Supporting the Comparison of Alternative Stories

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ABSTRACT

In media production, a team typically works with multiple alternative storylines or variations before selecting the best one for production. However, current media production tools do not support decision making through the comparison of alternative storylines. Using the conventional form of storyboards found in animation, commercial, and movie studios as a basis, we propose a novel user interaction feature that facilitates effective comparison amongst alternative storylines or variations. We review existing storyboarding practices, and then present our interaction strategy, which was informed by interviews of people in the industry. The fully-implemented system went through a series of usability tests with both professional and non-professional users. We discuss how our design can help the users with diverse backgrounds at different stages of story development in comparing the alternatives. Such a tool may be useful in other domain areas where temporal comparison of alternative solutions is beneficial.

Author Keywords

Storyboard; Story comparison; Interaction design.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

A storyboard is a sequence of illustrations or images, pre-visualizing a story or a narrative of media before going into a production or implementation. The storyboard serves as a brainstorming, planning, and communication tool between team members (Finch, 1988; Glebas, 2009), and has been widely adopted as a lower-cost, early prototyping tool for a variety of media production activities such as animation, TV commercial and movie production.

The storyboarding process generates multiple variations and versions of a story. Usually several ideas are explored, and a few of them are iteratively reviewed by team members for discussion and refinement until the team is satisfied and the most appropriate one is chosen for further production. While this workflow of the comparison among candidate stories is commonly practiced in the industry, few have studied the process of evaluating alternatives and whether or not it could be better supported by new interaction strategies.

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This research aims to address the comparison of storyboard alternatives by engaging in a user-centered design process in which a new prototype system was developed to support that stage of storyboarding. The contributions of our study include (1) a series of interviews that give a better understanding of how professionals currently deal with alternative stories, (2) the development of a fully-working interactive system featuring a novel user interface that facilitates effective story comparison, along with the design rationale, and (3) reflections and insights on the story comparison interaction through qualitative usability testing and feedback.

LITERATURE REVIEW

The popularity of storyboards as a production tool has resulted in broad research areas. Since the storyboard was invented, studies and tools were mostly interested in the storyboard *creation* (Choi & Cho, 2014; Henrikson, De Araujo, Chevalier, Singh, & Balakrishnan, 2016; Shin, Kim, & Park, 2005). In the last decade, more attention has been given to *collaboration* around storyboards (Hak, Winckler, & Navarre, 2016; Haller, Billinghurst, Leithinger, Leitner, & Seifried, 2005). Team members contributing to a project increase their creativity as story/frame variations are generated, and improve quality of outcome as the storyboard is evolved through iterations. However, these variation, iteration, and alternative evaluation aspects of storyboarding have received relatively less attention by researchers and designers.

Variation refers to the generation of different ideas at *one point in time* during story development. In the early stages of story development, variation may involve different stories or plots. In later stages, variation may involve details such as different camera angles or even colors of clothing. Variation can be supported by automatically generating options for users as in Director's Lens (Lino, Christie, Ranon, & Bares, 2011), or providing space for users to try out and explore variations as in FrameForge Previz Studio (frameforgepreviz.com) and TryFilm (Bartindale, Schofield, Crivellaro, & Wright, 2016; Bartindale, Sheikh, Taylor, Wright, & Olivier, 2012).

Versioning, on the other hand, occurs *over time* as the story evolves through *iteration*. Tracking versions or history is necessary since reverting to previous states is often required. The history can either be managed by an external tool, by an integrated basic operation that allows users to save copies, or by an integrated history mechanism within the system (Terry, Mynatt, Nakakoji, & Yamamoto, 2004). The save-copies method is most popular with digital storyboarding systems today, but it requires good file organization and systematic naming conventions (Simon, 2012). Tools such as Coeno (Haller et al., 2005), Redboard (www.redboard.tv), Storyboard That (www.storyboardthat.com), and Storyboard Artist Studio (powerproduction.com/storyboard-artist-studio.html), offer the ability to save history within the system so that the users can view and quickly switch between versions.

While variation and versions are defined differently, they both produce story **alternatives**. (Smith, Xu, & Bailey, 2010) presented an interaction model for working with alternatives in general, including the ability to easily switch between ideas and to offer different ways to view multiple ideas at once. In a linear storytelling, a team works with alternatives but has to eventually select the best for their audience. *Alternative evaluation* is therefore a critical process for the success of a production. The evaluation typically requires a comparison, which is explicitly supported in some tools (e.g. diff or merge tools) and implicitly supported in variation generation features, history management such as (Grossman, Matejka, & Fitzmaurice, 2010), or version control such as (Chen, Wei, & Chang, 2011; Zhao et al., 2014). However, these methods have not been used in comparing stories in media production, as they seldom take into account the *temporal* nature required in the comparison. Here, it is not sufficient to merely compare a few individual images or block of text side by side: stories unfold over time, and events must be in a specific order.

