A Smart Assistant for Shooting Virtual Cinematography with Motion-Tracked Cameras

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ABSTRACT

This demonstration shows how an automated assistant encoded with knowledge of cinematography practice can offer suggested viewpoints to a filmmaker operating a hand-held motion-tracked virtual camera device. Our system, called *Director's Lens*, uses an intelligent cinematography engine to compute, at the request of the filmmaker, a set of suitable camera placements for starting a shot that represent semantically and cinematically distinct choices for visualizing the current narrative. Editing decisions and hand-held camera compositions made by the user in turn influence the system's suggestions for subsequent shots. The result is a novel virtual cinematography workflow that enhances the filmmaker's creative potential by enabling efficient exploration of a wide range of computer-suggested cinematographic possibilities.

Categories and Subject Descriptors

H.5.1 [**Multimedia Information Systems**]: Animations, Video

General Terms

Algorithms, Human Factors

Keywords

Virtual Cinematography, Motion-Tracked Virtual Cameras, Virtual Camera Planning

1. INTRODUCTION

Creating camera edits and movements for computer generated animation remains a time-consuming and largely manual endeavor requiring cinematographic skill and experience with 3D animation packages. Some technically-savvy filmmakers are now using motion-sensing devices to capture complex virtual camera movements rather than key-framing the camera [1]. However, these existing devices operate as plugins to animation packages such as Maya that can rapidly create an infinity of variations in visual effects, but offer no similar ability to create variations in virtual cinematography.

Researchers in automated virtual cinematography systems have produced increasingly sophisticated algorithms that can generate virtual 3D camera work to mimic textbook guidelines [2]. But in succeeding to reduce human effort, they fail to harness the input of creative human filmmakers and as a result produce cinematography of little creative value. Our *Director's Lens* system introduces a novel workflow that combines creative human intelligence with the computational power of an automated cinematography system, to enable a filmmaker to explore a variety of automatically suggested virtual camera compositions (see Figure 2). Camera compositions represent cinematically distinct ways one might film a given shot and which are consistent in user-specified continuity properties with the previous shot. For computing its suggestions, the system exploits an annotated screenplay which provides the narrative context in the form of text descriptions of locations, subjects, and time-stamped actions, with links to the 3D models employed in the scene. Moreover, the system tries also to mimic users' composition from previous shots. With the help of a motion-tracked virtual camera (see Figure 1), the cinematographer can easily refine a suggestion to use it as a starting point to craft a shot.

2. THE DIRECTOR'S LENS

In this interactive demonstration of our Director's Lens system, a user operates a small hand-held touchscreen LCD screen equipped with motion sensors and custom-built button and joystick controls (see Figure 1) to record virtual camera movements (i.e., shots) to visualize a recreation of a scene from Michael Radford's film version of Orwell's 1984. The application runs on a notebook PC with a USB cable to communicate with the device's buttons, joysticks, and touchscreen, and an HDMI cable to mirror the PC's display on the handheld LCD. Optical motion capture cameras mounted on tripods track the position and orientation of a rigid body marker cluster affixed to the device, which in turn map to the position and orientation of the virtual cam-

