Scalable Blendshape System for Texture Based Facial Animation

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Figure 1: The Face Studio, Animator's Viewport, Face Texture, Final Render ©Warner Bros Inc., The LEGO Corporation. All rights reserved.

ABSTRACT

To support the increased animation demands of *The LEGO Batman Movie*, the team at Animal Logic developed a unique blend-shape system for animating LEGO faces. Animators were presented with real-time texture previews, and the ability to quickly sculpt the shapes of contour-curves by efficiently modifying vertices and tangents. The proprietary animation system would create new blend-shapes on the fly for each new pose.

CCS CONCEPTS

•**Computing methodologies** →**Animation;** *Parametric curve and surface models;*

KEYWORDS

ACM proceedings, Rigging, Texture, OpenGL

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1 A NEW STRATEGY NEEDED

The team's previous approach of animating the individual XY coordinates for curves' CVs and tangents, had resulted in excessive numbers of function curves. In complex faces such as UniKitty this resulted in key-frame edits taking upwards of 20 seconds. Clearly, with the increased complexity of *The LEGO Batman Movie*, the team would have to devise a whole new animation strategy. The result was a system that stored animation as a delta on each curves' CV and Tangent. Each delta was then associated with a blend weight, and the proprietary animation system would create new blend shapes on-the-fly for each new key pose.

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2 PROBLEMS OF SCALABILITY

The previous animation system exposed $Nac = Ncu * Ncv * Nco$ animation curves for each characters face, with Ncu being the number of curves, Ncv being the average number of CVs and tangents per curve, and Nco being the number of coordinates used (XY only to represent 2D curves). Thus, for an average shot containing 50 key poses (including 25 unique poses), on a character with 50 curves, and an average of 30 CVs and tangents, animators were required to animate 3000 function-curves with a maximum of 50 keyframes per curve.

By modifying the approach to incorporate one animation curve per blend-shape, with individual CVs and tangents positions being recorded as a delta from the original, the new system would expose a number of animation curves of $Nac = Ncu * Nup, Nup < Nkp$ with Nup being the number of unique key poses in the shot. The new system used on the same average shot would only expose 1250 animation curves with 75 keyframes each.

3 CHALLENGES

The team's primary challenge was to maintain the ease-of-use for animators who were unaccustomed to creating blend shapes on each key pose. The tools were tailored to the specific workflow and animation style developed on *The LEGO Movie*. Even with the new system, long monologues resulted in a significant increase in shapes. To address this the team implemented cleanup tools that would delete unused shapes and ensure that these exceptional shots remained manageable.

4 CONCLUSION AND FUTURE WORK

With new developments in the Animal Logic Animation Library, the team has made it possible to animate hundreds of characters at unprecedented speed while maintaining extremely high quality, enabling significant increases in the visual complexity of the LEGO Faces, which posed its own construction challenges to the LEGO Corporation. Performance could be further enhanced with the use of a hash of individual shapes, which would ideally increase the consistency and efficiency of reuse. Furthermore, the use of this dynamic animation system could be applied to other contexts besides realtime texture generation.