There are some works related to the comparison and evaluation of alternatives in other areas, such as presentation slides (Drucker, Petschnigg, & Agrawala, 2006) and workflows (Kong, Grossman, Hartmann, Agrawala, & Fitzmaurice, 2012). While some storyboard tools support the concept of alternatives, they lack support for the comparison and evaluation of alternatives. The study presented here attempts to bridge this gap by bringing the benefits of direct story comparison features to the media production domain. These findings potentially extend to other domains as well.

UNDERSTANDING THE STORYBOARD PRACTICE

We interviewed four professionals, focusing on methods for handling changes made during story production. Our interviewees had three to eight years of experience in animation (identified as I1, I2, I3), movie (I2), or commercial production (I3, I4). All interviewees mentioned similar practices at the very early stages of pre-production: they sketch story concepts on pieces of paper to visualize their ideas, and the sketches are inserted, deleted, and rearranged by moving those pieces of paper.

From hand-drawn sketches, I1's and I3's teams create a formal digitalized storyboard, where each image is assigned a reference number (e.g. 0010 and 0020, where the last digit is reserved for inserted frame(s)). A storyboard artist works closely with a director to further edit the storyboard. They either overwrite modifications or save modifications as new versions with a running number (e.g. _1, _2, and so on). I1's team has an internal program to track these version numbers. The storyboard artist typically presents only the best version, either the whole story or only the portion where a change occurred. In some cases, such as changes in colors or character design, multiple options are compared side by side. I2's team, on the other hand, continues with pieces of papers to be posted on a wall in sequence. When there are changes, the artist redraws and replaces that frame on the wall. They may take a photo of the wall and archive the pieces of paper, which may be used later in the current or another project.

Storyboarding practices are slightly different in the commercial business, where a client or an owner of a product to be advertised is involved. Three to five alternative stories are created and presented to the client, possibly as rough sketches. The client then picks one story. Both I3's and I4's teams draw a detailed storyboard digitally, but print all frames on one or two pages of A4-size paper for presentation to the client. I3 also notes differences between each alternative on the paper and sometimes creates a simple Flash animation from a storyboard to give a sense of timing. When clients request changes, the professionals redraw frames, save them as new files, and print the new storyboard for presenting alongside with the previous version.

All the professionals said that their editing process is iterative and involves many alternatives (both variations and versions). Although they did not state any specific problems related to comparisons, the fact that they have to select the best alternative highlights the importance of the comparison process and suggests the potential benefits of explicit support for alternative comparison.

STORYBOARD INTERACTION AND VISUALISATION

Figure 1 shows a screen shot of our final user interface, which went through three rounds of iterative refinements.

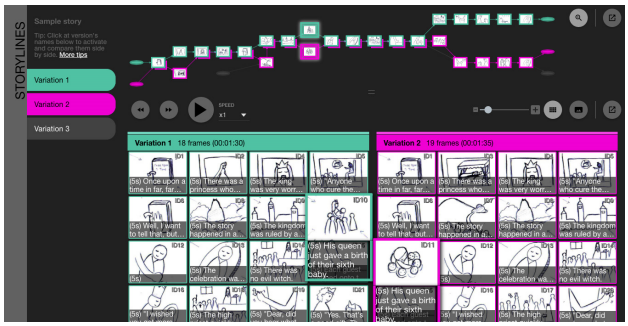

Figure 1. UI with 2 alternatives selected in grid view, embedding our story graph (top) with traditional storyboard (bottom). Selected frames are synchronized across all panels.

A list of buttons, each representing an alternative, is shown on the top left of the screen. Each alternative story

is assigned a color, random but customizable by the user, to be consistently featured throughout the interaction to help easily oversee and differentiate the alternatives. Users can create a new alternative by duplicating an existing alternative, renaming it, and modifying its content (the story). User can click on a story in the list to activate (show) or deactivate (hide) it. Multiple alternative stories can be activated at the same time.

The story graph panel (top part of the screen in Figure 1) shows an overview of the story in relation to other available alternatives in that story. A node represents a single frame in a story. It shows the thumbnail image of the frame if it belongs to any active alternative. Other available alternatives that are not currently selected are greyed out to minimize visual clutter and confusion (see Figure 2 (top)). When a frame is part of more than one selected alternative, that frame is visualized as multiple images stacked together with different border colors (see Figure 2 (bottom)). A number of different ways to represent these were considered before settling with this particular visualization.

