

Design of a Virtual Film Set for Cinematography Practice

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Abstract

The way scenes and characters are filmed—through the design of camera style, lighting, and color—can completely change the way the audience interprets the story. However, as filmmaking is costly, beginners and amateurs don't often have the opportunity to experiment on the set. In this work we bring the shooting into a virtual environment, allowing the user to play the roles of the director, cinematographer, and cameraman in a virtual film set. Our system integrates automated camera placement and smart assistance to recommend camera styles for a personalized movie. We conducted a pilot study on amateur users to observe the educational properties of the tool.

CCS Concepts

•Computing methodologies → Animation; Virtual reality;

1. Background

Traditionally, filmmaking is costly, and every second on the set is precious, leaving little time to experiment and make mistakes on the set. However, with advances in virtual reality, head mounted displays, and enhanced motion detection techniques, have brought us one step closer to developing affordable applications to make filmmaking much more approachable to individuals, whether professional or amateur.

In the past, film knowledge has been incorporated into automated camera placement and planning in 3D environments [CAH*96] [GRCS14] and editing interfaces [WLC17]. Our goal is to provide a fully immersive virtual filmmaking environment with intuitive controls that allow the user to select and adjust camera positions while hiding the complex mathematical details, and that can—based on film knowledge—guide the user to experiment different styles. To this end, we designed a virtual film set in which the user can play the roles of the director, cinematographer, and cameraman, interacting directly with the placement and cuts between virtual cameras, and watching the replay in real time. A user evaluation was conducted in order to gather feedback on the user's impression of our system.

2. System Design

Our development environment is in Unity, and we use HTC Vive, including the head-mounted display (HMD) and handheld controller as the interaction device. Through the interaction with our virtual movie studio, the user can choose one of four modes, as shown in Figure 1, including an overview God Perspective, playing three different roles (Director, Cinematographer, and Cameraman) for experiencing the shooting of a movie.

2.1. Four Modes of Operation

The God Perspective mode provides a top-down viewpoint providing a clear overview of the whole studio, including each actor's position, placement of camera, and layout of scene. The God Perspective can help the director have a complete overview of the shooting environment.

The director is an indispensable member in the studio. When the user plays a role of director, the user can control the shooting through the monitor. The monitor provides the director with one master cam and three sub cams. The each sub cam corresponds to a virtual camera, and the director can select a sub cam to become the master cam by using a laser pointer. Simultaneously, the monitor can be dragged by the controller to find the suitable position to observe.

The cinematographer can directly drag the camera in the virtual studio, and at the same time, see what the camera sees via the small attached LCD screen. This mode is especially useful when the camera is positioned above or below the cameraman's eye position since the LCD screen can be rotated to provide a clear view of the shot.

Many film textbooks use the metaphor of the camera being the "silent observer". Thus the most natural shooting method would be to record what you see with your eyes directly onto a screen. In the cameraman mode, the HMD will directly become the camera lens, simulating the user look through an optical viewfinder. Through the control of the HMD movement, users can easily find a shot that they like simply by looking at the objects they would like to shoot.



Figure 1: Four modes of usage, from left to right: God Perspective, Director, Cinematographer, and Cameraman

2.2. Smart Shot Recommendation

Because photography novices usually do not know how to frame, the system provides a shot recommendation function. Our system is linked to a database of framings annotated from real films of actor positions on screen. The camera positions to realize these framing properties is then calculated using the Toric space model introduced by Lino [LC12].

The Toric space is a calculated model to lock an object to a specific location on the screen. Through the monitor and the controller, users can preview and choose a shot from the recommended shots, as shown in Figure 2. When the shot be selected, virtual camera is automatically placed in the 3D environment.



Figure 2: Example Recommended Shots

2.3. Live Replay

In the real world, the actors usually need to repeat their actions multiple times in order to produce multiple takes that will then be edited into a single sequence. This practice is time consuming in terms of actors and other resources. In our virtual studio, the system provides playback controls, as shown in Figure 3 for users to go to a specific time in the animation. Through the playback controls, the user can repeat or pause the animation, and find details they would like to film. Repeating this process, users can practice the technique and approach of film editing.

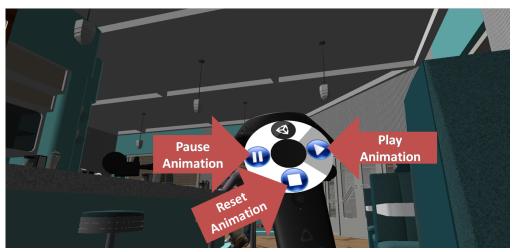


Figure 3: Playback Controls

3. Evaluation

We recruited 6 participants ages 22 to 25 for a pilot study. The participants had varied experiences in virtual environments. Of the

6 participants, 5 were novices to filmmaking while one had some experience in making short films. After an explanation of the experiment and demo of our system, the participants were asked to complete an editing task of a scene from *Back to the Future* using a combination of the Director, Cinematographer, and Cameraman modes. All the actions carried out by the participants were recorded as logs. In the end, a post-experiment questionnaire was presented to them for feedbacks.

We found that the participants spent most time in Director mode, since it allowed them to monitor the whole set and all the cameras on scene. Cinematographer mode was also frequently used, though compared to choosing recommended shots, participants preferred to interact directly with the camera, since it was less restricting.

4. Conclusion

Our system simulates a real film set, allowing users to take on roles of the director, cinematographer, and cameraman. Moreover, with our smart camera placement and recommendation mechanism, users can quickly grasp the overall structure of the filmmaking process, which includes the actors positions and expressions, and from this make decisions to place the camera. Amateurs can experiment various filming techniques through this VR application, making the complex problem of placing the camera to film a scenario an approachable one.

In the future we hope to improve the system based on our experiment, to make a application that can be used in previz or educational scenarios.

References

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