A MULTI-TOUCH 3D SET MODELER FOR DRAMA PRODUCTION

Maarten Cardinaels[1], Karel Frederix[1], Johan Nulens[1], Dieter Van Rijsselbergen[3], Maarten Verwaest[2], Philippe Bekaert[1]

[1]Hasselt University – tUL – IBBT
Expertise Center for Digital Media
Wetenschapspark 2, 3590 Diepenbeek, Belgium,
[2]VRT-medialab, Ghent, and
[3]Ghent University – IBBT – MMLab, Ghent, Belgium

ABSTRACT

In contrast to other industries, the media industry and in particular television has not yet been optimized by advanced techniques such as virtual modeling in the pre-production stage. As a consequence, most of the creative decisions in television productions are taken at production time, rendering the production stage more labor intensive than it perhaps should be. We are convinced that television production can also benefit from virtual modeling techniques in pre-production.

To this end, we developed an integrated modeling tool for drama production. This tool allows directors to pre-visualize drama scenes in 3D using an intuitive multi-touch interface. Multi-touch technology allows a very intuitive and user-friendly interface for manipulating 3D scenery - no previous expertise in 3D modeling is required and the learning curve is flat and short. Using nothing more than hands and fingers on the multi-touch table, directors manipulate characters, props, cameras and microphones.

INTRODUCTION

The media-industry, and in particular television is characterised by typical manufacturing processes. On par with any other industry, its production processes are preceded by design and development. But, in contrast to other industries, audiovisual engineering has not yet been optimized by advanced techniques such as virtual modeling. These techniques render a fairly exact model of the finished product and are intended to bring forward the phase of trial-and-error from the production to the engineering process.

Figure 1 – Virtual model of a drama set and characters

Script editing is still the basic process by which audiovisual material is engineered. Being in fact a textual representation, the script contains a relatively small fraction of the entire decision process which is required to realise a drama episode.

The workflow in common drama production can be roughly divided in seven stages, which we call *the drama production pipeline*. First of all, a scenario has to be written. This is usually done for a number of episodes at once. In a second stage, a synopsis writer cuts episodes up in scenes. After that, the dialogue scripts need to be written, before a shooting script can be created. The next step is to do the actual shooting. When all the shooting is finished, the recorded material will be quality assured before finally being sent to an editing station.

The shooting script process is traditionally driven by a paper-based storyboard, with annotations and arrows to clarify the illustrated events. We are convinced that the use of virtual modeling allows more creative decisions in this stage. Therefore, we developed a 3D scene modeler to manipulate 3D scanned versions of sets and characters (Figure 1). This modeler can be used to replace the traditional shooting script process. It is also capable of communicating with a central drama server which manages the data throughout the entire drama production pipeline. However, we will not further elaborate on the communication aspect as it lies beyond the scope of this paper.

In order to realize an intuitive tool, we developed an interface based upon a multi-touch setup (as described in the next section). Using only one's hands instead of a keyboard and mouse, the process of modeling a scene becomes just as easy as working on a paper-based blueprint of the set.

The domain of 3D pre-visualization of course is not new. There are some commercial solutions available on the market. FrameForge 3D Studio (1) offers a tool for drag 'n drop set building, and it provides ways to place virtual cameras in the set with a complete list of adjustable parameters (pan/tilt, dolly, zoom, roll, focal length etc.). It also provides a large library of posable actors and objects. A second well-known solution in the film industry is StoryBoard Artist (2). This product tries to combine 3D pre-visualization with traditional storyboarding techniques. It focuses more on the concept of storyboards, while our focus is on trying to create an exact virtual model of a scene. Antics 3D (3), does more than pre-visualization, it can be used as a complete animations studio with lots of pre-created sets, characters, props and buildings. While these solutions provide an interface that is easy to use, we believe our tool benefits from a multi-touch setup to achieve an interface that is even more intuitive.