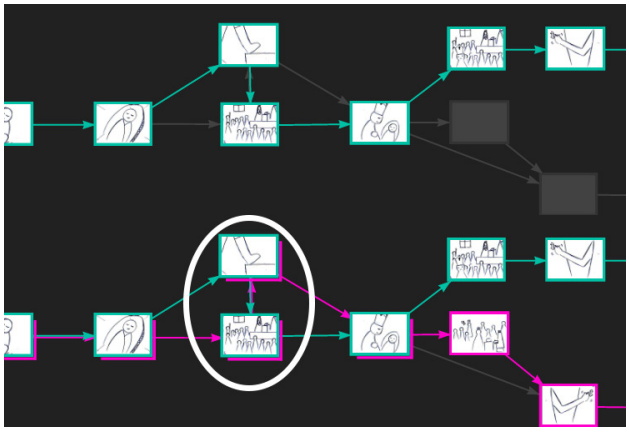

Figure 2. A portion of the story graph with 1 active alternative (top) and 2 active alternatives (bottom).

The lower part of the interface is the main storyboard, allowing a direct visual comparison among active alternatives. The user can switch between the grid view and full image view. The grid view (shown in Figure 1) is the traditional "storyboard" format where each frame is miniaturized and put next to each other spatially. The size of the frame can be adjusted by dragging on the slider control (shown just above the storyboard on the right side in Figure 1). The full image view (shown in Figure 3) shows the currently selected or played frame of the selected alternative stories, magnified to fill the lower part of the screen in order to help the user focus on the current frame in detail rather than in relation to neighboring frames.

The integrated playback feature allows the user to test the continuity of the storyline in a form closer to the final product. Users can play alternatives according to the time set in each frame. The playback control buttons (below the start of the graph view in Figure 3) can be used to play the storyline(s) from the currently selected frame onwards. The speed of the playback is adjustable, and it can also be played "step by step", manually flipping through frames one by one. At any point during the interaction, the user can select frame(s) anywhere on the screen and then play alternative stories side by side, pause, change the current frame in one alternative story, then play again, and so on. This flexible interaction facilitates a more engaging exploration of alternative storylines.

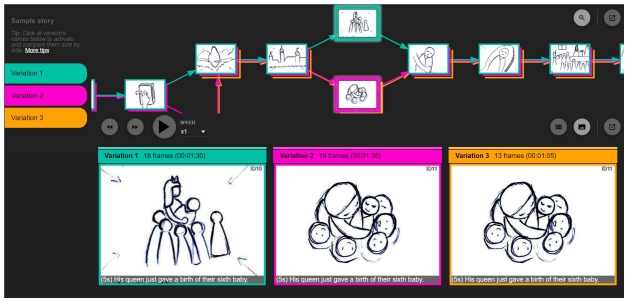

Figure 3. UI with 3 alternatives selected in full image view, allowing playback of multiple alternatives at the same time.

Other than the main comparison features summarized in this section, the interface allows frame uploading, basic management operations (e.g. add/edit/delete frames and text), permission setting, and shortcut keys for playback control. The system is a fully-working, web application implemented in PHP and JavaScript, that runs on major web browsers in Windows, Unix and iOS platforms.

USABILITY TESTING

We conducted a usability test with 10 participants one by one (5 male, 5 female; ages between 21-45). Seven of them (P4-P10) had no prior experience in storyboarding. Three participants (P11-P13) had varying degrees of experience, including at a professional level, and were different from the participants in our initial interview. We prepared three sets of stories, each with a few alternatives. (1) *Sample introduction* (3 alternatives, 13-19 frames), which contained differences in plots and camera angles, was used for introductory training and practice. (2) *Folklore story* (2 alternatives, 92-98 frames) contained a longer story based on a folklore and had alternatives with differences in plot. (3) *TV Advertisement* (3 alternatives, 28-30 frames) contained a TV commercial storyboard contributed by a professional, and had differences in lead character, background, and other minor visuals.

Participants first saw a demonstration of the tool and did a practice trial using the *Sample introduction*. Participants were then asked to browse the two stories and determine which of the alternatives in each story they preferred. Five participants started with the *Folklore story* while four participants started with the *TV Advertisement*. The remaining participant did not interact with the system, but only wanted to see a demonstration. The screen interaction was recorded for later analysis. There was no time limit, but we found that each participant spent no more than 30 minutes on a task. We asked participants to fill in a short questionnaire after each task and fill in a final questionnaire after both tasks were done. The entire session took between 45-90 minutes for each participant.

