

Sketching cinematography: from storyboard to layout animation.



This PHD thesis will take place in the ANIMA team at INRIA Grenoble Rhone Alpes, under the supervision of Remi Ronfard, Research Director at INRIA and scientific leader of the ANIMA team.

Contact : Rémi Ronfard, tel. 06 69 53 12 87, remi.ronfard@inria.fr.

Context

ANIMA is a new team being created at INRIA in 2020 with the goal of « authoring and directing animated story worlds ». ANIMA is a continuation and off-spring of the IMAGINE team (2012-2020). One central goal of the team is to generate 3D animation from sketches and storyboards.

An important step towards this goal is the generation of layout animation from storyboards. Storyboards are 2D sketches representing the desired animation with the screen positions, orientations and poses of all elements in the scene (Begleiter 2011, Price and Pallent 2018). Actor and camera movements are depicted using conventional arrow signs (Goldman 2006). Storyboards are then synchronized to a recorded soundtrack to provide a 2D animatic. The next step in the traditional animation pipeline is layout animation, which creates a 3D version of the animatic, using a low resolution version of the 3D scene. A key element in layout animation is the « blocking » of the scene, which computes the relative positions of the scene elements and the camera in 3D space (Proferes 2017).

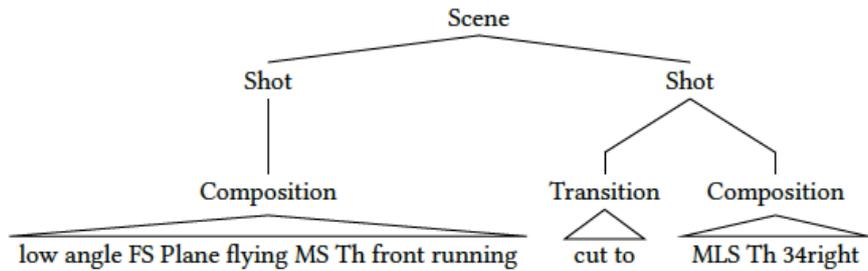
Objectives

The goal of this PhD will be to automatically generate actor and camera movements in world coordinates from two or more storyboard panels indicating the actors positions and movements on screen. Previous work has been limited to static scenes with limited camera movements. In this Phd thesis, we would like to propose a general framework for arbitrarily complex scenes, with synchronized camera and actor movements (Ronfard 2019).

The scientific problems to be adressed during the thesis are as follows :

- Parsing storyboard panels into screen compositions, camera actions and actor actions (Goldman 2006, Ronfard 2019).
- Solving for actor poses and camera position, orientation and field of view for any given screen composition (Drucker 1996).
- Interpolating the actor and camera poses between compositions in an efficient and aesthetically pleasing manner. To that effect, computational measures of movement aesthetics will need to be proposed and evaluated. Actor and camera movements will be computed as solutions to a constrained optimization problem with projective space-time constraints (Witkin and Kass, 1988, Gleicher 1992, Guay et al . 2014).

In each case, we would like to offer a sound and complete mathematical formulation and solution, supported by an efficient implementation and a formal validation based on expert evaluations and user studies.



Example of layout animation created by an artist from the storyboard of « North by northwest » by Alfred Hitchcock.

This PhD work will be implemented in the Unity 3D real-time game engine, using 3D assets already created by INRIA and replicating existing 3D scenes from well known movies (North by North West, Back to the Future). This will provide a « ground truth » of 160 layout animation shots created by professional artists together with the corresponding storyboards which will be used to evaluate and validate the proposed solutions.

The topic is proposed to Masters students in computer science or applied mathematics with excellent skills in geometry and computer graphics.

References

1. [Marcie Begleiter](#), From Word to Image: Storyboarding and the Filmmaking Process. Michael Wiese Productions, 2011.
2. Steven Drucker. Intelligent Camera Control for Graphical Environments. PhD thesis, MIT, 1994.
3. Michael Gleicher. Through-the-lens camera control. SIGGRAPH 1992.
4. Martin Guay, Rémi Ronfard, Michael Gleicher, and Marie-Paule Cani. Space-time sketching of character animation. SIGGRAPH 2015.
5. Andrew Witkin and Michael Kass. Spacetime constraints. SIGGRAPH 1988.
6. Fraser MacLean. Setting the Scene: The Art & Evolution of Animation Layout. Chronicle Books, 2011.
7. Steven Price and [Chris Pallant](#), [Storyboarding: A Critical History](#), 2018.
8. Nicolas Proferes. Film Directing Fundamentals: See Your Film Before Shooting. Routledge, 2017.
9. Ronfard et al. The Prose Storyboard Language: A Tool for Annotating and Directing Movies, Arxiv 2019.
10. Goldman, D. B., Curless, B., Salesin, D., and Seitz, S. M. Schematic storyboarding for video visualization and editing. *SIGGRAPH 2006*.