Reinventing a Character Creation Pipeline Using Landmarking, Simulation, and Shared Character Data

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ABSTRACT

Reinventing the humanoid character build pipeline at Blue Sky Studios presented several opportunities to create synergy between different processes, all centering around the concept of creating and maintaining a standardized Universal Mesh. The automation of rig argument placement, the building of rigging tools that use aspects of character geometry as inputs, the separation of character data from assets, and the creation of a stylized simulation-based approach to deform animated characters were all influenced by this base Universal Mesh. Ultimately, this approach offered new ways to get the most out of our character pipeline.

CCS CONCEPTS

• **Computing methodologies** → **Computer graphics**.

KEYWORDS

production efficiency, asset pipeline, deformation, character data, universal topology, landmarking

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1 UNIVERSAL MESH

To take a fresh look at what a Universal Mesh could be, we started by examining all humanoid characters created at the studio, tailoring a polygon count and topology layout that would maximize the variety of characters we could create. Then, generating a set of shaded landmarks that denote topology placement best practices, deformation areas, and fur/groom zones, the landmarking was extended to include rig argument placement points. This allowed us to use the Universal Mesh not only as a base for modeling our humanoid characters, but also as a first step for rig installations.

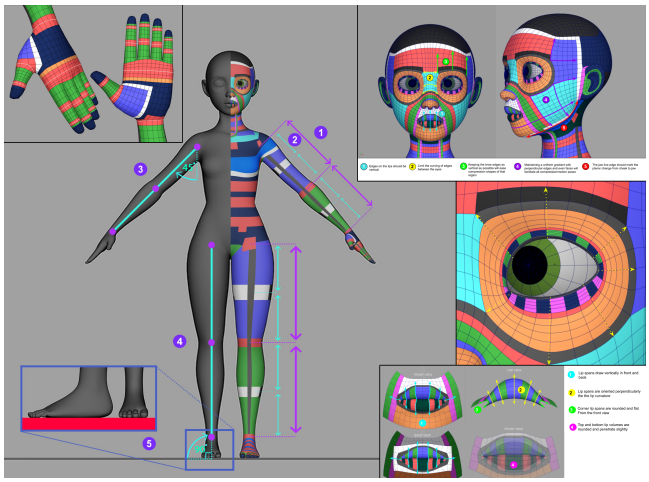

Figure 1: Example of landmarked Universal mesh and modeling guidelines.

The Universal Mesh was designed to have an odd number of spans through strategic patches of the model for possible curvatures based on the design. This odd number would allow the least amount of silhouette deviation and allow seamless transfers through a wide variety of potential shapes.

Two possible mesh workflows were designed to accommodate the need for higher resolutions based on character design; they were as follows:

1.1 High Res/Alternative Topology

The High Res/Alternative Topology is either a higher-res version of the Universal Mesh or a mesh that is a derivative of the Universal Mesh. If the base Universal Mesh is incapable of hitting the silhouette at the cost of acceptable deformation; this process was to be used. The rigged universal mesh would drive the High Res/Alternative Topology with Delta Mush and Tension Map deformers placed within the stack on the High Res/ Alternative Topology. Blendshape deltas would then be added to the High Res / Alternative Topology for any needed high-density shape work.

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1.2 Driven Displacement Map Mesh

With viewport visualization of Maya displacement maps now in real-time, the goal was to drive a Displacement Map Rig with the Universal Mesh Rig as a solution for when a design call-out could not be hit with the native density of the Universal Mesh. Weaving in a Zbrush workflow pipeline with the addition of a pose space deformation system, characters that required a higher amount of detail would have their silhouette manipulated with a displacement map, allowing animators to produce performances without questioning what is actually in-camera. This information would travel down the pipeline to texturing and garment development. The maps were then to be converted to vector displacement maps at final render for greater fidelity.

