Coco AnimSim: Increasing Quality and Efficiency

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Figure 1: Miguel and Family - Final film frame ©Disney/Pixar. All rights reserved.

ABSTRACT

Coco's clothing design and story presented challenges for the Simulation and Animation departments, requiring a new approach to create appealing clothed silhouettes and believable motion on characters. Many of the characters are skeletons, whose silhouettes are significantly altered by clothing, increasing the influence of simulated elements on acting. The main living character in the film, Miguel, uses clothing to disguise himself, so seeing interaction with his cloth was also essential for acting. To achieve these requirements we created a new process, AnimSim, consisting of fast, stable clothing simulations, simple cloth interaction tools, and a refined partnership between the simulation artists and character animators. Our collaboration increased quality and efficiency for both departments by providing animators with context early in the process and cleaner animation for simulation artists.

CCS CONCEPTS

• **Computing Methodologies** → **Simulation and Modeling**; • **Animation**;

KEYWORDS

simulation, animation

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1 TAILORING FOR STABILITY

Coco's clothed skeletons presented an immense stability challenge. The loss of body mass created a complex canvas for tailoring. We wanted animation to be able to run full simulations on skeletons with extremely high success rates, even during animation blocking. Tailors used varied approaches to create beautiful garments with stability as a priority.

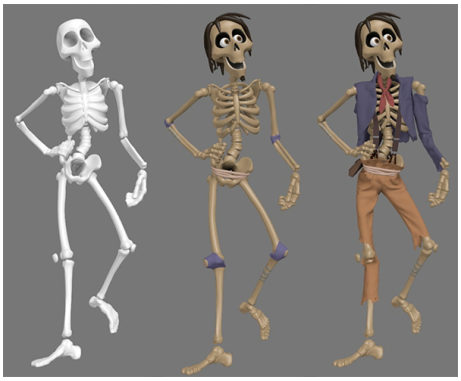

Figure 2: Hector collision body, joint cloth, and full costume. ©Disney/Pixar

We added extensive upgrades to our cloth simulator in both collision detection and performance, used higher resolution cloth, and combined bones into enclosed objects where possible. For stability in joints, tailors filled the negative space with cloth strips or normal accelerated force fields that kept garments from falling into separated joints. To fill negative space for volume as well as guard against holes and gaps that would cause instability, tailors added volumetric cloth in strategic areas.

2 ANIMSIM TOOLS

To support Miguel's interaction with his pockets, zippers, and hood, we created new tools for cloth acting. These included a new spatial grabbing tool called a simgrab, and a robust, fully simulated pocket tool that animation could use to interact with the simulated pockets. Animators used simgrabs to accurately control a clothing grab's position, duration, and strength, while iterating. The pocket tool gave animators controls to insert/remove hands from pockets while having full simulation feedback.

With these tools, animators quickly met the physical needs of positioning and timing during animation. Thus, acting choices and performance became the focus, instead of mere functionality.

Figure 3: Animation-run sim of Miguel putting hand in pocket. ©Disney/Pixar

3 ANIMSIM WORKFLOW

The classic approach to clothing simulation involves simulating garments on characters' bodies once animation is complete. The typical hand-off between animation and simulation is linear; animate first, simulate second. Problems arise when the physical behavior of the cloth does not coincide with the acting. This process relies too much on guesswork to achieve believable acting with clothing.

Our new workflow consisted of building stable cloth assets that could be simulated during various stages of animation, from blocking to polish. We added a new simulation task to animation's process, allowing them to simulate cloth assets prior to their preview renders. Alongside animation, simulation artists evaluated the cloth motion iteratively, improved the performance by changing cloth and field parameters, and collaborated while the acting decisions were being made.

Other benefits come from working in this cyclical way. When running sims earlier, animation can better prioritize their budget. Consider the case where a dress covers the leg motion. It is wasteful to spend time polishing leg animation that is hidden by clothing. This helps save valuable production time while maintaining high quality. Animators are also now aware of pops or intersections that break simulation, since they are running simulations. This results in cleaner inventory and throughput for all of us.

4 COMPLEX ANIMSIM

The character Chicharron lays in a hammock, half buried by a collection of props. The composition and motion of the hammock, and props had a large influence on the acting. The complexity the effect required Sim to develop a two part simulation. First a cloth simulation ran on the shirt and hammock, followed by a rigid body simulation for the props.

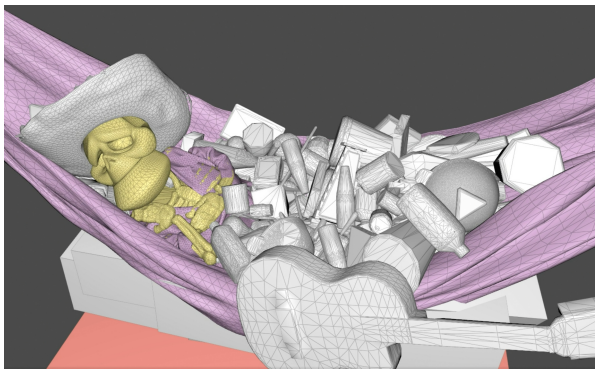

Figure 4: Chicharron in his hammock. ©Disney/Pixar

Sim enabled animators to run the simulations themselves; these simulations provided context, and expanded the acting choices for animators, Sim artists, and directors, improving the quality and efficiency of the work. Sim built tools that provided animators with the ability to shape the hammock, adjust the starting position of props, convert a prop from dynamic to kinematic, or completely remove a prop from a shot. These tools were also extensively used by Sim artists. Sim artists collaborated directly with animators to resolve issues and finesse the sims; examples included adjusting preroll, adding and removing collision objects, and adjusting dynamic properties.

5 SUMMARY

The AnimSim process allowed us to make cloth-involved acting decisions earlier, and the freedom to tackle more complexity. We were able to achieve a higher volume of work with more efficiency, while elevating quality and performance.

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