, the designers drew many thin folds accentuating the armpits, elbows, neck, and belly. We knew how to create rigged folds, but producing physical, non-rigid folds with art-directed placement took some experimenting. In real life, folds form when clothing doesn’t fit quite right. We borrowed this idea and intentionally made our garments ill-fitting. We raised and tightened armholes in the cut, so folds would occur in the armpits. We stretched the cloth over Joe’s belly to create tension folds, and made sleeves and pant legs extra long, then bunched them up using our interactive simulator to add more detail and interest to the silhouettes. Increasing cloth-to-body friction helped hold these naturally occurring folds, instead of sculpting and stiffening them as we have done in the past.

Our first inclination for bulky garments and outerwear was to stiffen up the cloth parameters, but that reduced the energy and movement. We found that our softer cloth parameters would hold their shape if we used more physically accurate tailoring and construction detail than on previous shows, including jacket lining, physical pockets, ties, and bows. Many of the jackets, including Joe’s overcoat and suit jackets, as well as the background characters’ bulky coats, used double-sided sim meshes, which gave them a perceived weight. To create wrinkles in the sleeves, we shrunk the lining, forcing the outer sleeve to buckle. For bulky coats, we used a combination of force in the direction of the normals and “limit springs,” which prevented cloth vertices from getting closer than a certain distance to a set of cloth faces. For puffer coats, we also simulated interior cloth pillows for structured bulk. Joe’s tight brown suit used a simulated cloth belly that could compress and fold from the tension, giving the appearance of fat rolls. These techniques allowed us to create a wider range of garment silhouettes. In fact, all of the background characters shared the same body, relying entirely on hair and cloth for variation in their silhouettes.

After developing guidelines for loose-fitting, tight-fitting, and structured garments, we added a few finishing touches to push our assets even further stylistically. We used our interactive simulator to create “memory wrinkles” by wadding up the garments or bending elbows and knees, then using the wrinkled poses for the

default bend angles. We increased bend stiffness only in areas of high curvature to avoid making the whole garment too rigid. This technique was used on Joe’s hospital gown to make it feel used and worn, as well as on the inner elbows of most shirts and jackets and on the back of pant knees. Springs were added along seams to add puckering, breaking up smooth regions. We introduced flares into the cut of the garments on the ends of sleeves, pant legs, bodices, skirts, and collars. On more featured characters, we took a finishing pass adding asymmetry to collars, cuffs and folds. These subtle details enhanced the visual interest of each of our characters.

3 SHOT WORK

Overall, simulations resulted in more detail and chaos, and we embraced this. Many costumes performed well out-of-box due to the natural tailoring and stylistic allowance of imperfection. In some action shots, we added wind for even more energy. The reduced damping and softer fabrics often resulted in oozing in low-energy shots. We found unique solutions for the different situations this would appear - animating weak glues, increased damping, increased cloth-to-cloth dynamic friction, or post-sim cleanup. We often organized and cleaned up sharp and crunchy folds post-simulation with deformers and sculpts, instead of erasing them completely as we would have on past shows. Occasionally, we even increased the size and scale of folds on silhouettes for more dramatic warbles.

Because the cloth was less predictable, standard A-pose prerolls did not always produce optimal draping. We relied more heavily on creating custom start poses and draping on a per-sequence or per-shot basis. To do this, our software engineers upgraded our interactive simulator to better handle shot work. We pulled cloth around and hand-placed folds for sequences with Joe’s hospital gown in the bed, Joe sitting at the piano in his suit, characters sitting in barber chairs, characters in extreme poses, and so on. Supplying the simulator with a more art-directed start pose guaranteed a more visually pleasing result with minimal post-sim shot sculpting. For certain garments, we created custom fit alterations for different poses to have a more appealing drape. For example, when Joe sits hunched at the piano in his nice blue suit, we altered the 3D rest shape of the jacket to have higher shoulders. These techniques helped us carry the art direction and style from early design through to the final frames of the film.

4 CONCLUSION

Costumes are an important part of film, as well as a good opportunity to push stylization in both form and motion. We found and communicated our ideas by analyzing the show’s artistic goals and developing style guidelines for different types of garments. By experimenting with new tailoring techniques, changing our approach to simulation shot work, and pushing the limits of existing technology, we were able to develop a new and unique costume look. These costumes supported the design and animation of the characters and world, enhancing the look and feel of *Soul’s* New York City.

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