Most of the participants utilized the story graph to quickly go through or skip frames that they had viewed,

and paid attention to frames that belong to a particular alternative. They navigated through multiple alternatives side-by-side, mostly after browsing one alternative (or they already knew the story). Four participants continued side-by-side playback comparison in full image view even when frames started to mismatch between two alternatives (due to insertion or deletion of frames). One participant (P8) used the story graph to adjust the current point of an alternative so that the two alternatives were more synchronized in their side-by-side playback. Five participants were particularly good at explaining the differences among alternatives. Two participants asked about the target audience for the *Folklore story* before making their choices. Some suggested that they preferred some other alternatives and wished to mix, for example, the first part of alternative 1 with last part of alternative 2.

We asked participants to rate the system using a 5-point Likert scale. Table 1 shows the results in terms of the ease of use for the two stories. While our sample size is too small to derive any statistically-significant findings, it appeared easier for participants to browse and understand the *Folklore story* alternatives than the *TV Advertisement* alternatives, even though the folklore was much longer. The main reason may be that the variations in the *TV advertisement*'s alternatives were more subtle, visual-level ones while those in the *Folklore story* were more obvious plot differences. This highlights how different types of alternatives (plot, character, visual, texture, duration, etc.) might need to be highlighted in different ways. Table 2 shows the rating in terms of the usefulness of the features.

Task	Folklore	Advert	Average
Understand the story	**4.56**	4.11	4.33
Explore ideas/options	**4.22**	4.00	4.11
Identify differences	**4.33**	4.00	4.17
Make decision	**4.00**	3.67	3.83

Table 1. Ease of use: 1 (strongly disagree) to 5 (strongly agree).

Features	Folklore	Advert	Average
Color coding	**4.33**	4.11	4.22
Story Graph	4.44	**4.50**	4.47
Side-by-side views	4.25	**4.44**	4.35
Playback	**4.13**	4.00	4.06

Table 2. Usefulness of features: 1 (strongly disagree) to 5 (strongly agree).

Overall the feedback was positive. P6 commented that *"I like the idea of giving the users more versions and how the user can scroll the story to the section he prefers."* P8 stated *"the system helps me a lot to compare two or even more versions at the same time, especially the graph lines and side-by-side functionalities,"* and *"the graph lines show logic of stories which make them clear to me. Also, different colors show a beautiful interface and easily for users to recognize different versions."* On average, the usefulness of the story graph and the side-by-side views (including both grid view and full image view) was rated slightly higher for the *TV Advertisement*. However, P11 did not use the story graph while viewing the *TV Advertisement* and P12 did not use the side-by-side views for the *Folklore story*. A reason given by P11 was that *"the story graph really help to find the difference in the story but not really in advertisement because for advertisement you could spot the difference quite fast by comparing side by side."*

The user interface required time for some of our participants to get used to. P8 commented *"using multiple selection to navigate individual branches is a bit confusing at first."* However, most participants managed to complete the comparison tasks without any active assistance. One participant (P4) did not use any comparison-specific features: *"I paid little attention to comparison part"*, he explained, *"what I like is that I can choose another story easily."* A functional limitation in the system was addressed by P5 and P12: *"at some point I was looking at one frame ahead in alternative 3 compared to alternative 2, so that was not very useful."* Some participants selected multiple alternatives not to directly compare amongst them but just so that the story graph will show the thumbnail contents in its nodes. P13, an experienced media marketing expert, commented that general purpose tools such as PowerPoint and VDO were already easy to use. She pointed out that a company might not be willing to pay extra money for such a dedicated storyboard tool, but that if a tool can facilitate the whole production process including the creation, composition as well as comparison, it might prove more useful.

CONCLUSION

As opposed to traditional methods, our design provides an overview of all considered alternative stories at once with less visual clutter, encouraging the user to explore and compare them more easily. The system features a composition of the overall story graph and switchable side-by-side views with a strong color-coding to easily differentiate the alternatives. Our study results suggest that this design might have more benefits when comparing big differences like plots rather than subtle differences. However, ratings for usefulness of elements and users' comments suggest that our combination of elements can still support comparison in all stages of pre-production. Also, some participants wanted to mix parts of the alternatives they saw, and this hints that our interface could support more active creation tasks in addition to comparison. We will continue refining and extending the comparison interaction based on our findings so far. We will explore different ways to synchronize views when alternatives are played side by side (e.g. selecting some segments from alternatives and playing only those parts). We will also identify other domain areas where this temporal comparison strategy could be useful (e.g. comparing alternatives of UI sequence during an interaction design process, comparing workflows to follow the easiest one).

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