

# Film Ties: A Web-based virtual 3D lab for teaching the film art from script to blocking

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## Abstract

*Film production education programs include hands-on training in script writing, planning blocking of performers and cameras on set, camera operation, editing to select the best footage at each beat of the story, and expert critiques to help students improve their work. Unfortunately, this ideal form of active, hands-on learning for film production requires access to specialized equipment, movie sets, and expert film instructors. Complementary film studies education programs teach how to read the visual language of a film to breakdown each shot to understand how and why it works. Both film production and theory education involve a social component in which students collectively screen, critique, and breakdown shots seen in the films. This short paper presents work in progress to develop a Web-based virtual 3D lab, which can be used to simulate the central learning activities found in film production and film studies educational programs. The system can also be used to crowd source annotated corpora of film, which would serve as a resource for film scholars and machine-learning algorithms.*

Categories and Subject Descriptors (according to ACM CCS): H.2.4 [Systems]: Multimedia databases—; Group and Organization InterfacesH.5.3Computer-supported cooperative work

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## 1. Introduction

Using our Web-based, client-server tool, Film Ties, film educators and students can create scripts, shot lists, blocking layouts of performers and cameras on set, and share critiques and shot breakdowns. The Web-based format has the potential to deliver hands-on practice to an increased number of film education programs since the only requirements are a WebGL-capable browser and tablet device or computer. Film Ties would enable film production programs to include additional hands-on practice prior to using the specialized equipment. Students and instructors would have access to shared repositories of expertly annotated examples of cinematography tying together shot compositions in the context of their script dialogues, top-down blocking layouts, shot-by-shot critique comments, and shot breakdowns. Such an annotated repository of film examples, could also be used as resource by state-of-the-art intelligent cinematography planners such as [MCB16]. The balance of this paper presents related work, introduces the Film Ties authoring and annotation features, and presents several examples.

## 2. Related Work

Several prior works provide tools to create annotated corpora of cinematography. The Insight tool provides a graphical interface to overlay virtual 3D figures and heads onto digital video frames to encode the framing of characters at several levels including the scene, sequence, shot, and frame [MWS\*15]. Panorama en-

gages users in a playful activity to frame artful compositions in a computer-generated two-dimensional landscape and also express preference ratings. Panorama learns a predictive model of composition preferences from its corpus of samples collected using Mechanical Turk [SEJ12]. Ronfard proposed an automated framework for aligning shot annotations with a movie script [RTT03]. The Prose Storyboard Language presents a detailed notation for describing composition of shots and camera moves in a human-readable format [RGB15]. As an annotation tool, Film Ties differs from these prior works in that it can collect data during the process of editing a virtual 3D film. Film Ties is complementary to Insight and Prose Storyboard Language in that it offers an alternative interface for collecting annotated compositions presently output in javascript object notation (JSON) [BSS\*15]. Film Ties can also be used to collect annotated compositions which are paired with their corresponding script entries, shot list entries, top-down blocking layout, three-dimensional scene layout, along with natural language critique comments, and structured multiple-choice shot breakdowns. Film Ties, like Panorama, applies crowd sourcing to collect annotated examples, but gives its users a creative tool, which they can use to freely compose and share their own original virtual 3D movies.

## 3. Existing Film Blocking Software

A number of existing commercial applications provide easy-to-use non-technical tools to facilitate authoring of blocking layouts and

3D virtual storyboards and would appeal to film education programs. The Film Ties user interface and workflow are designed to match this ease-of-use and appeal to non-technical users.

Shot Designer —provides an intuitive interface for rapidly blocking out placement of cameras, lights, performers, and props in two-dimensional overhead diagrams.

ShotPro —enables users to block scenes by placing and moving virtual 3D characters and props and export previs movies.

Frame Forge 3D —creates highly-accurate 3D blocking layouts with full dimensions for all objects including specialized cranes, dollies, and jib arms.

These existing consumer applications feature easy-to-use interfaces, large libraries of pre-built props and characters, and the ability to create printable storyboards and shot lists. However, none of these applications include a social critique or commentary facility that would facilitate construction of annotated film corpora.

#### 4. Filmties Overview

Film Ties is a Web-based social system for creating, sharing, and commenting upon virtual 3D animated movies. Film Ties is a client-server system that stores content in a SQL database. The initial version operated using pre-coded sample scenes, which limited its utility and appeal [BSS\*15]. This paper presents an enhanced version of the Film Ties Web-based user interface that enables users to create their own films using a Web-based virtual 3D simulation of the key stages of the film production process including:

Characters —Define a set of characters and their characteristics.

