COMPUTER-ASSISTED SOLID 2D ANIMATION

Location: Inria—U. Bordeaux, MANAO research team (http://manao.inria.fr)
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Project description

Existing 2D computer-assisted animation tools can be used to create planar animations (e.g., walking cycles) and simple 3D movements (e.g., rotation of a face). However, for more complex 3D movements (e.g., out-of-plane rotations, folding a shape onto itself), the creation process remains laborious, the user often having to add intermediate poses.

The main aim of this thesis is to investigate new methods and develop new tools to overcome these limitations, while remaining compatible with conventional animation workflows and providing adequate controls for artists. To achieve this, the approach envisioned is to transform 2D guide shapes into 3D volumes that can be manipulated by the artist, which will then be used to interpolate key drawings. This approach is inspired by the traditional animation method known as "solid drawing animation" [1], developed from 1930 onwards by animators at Disney Studio.

This approach raises two central research questions: 1) How can we reconstruct, for each key frame, minimal 3D guide volumes from the construction lines of the guide shapes, and then intuitively control their animation and deformation in 2D? 2) How can we link these guiding volumes together, in particular establish their depth relationships, when the artist draws only the features visible in the key frames, and then interpolate these features in the intermediate frames, taking into account the movement of the 3D guides and induced occultations?

It should be noted that, unlike previous work in sketch-based modeling such as [2,3], we will not be seeking to reconstruct the complete 3D scene described (incompletely) by a drawing. Like the guide shapes to which they correspond, our 3D volumes will be independent of each other, viewed by an orthographic camera, with no notion of occlusion or depth, which should simplify the first problem. The second question remains very ambitious, all the more so by offering non-linear controls of the result to an artist,

but we will be able to capitalize on the data structures and algorithms developed in our current system [4,5].

Expected skills

The successful candidate should have taken Master courses in Computer Graphics and have a strong experience in C++ programming. Additional skills in some of the following topics would be appreciated: computer vision, user interface, numerical optimization. Personal interest for drawing and 2D animation would be a plus.

References

[1] O. Johnston, F. Thomas. The illusion of life: Disney animation. 1995, Abbeville Press.

[2] C. Zhang, L. Yang, N.Chen, N. Vining, A. Sheffer, F. Lau, G. Wang, W. Wang. CreatureShop: Interactive 3D Character Modeling and Texturing from a Single Color Drawing. IEEE TVCG, 2022, pp. 1-18.

[3] F. Hähnlein, Y. Gryaditskaya, A. Sheffer, A. Bousseau. Symmetry-driven 3D Reconstruction from Concept Sketches. SIGGRAPH, 2022.

[4] M. Even, P. Bénard, P. Barla. Non-linear Rough 2D Animation using Transient Embeddings. Computer Graphics Forum (Eurographics), 2023, 42, pp. 411-425.

[5] M. Even, P. Bénard, P. Barla. Inbetweening with Occlusions for Non-Linear Rough 2D Animation. Research Report RR-9559.