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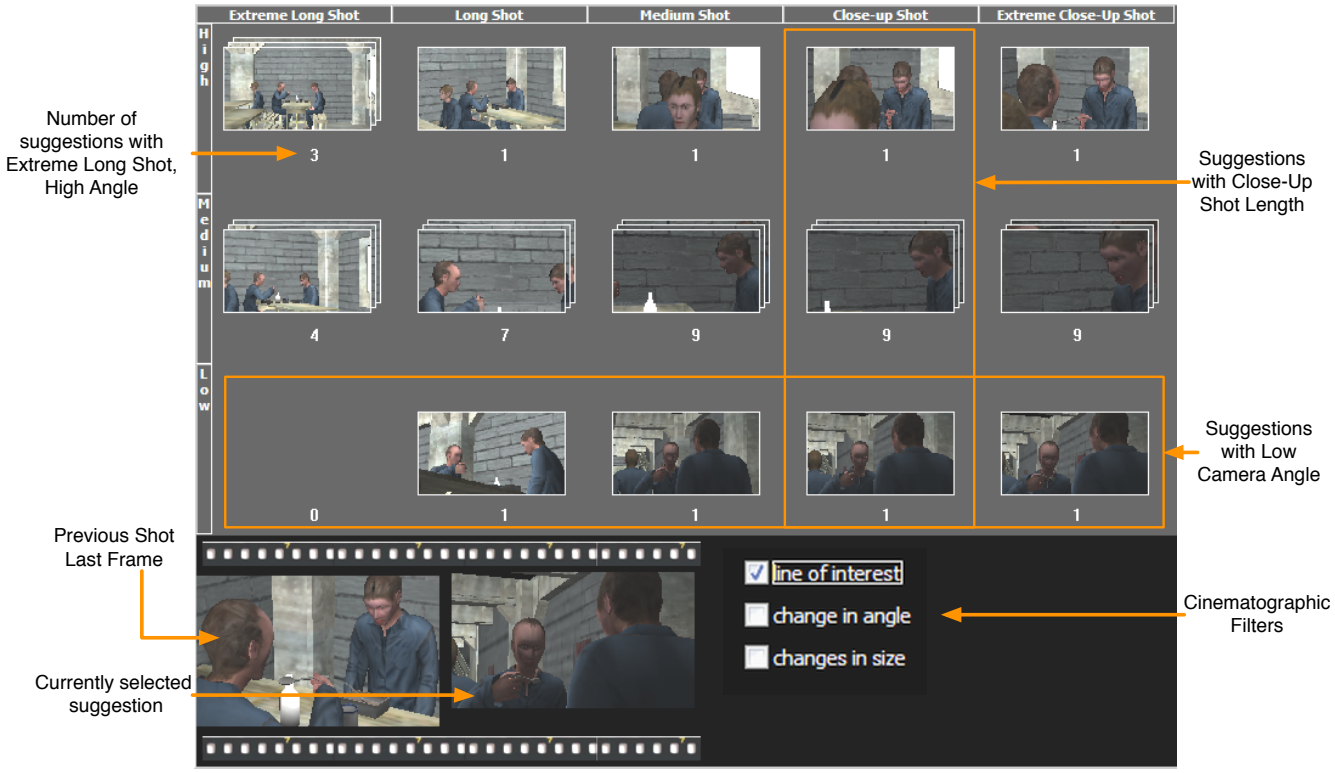

Figure 2: Screenshot of the interface in Explore Suggestions mode. User selects *Line of Interest* visual filter requesting only those suggestions that respect the line of interest relative to the previous shot's last frame (pictured in the bottom left).

Figure 1: Our custom-built hand-held virtual camera device with dual handgrip thumbsticks, buttons, and 7-inch LCD touch-screen.

era. Other versions were built from a Microsoft XBOX 360 gamepad and the same type of LCD touchscreen, but with a gyroscope sensor to drive camera orientation and gamepad thumbsticks to drive camera position.

A user can record a movie by iterating the following workflow: (i) identify the instant in the movie produced so far where a cut should be introduced (initially, at the beginning of the animation); (ii) ask the system to compute suggestions to start a new shot; (iii) browse the suggestions by their cinematic properties (see Figure 2); (iv) choose the one that is closest to what the user likes; (v) possibly move or turn the virtual camera device to refine the composition, and start shooting by moving the device like a real camera.

An alternative, simpler workflow can very rapidly produce a sequence of static shots by simply exploring and selecting suggestions, without using motion tracking.

When browsing suggestions users explore variations in shot distance, height, and angle in addition to whether or not suggestions conform to or differ from the previous shot in continuity, size, and angle. In this way the user rapidly explores many different possible ways to film a given sequence and assume manual control to improve upon the system's compositions and movements.

3. CONCLUSION

This demonstration[1] represents the very first coupling of motion-tracked virtual camera devices and automated computation of suggested viewpoints to support a filmmaker's creative choices. The demonstration highlights both the tool's creative potential to play and explore distinct cinematic possibilities for a scenario and to rapidly compose cinematography that follows desired continuity and editing conventions.

4. REFERENCES

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