Script —Define the script in terms of units called beats, which organize the script into semantically-related sections. Script entries include text of character dialogues and director notes to the performers on how they should act.

Shot list —For each beat of the story, specify the preferred camera angle, distance, and movement along with optional notes to the camera operator.

Blocking layout —Select and place 3D models to represent props and characters. A simplified timeline interface structured around the story beats is used to access moments in the animation. The user can layout characters and cameras in a familiar top-down blocking layout or adjust cameras while looking through them. The blocking layout user interface combines storyboard-style camera views with a top-down blocking layout view.

Screening —Students can view shared 3D films. When screening a user can elect to watch the film in a single full-screen viewport, or with multiple side-by-side viewports so they can compare two or more camera shots side-by-side to better appreciate continuity edits in cutting between consecutive shots.

Create shot breakdowns —View a 3D film to analyze and identify the shot composition, movement, and editing continuity properties selected from a list of multiple choice options.

Create critiques —Users can post critique comments on the currently selected beat.

Viewing of critiques —The Film Ties interface allows users to view their original animated blocking side-by-side with a critique take that displays alternative camera angles. In playing a critique, text commentaries will appear in real-time along with the animated virtual 3D replay.

Social and sharing —The Film Ties application is a Web-based tool that runs on any Web-GL compliant mobile device or desktop computer. Student work is stored on a database server enabling users to share and critique their work remotely.

These features of Film Ties were designed to support the learning activities commonly found in film production end film studies education programs. We conducted a review of course descriptions, course learning outcomes, and sample assignments from a number of film programs.

#### 5. Film Production Education

Film production educational programs teach students hands-on practice of producing a film which may involve tasks of screenwriting, storyboarding, blocking diagrams, directing of performers, lighting, camera operation, editing, and critique. Filmmakers learn their craft by writing visual stories beginning from a script that is then analyzed and broken into a series of beats, or key movements. In pre-production, filmmakers plan how they will block each beat of the story by deciding on the position and movement of camera, lights, and performers. Filmmakers may create previsualization documents including hand-drawn storyboards, top-down blocking layout diagrams, and shot lists. Film students record and edit footage into finished film projects. Students and instructors then screen the student films and engage in constructive critiques.

#### 6. Film Studies Education

Film studies programs train students to be critical and analytical viewers of film who can screen a film and recognize how the elements of camera, staging, acting, lighting, and sound work together to convey a desired artistic message. Learning activities typically involve screening or viewing films, analyzing films, and discussing or writing about the films. Film studies students write shot breakdowns in which they screen a movie clip, recognize, and document use of cinematic devices for each shot. In a typical shot breakdown activity students recognize use of common cinematic devices including shot distance, shot height, and type of camera move.

#### 7. Film Studies Web Site Organization

Film Ties functionality is distributed over six main Web pages including home page for logins, creation and browsing of movies, movie content workflow menu, character editor, script editor, shot list editor, and blocking layout editor.

##### 7.1. Home Page

Students and instructors begin using Film Ties by visiting the home page (Figure 1) where they are prompted to either register as a new user by choosing a unique name and password. Returning users are prompted to login.

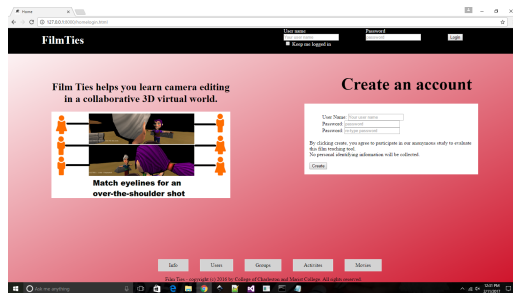


Figure 1: *Filmties* home page

## 7.2. Create and Browse Movies

To begin a class activity, an instructor or student would begin by creating a new movie project. For example, an instructor creates a new movie project by entering the movie title and a brief text description.

## 7.3. Movie Content Workflow Menu

After creating a movie, the user visits the movie content workflow menu which presents options to define characters, edit the script, write a shot list, block the layout of characters, props, and cameras, screen a movie and write shot breakdowns, or screen a movie and write critique comments. This workflow menu lists buttons labeled with the names of each of these options and in the order that they would be performed in a typical movie production. The system allows for flexible workflows in which one director may prefer to sequentially plan the entire script and shot list before blocking performers and cameras, while other directors may prefer to edit and revise both script and shot list while doing blocking layout. If a director prefers a sequential workflow, then the director would create characters, write the script, and write the shot list before opening the blocking layout editor. Alternatively, a director could create characters and move directly to the blocking layout editor where he or she creates story beats, blocks characters and cameras, and edits the script entry and shot list entry for the current beat.