SYSTEM SETUP

In our daily life, traditional tables provide a convenient setting for people to meet and carry out tasks that require face-to-face collaboration. Interactive tables imitate these characteristics and further enhance them by providing digital processing mechanisms. Dietz and Leigh (4) introduced the DiamondTouch table in 2001 together with the DiamondSpin toolkit, by Shen et al (5). This setup allows multiple users to interact simultaneously while associating each touch with a particular user. The Microsoft Surface (6) is 30-inch tabletop display in a table-like form, where small groups can interact by using touch or placing identifiable physical objects on it.

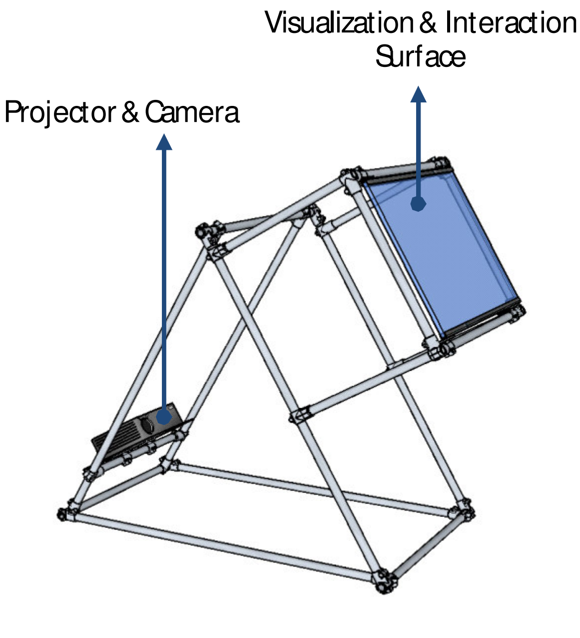


Figure 2 – System setup

Our setup (Figure 2) is inspired by the technology originally described by Han (7), and relies on the Frustrated Total Internal Reflection (FTIR) property of light inside a medium. The interactive screen is injected with infrared light which is scattered at a touch point. A mounted infrared camera is able to detect these scatterings. The camera image is post post-processed by computer vision technology returning touch information such as coordinates and touch intensity.

We believe our tool benefits from using a multi-touch table. By combining the visualization and interaction surface into one, we can provide direct manipulation interaction techniques. If well designed, this way of manipulating content can be more natural and compelling than traditional systems which rely on indirect input mechanisms (e.g. a setup composed of a keyboard and mouse). Furthermore, by shifting from one to multiple input points, we provide intuitive gestures which closely imitate real-life operations. Although multi-touch tables use a 2D interaction and visualization surface, they can be used to manipulate 3D data as well. An overview of similar technologies is described by Grossman and Wigdor (8).

3D MODELER

Overview

As illustrated in Figure 3, most of the screen is taken up by a 3D representation of the set. A few important widgets fill up the rest of the screen: the camera viewport widgets, some buttons to switch from top view to a camera view, and optional additional widgets to edit the properties of the currently selected object. The camera viewport widgets provide a camera point-of-view with physically correct values such as view angle, focus and depth of field. The user is initially presented with a top down view on the virtual set, which is convenient for object manipulation.