2 MORPH SKELETON

The Morph Skeleton is a unique rig system that installs into a model to allow the character's pre-skeleton to be driven by its geometric volume. The pivots of the system are riveted to the geometric volume through registered surface coordinates of attachment planes which are wrapped to the geometry itself. Once we implement it in a character model using a universal topology with landmarks, the Morph Skeleton becomes a rig that automatically repositions joints and arguments to any new character design that is applied as a blendshape target. This technology allows us to easily create an entirely new character rig installation accurately, while also reusing all available outputted deformation data from another character rig that uses the same universal topology. Once a skeleton is "morphed" to a new model's shape, a user interface made up of selectable controls on the skeleton lets the TD make final adjustments across the entire joint hierarchy for orientation and placement. Special effort was placed on making the interaction approachable, so any artist (not only TDs) would be able to work with this skeleton setup.

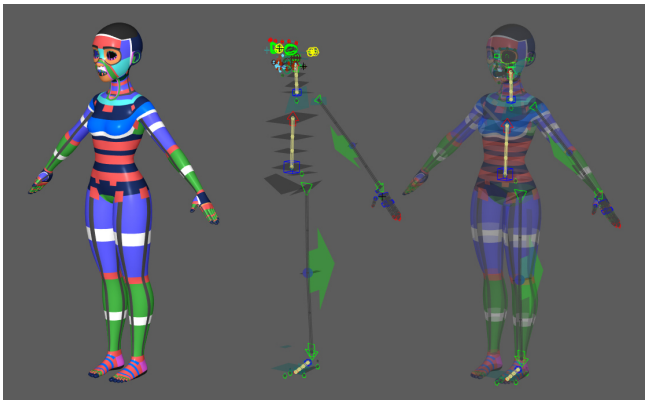

Figure 2: Morph Skeleton rig with tweak controls and attachment planes beside landmarked Universal Mesh.

3 RIG BUILDER UI AND CHARACTER DATA

The Rig Builder UI is a tool that combines the use of the Universal Mesh, Morph Skeleton, rig install scripts and Character Data import/export. This tool creates an all-in-one place for almost any artist in the Character Department to test out a new model volume or new garments within minutes. The use of this technology was instrumental when we began iterating on character design early in our production. Proportionality, garment simulation, and animation testing were all accomplished fast and without the need for a rigger to act as a middle man in the process. The tool also gives the user the ability to export data from a rig to be used on a different model with similar volume. The exported Character Data is composed of all deformation and motion system configuration data.

4 PUPPET RIG

The Puppet Rig is a simulation based approach to deformation and corrective generation tailored for feature animation. Utilizing Ziva Dynamics (a muscle based system) as our simulation software, we adopted a stop motion inspired workflow. Contrary to anatomical, muscle based setups, the Puppet Rig uses a unique armature style bone and tissue design. Instead of focusing on dynamics and sliding effects, the Puppet Rig targets volume preservation, broad deformation falloff, consistency, and clean geometry output. Simulation is done at the tissue level, and the Universal Mesh is bound directly, via an in-house deformer, bypassing the need for a 'final skin' simulation step. The results can be harvested directly as baked shapes, or used as source data if paired with a machine learning/RBF approach. The Simulation inputs leverage the Universal Mesh and Morph Skeleton to shift to different character forms, enabling a quick start to corrective generation that can be automated.

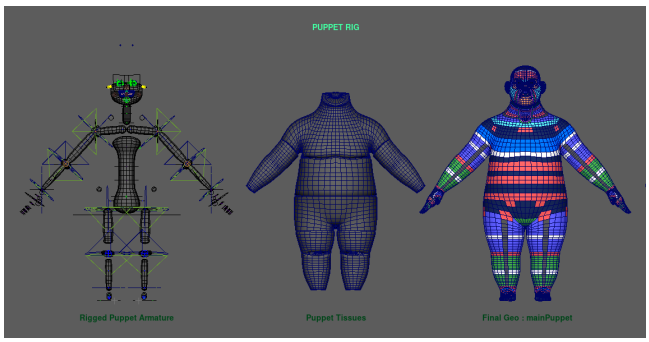

Figure 3: Puppet Rig bones beside the Puppet Rig tissues and landmarked Universal Mesh.

5 CONCLUSION

Although the new Blue Sky character pipeline may never be fully used in production, there are several ideas and techniques from it that might serve as an inspiration for future work in the feature animation industry. Using the Universal Mesh to drive rigging, creating tools that support this concept and extend data exchange, as well as re-examining how we can use simulation for feature animation can create benefits that are seen across multiple disciplines in a studio pipeline.