## 7.4. Create Characters

The first step in defining the content of a movie is to define its cast of characters. Subsequent steps such as script writing will present the user with pull-down menu choices populated with the names of the defined characters. For each character, the user enters a unique name, selects an archetype from a pull-down list of choices including hero, heroine, sidekick, foil, villain, comic relief, or minor, and enters a brief description of traits and motivations. The character editor uses an editable table that is built using the JQuery and the JsGrid javascript libraries.

## 7.5. Write Script

In script writing film students must take an instructor-provided story or original story, then divide the story into discrete logical units known as beats, which the user identifies by assigning

unique positive integers. Each line of spoken dialogue or action is assigned to occur in a specified beat number. The script editor presents an editable table interface that displays a scrollable view of all of the script entries displayed sorted by ascending order of beat number. The user can edit the number of each beat and the editable table will re-sort the script entries by ascending order of beat number. The second column of each script entry is a drop-down list pre-populated with the names of the characters defined using the Create Characters editor. Other columns allow the user to enter the dialogue text or action description along with a column for entering optional notes. The script editor's editable table is built upon JQuery and the JsGrid javascript libraries. Figure 2 presents a cropped view of the script editor display for a scene from Hitchcock's *Vertigo* in which Gavin Elster convinces Scottie Ferguson to help protect his wife Madeleine from apparent visions of ghosts. In the first beat, Gavin speaks the dialogue line "I am afraid some harm may come to her." The script entry also displays the director's note that says "Gavin is speaking of his wife. This will be revealed as ironic when Gavin is shown to be the killer." In the second beat, Scottie speaks the line "From whom?"

Beat	Character	Action	Action Detail	Notes	
1	Gavin Elster	speaks	I am afraid some harm may come to her	Gavin is speaking of his wife. This will be revealed as ironic when Gavin is shown to be the killer	
2	Scottie Ferguson	speaks	From whom?	This line will also prove interesting as both characters will eventually come to know who they think is Madeleine	

Figure 2: *Script editor Vertigo* dialogue beats

## 7.6. Plan Shot List

After completing the script, an instructor or student may plan how to film the movie by creating a shot list that specifies the desired camera shot, camera movement, and lens effects for each beat. To add a shot list entry, the user chooses the beat number, shot distance selected from a menu of choices including extreme close-up( ECU ), close-up (CU), medium (MS), medium close-up (MCU), medium long (ML), long shot (LS), and extreme long (EL). The user next selects the desired camera height relative to the action as either low, normal, or high. Choose camera move to indicate whether or not the camera is in motion during this shot and if so what type of motion chosen from among pan, tilt, track, crane, track to follow, or crane to follow. The user may specify a preferred type of lens by indicating its size in millimeters.

## 7.7. Blocking Layout and Animation Editor

With the blocking layout editor (Figure 3), users can block and animate movement of characters, props, and characters to realize the actions and dialogue planned in the script along with the camera shots and moves planned in the shot list. The blocking layout editor presents a simplified animation timeline organized according to the beats defined in the script. The blocking layout editor provides the following functions:

- Add character, prop, movie camera, or light to the 3D scene.
- Add or delete story beats.
- Select the current beat by clicking on one of the numbered circles in the toolbar.

- Play or pause animation.
- Move or rotate a selected object into the desired position and orientation for the current story beat.
- Configure the number of 3D viewport windows from one to four.
- Select which camera view is to be displayed in each viewport. A user may choose from one of the user-created movie cameras or one of the predefined editor camera views of overhead view, front, side, or perspective.
- Open a script editor panel to view or edit the script entry for the current beat.
- Open a shot list editor panel to view or edit the shot list entry for the selected beat.
- Open the shot breakdown panel to view or edit the shot breakdown for the current beat.
- Open the critique panel to view or edit commentary critique text for the current beat.
- Save or re-load the current 3D layout and animation.
- Exit back to the movie content workflow menu.