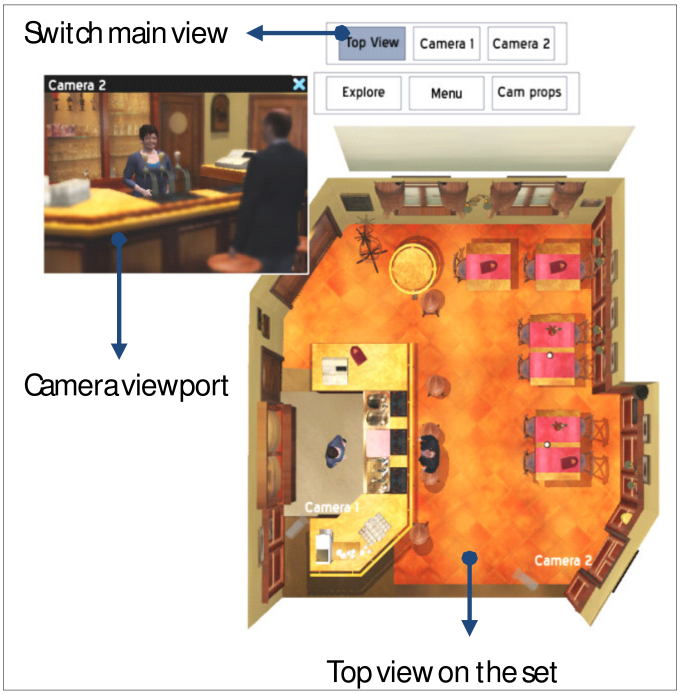


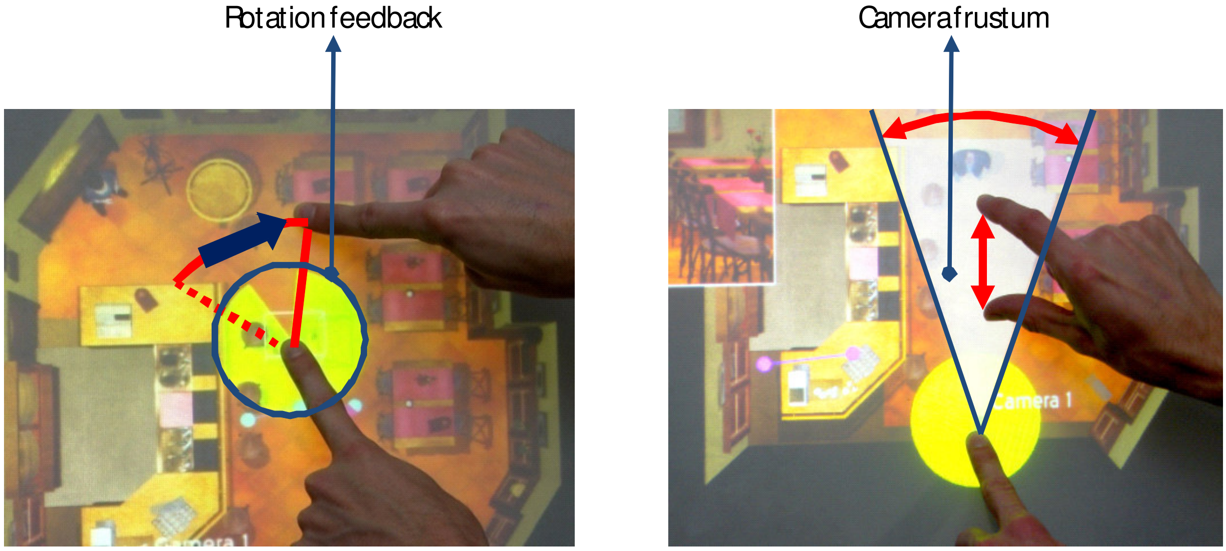
Figure 3 – Modeling tool overview

Object manipulation

A director shooting a scene is always striving for the most compelling composition. This composition is defined by a combination of several elements. The first one is the physical set. This can be an artificial custom-built set or a real-life set, inside as well as outside. A second element is the collection of actors. They are related to the set in terms of position and orientation. Furthermore, a set can be decorated with stage-properties.

Our tool provides a virtual equivalent for the most important real-life actions a director can perform. Relevant parameters of actors and stage-properties such as position and orientation can be changed by means of an intuitive multi-touch gesture. Figure 4(a) shows how to initiate the rotation mode for an object. Putting one finger on the object causes it to be selected, while pressing another finger allows it to be rotated. Each adaptation of the angle between the two fingers is reflected on the object's orientation. Feedback is given to the user by means of a circle segment. To prevent the object to be occluded for a too long time while manipulating it, and to ease the rotation of the second finger with respect to the user's other hand, the first finger can be released once the object is in rotation mode. The finger's initial position then is used to update the object's orientation.

A specific shot also depends on several camera parameters. Therefore, we provided gestures for camera manipulation as well. The camera's pan value can be changed using the same gesture as for rotating an object.



(a) (b)

Figure 4 – Rotating a character (a) and changing the camera field-of-view (b)

Adapting a camera's field-of-view is a simple extension of the previous technique (Figure 4(b)). The resulting frustum is indicated by a semi-transparent pyramid emanating from the camera. In this case the distance between the second and an additional finger determines the field-of-view value.

Navigation

When manipulating a 3D virtual environment, navigation techniques are indispensable. Figure 5 shows how to navigate the top view. At any time, the two virtual scene points under the user's fingers remain fixed, imitating sliding a piece of paper over a table. This means that when the user moves his fingers, the scene is moved as well. Rotating the fingers around their centre rotates the scene. Moving the fingers apart causes the camera to zoom in, while bringing them closer does the opposite.

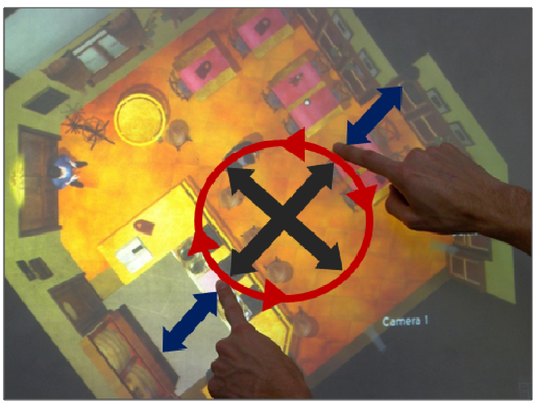


Figure 5 – Navigation on the top view

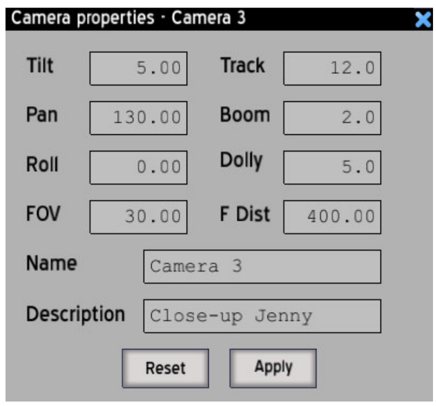


Figure 6 – Camera properties widget

Users can switch from the artificial top view to the 3D view of a specific camera. In that case, navigating comes down to adapting the parameters of that camera. Since this camera imitates a real-life camera, it has the same configurable parameters. To maintain consistency with top view navigation, we provide the same two-finger mechanism for adjusting the track, boom and dolly values.

Only one input point is needed for adjusting the tilt and pan values. Other camera parameters (field-of-view, focal distance etc) can be adjusted by means of the camera properties widget (Figure 6).

Animation and dialogues

Drama productions consist of scenes where object attributes dynamically change over time. Therefore, we introduced a notion of time in our model that allows users to define actions for all attributes. We distinguish two different types of actions an object can undertake: animations and dialogues.

Animations can be used to change the attributes of an object over time. An animation is described as a series of time stamped key frames. Each key frame contains information about the object attributes which can be manipulated directly in the scene by dragging key frame spheres (Figure 7).