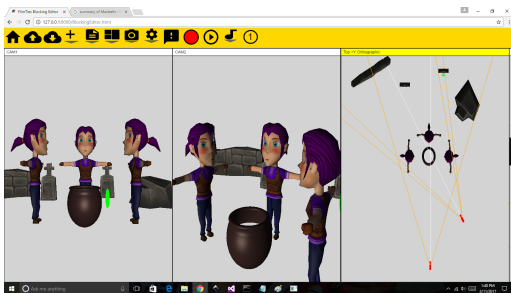


Figure 3: Blocking layout and animation editor

In Figure 3, the blocking layout editor window is configured to display three viewport windows one for the view seen through movie camera 1, the second for the view seen through movie camera 2, and the third showing a top-down or overhead view of the virtual movie set. The top-down view is especially useful to visualize the blocking of the scene to see how the characters and cameras are setup. The lines extending from the two cameras indicate the triangular field of view regions visible to each camera. In any viewport a user can simply click or touch (if a touchscreen is available) any character, prop, or camera. With an object selected the user can drag the mouse to move an object. To rotate a selected object click and drag the round rotation handle that extends from the selected object. For example, after adding characters to represent the three witches and two cameras, a user can click and drag the objects in the top-down view to rapidly rough out the blocking. To refine a camera view, the user clicks a camera viewport and then right clicks to call-up a context-sensitive menu to pan, tilt, track, dolly, or orbit the current camera while simultaneously looking through it.

Users create beats of time by clicking the beat menu (musical note icon) to create a beat or delete the current beat. Each time a beat is created a numbered circle appears in the top-right of the main toolbar. Click on a beat number to cue the animation timeline to that moment of the script.

While inside the blocking layout editor Web page, users can access main menu bar options to show selected content for the current

beat including script entry, shot list entry for selected camera, shot breakdown of the selected camera, and critique commentary. Each of these forms of content will cause the main 3D layout view to diminish in height to allow room for the form to appear at the bottom of the blocking layout editor Web page. The clicks the cancel button to dismiss the form and restore the blocking layout to full screen.

## 8. Blocking Examples

This section presents several example blocking layouts composed by the two undergraduate student co-authors of this paper. The first example recreates a scene from Hitchcock's *Vertigo* in which Gavin Elster convinces Scottie Ferguson to help protect his wife Madeleine from apparent visions of ghosts. Figure 4 shows a shot of Gavin standing on the upper-level of his office as he assumes a dominant blocking relative to the seated Scottie. In this view the user requests to display the script entry for the current beat, in which Gavin speaks the dialogue line "I am afraid some harm may come to her." The script entry also displays the director note that says "Gavin is speaking of his wife. This will be revealed as ironic when Gavin is shown to be the killer." The script entry dialog is used to both view or edit the script entry for the current story beat.

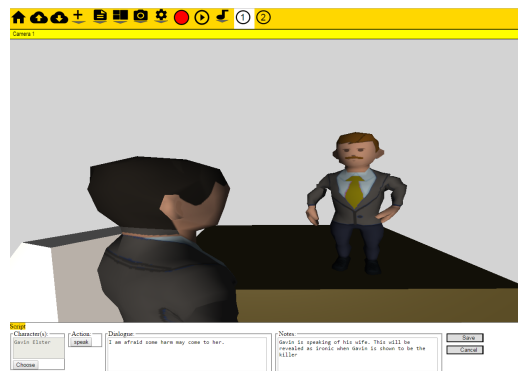


Figure 4: Vertigo camera view and script entry

Figure 5 shows a subsequent shot in which Gavin has moved directly in front of Scottie and the camera has dollyed back to frame both Gavin and Scottie. In this blocking a film student has staged the camera so that Scottie and Gavin appear at similar heights in the frame thereby missing the opportunity to emphasize how Gavin is gaining the upper hand in his effort to convince Scottie to follow Madeleine. An instructor could use the comments feature to enter a critique that prompts the student to show the power struggle between the characters by choosing an angle that shows Gavin in a dominant position or to move Gavin onto the elevated floor level. The lower part of this figure also includes the shot list entry that calls for a shot of Gavin and Scottie, framed at medium long (MLS), normal height, with a track back camera move. Users can replay the animated 3D movie with any of the information dialogs visible to see script, shot list, shot breakdown, or critique comments automatically switched to correspond to moving from one beat to the next.

Film Ties can also be used as a visual storytelling tool. One of the



Figure 5: Camera view with critique comments and shot list entry

student co-authors wrote an original screenplay based on Based on the Nigerian Yoruba legend of Eshu the Trickster [Cos87]. In one frequently-told story, Eshu wears a hat having different colors on each side, walks between two friends leading the two to argue over the color of the hat. Figure 6 shows the top-down blocking layout with matching over-the-shoulder shots of the multi-colored hat as seen from the opposing perspectives of the two friends (Figure 7).



Figure 6: Top-down blocking diagram of matching over-the-shoulder shots



Figure 7: Matching over-the-shoulder shot

## 9. Conclusion

We are preparing to deploy the Film Ties system online for user testing in film classes. We plan to extend the linear beats into a hierarchal structure of scenes. We plan to collaborate with other researchers to export the blocking configuration 3D scene layouts, 2D camera compositions, critique comments, and shot breakdowns so that they may be used by film scholars and intelligent virtual film systems.

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