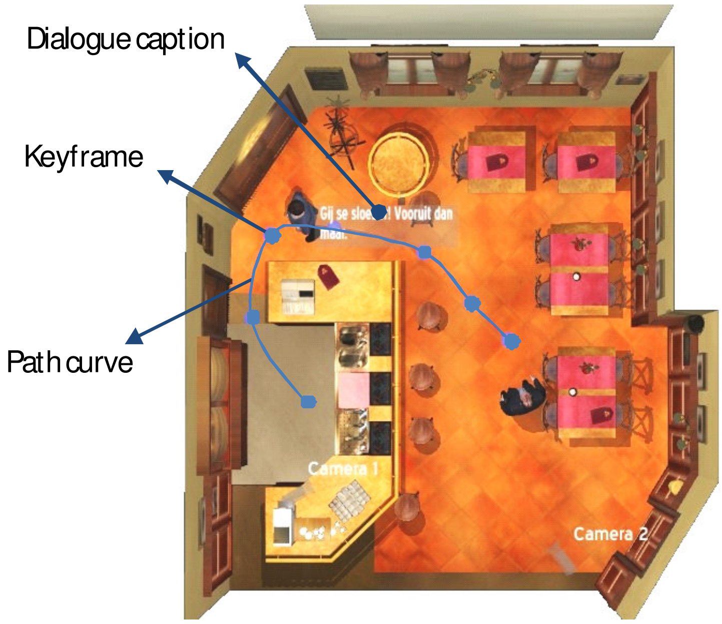


Figure 7 – Actions in 3D space

The attribute values are automatically spline-interpolated to enable smooth transitions. This way directors can, for example, easily define a path for an actor or camera, and animate zoom or any other exposed attribute. Figure 8 illustrates the use of our action widget which allows manipulating animations and dialogues on a timeline.

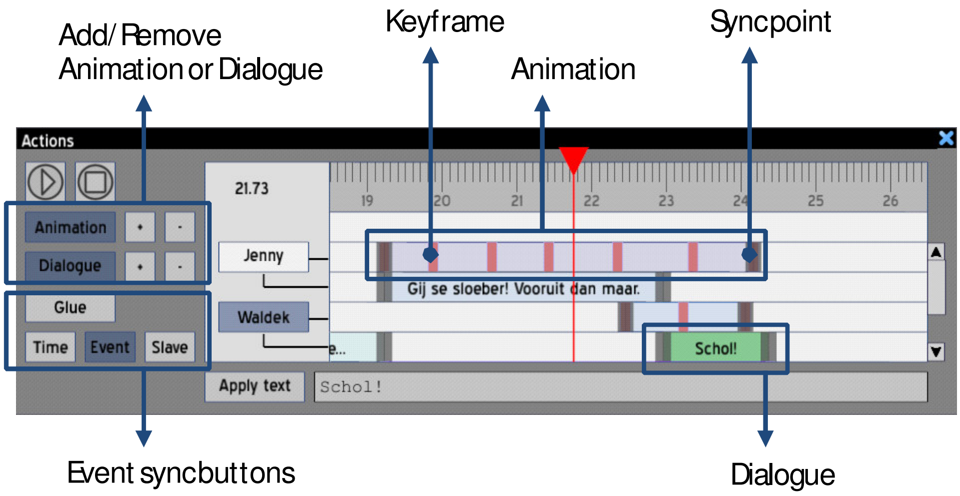


Figure 8 – Action widget

At the time of writing, we are also planning to incorporate true character animation in the near future. This will not only improve visual perception, but will also be of use from a time estimation point of view. By using predefined animations for common actions like walking or sitting down, we can obtain better estimations for the duration of a scene.

The second type of actions consists of dialogues. As with animations they are key framed to enable the user to specify the start time and end time.

Actions are often interrelated: imagine two characters having a conversation while at the same time entering a room. These actions need to be synchronized in such a way that when the timing of the first one is changed, the second one will change accordingly. Users can do this by connecting two or more key frames in a master/slave relation.

CONCLUSION

In this paper, we introduced a tool for rendering the drama production process more efficient. By using a virtual model of the finished product we can move costly trial-and-error cycles from the production phase to the pre-production stage. The main difference with other systems is the integration of a multi-touch table. This setup allows us to provide intuitive gestures which closely imitate real-life operations.

We plan the possibility to output a rough first cut montage edit decision list in the near future, in which synthetic audiovisual elements are to be replaced with essence captured during production.

ACKNOWLEDGEMENTS

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