Supporting Visual Temporal Media Comparison

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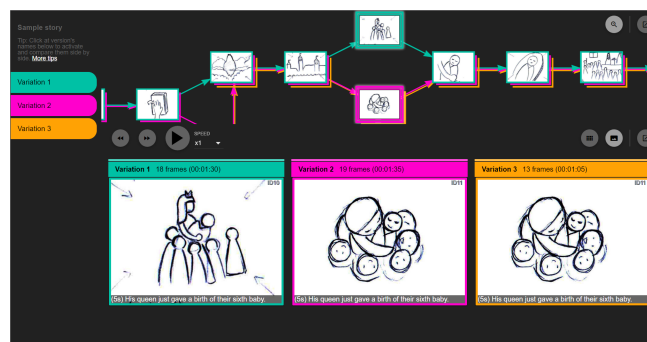
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Figure 1: An example UI of story comparison support design. A composition of the overall story graph and the switchable side-by-side views helps users browse alternatives easily and exploratively.

Abstract

Comparison is often a basis for understanding, discovering, evaluating, and improving an artifact or process. Throughout my PhD thesis, I will investigate various problems related to visual temporal media (e.g. video) and develop theories and systems to support the comparison of such media through iterative and user-centered design. Results will help us understand comparison task more deeply and establish design implications to support general temporal media comparison as well as improve activities that rely on visual comparison.

Author Keywords

Visual Temporal Media; Visual Comparison; Interaction design

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous

Research Situation

I am a second-year Ph.D. student in Information Systems Technology and Design at Singapore University of Technology and Design, financially supported by Singapore International Graduate Award. During the first year, I worked with my supervisor, Dr Hyowon Lee, to develop an interactive system that supports the comparison between stories

in storyboarding. Now we are expanding our design and findings, in order to understand and develop theoretical foundations and interactive features and applications that implement such foundations to support visual temporal media comparison in general as my Ph.D. thesis.

Context and Motivation

Comparison is one of the most basic cognitive activities we engage in. It plays an important role in understanding and discovering insights from data as well as making evaluation and improvement. Its values are demonstrated by designs and systems that explicitly address comparison in various types of objects and purposes: comparing products to buy while shopping; comparing workflows to learn a technique [2]; comparing ideas with others to improve productivity and creativity [4], and so on.

Visual temporal media is media that depend on time for its content to be presented to a user such as video and presentation. Despite its popularity in today's media consumption trends, design for visual temporal media comparison is almost non-existent. In most cases, people rely purely on their memory or use an algorithm to map objects into simpler or more abstract forms (e.g. percentage in number or graph). Each method results in either high cognitive cost or loss of potentially useful information in the original contents.

I argue that visual temporal media comparison should be studied, explored, and more explicitly facilitated. Proper design of user interface/interaction and visualisation can reduce comparison cost and convey more meaningful information. Consequently, tasks that depend on or benefit from comparison can be improved and we can enhance the way we produce and consume media on the whole.

Related Works

In 2011, Gleicher et al. [1] introduced taxonomy of visual comparison based on design strategy. Although they could classify more than a hundred designs into three basic building blocks (juxtaposition, superposition and explicit encoding), the approach still has many open questions including a lack of generalisable knowledge or guidelines to help designers. Thus, visual comparison is usually designed for specific scenario. Comparison cost and difficulties [7, 9] are usually considered and minimized according to context and complexity of the objects being compared.

Temporal media turns out to be a very complex object to support comparison, since relationship of order and time within the media is usually as important as relationship between media instances. The order of elements raises several issues in comparison, as evidenced by continuous research in biological science that deals with long sequences of data (e.g. [6]). The visualizer cannot arbitrarily move or align those elements, and thus often requires more sophisticated design or more advanced relationship encoding to reduce the comparison cost. When considering the order with the time, duration acts as another dimension and further increases complexity. Recent researches in comparing temporal data mostly focus on large-amount of data, e.g. event log [10, 3] and time-related data in biology [8], and usually simplify elements using a technique such as [5] to reduce visual clutter and help discover patterns or trends.

These related works inspire and demonstrate potential of visual comparison tools for temporal media. However, none of them addresses one distinct characteristic of temporal media - each element should unfold to the viewer over time instead represent all at once, which leaves a challenge in designing the features and interactions for comparison support.

Problem Statement

Main objective of my research is to develop understanding in visual temporal media comparison and establish foundational knowledge (e.g. a theory, design principles and guidelines) that will help designers or developers improve comparative design for their applications. More specific research questions I am pursuing include:

- When do people compare temporal media items? What are the benefits and values of having explicit comparison support (e.g. in making evaluation and enhancement)?

- What are design elements that can effectively facilitate comparison of different types of temporal media items? How can the interaction amongst them be explained? Can its general features and mechanisms be extracted?

- Can those design elements be applied in general? If it cannot, what types or situations are there for each design to be suitable and why?

Research Method

My research is based on learning by examples. I first focus on specific practical problems, then generalize them to develop theoretical knowledge in visual temporal media comparison.

I will identify problems or use cases that visual temporal media comparison will be useful for from literature review and/or user opinions. For each problem, I will design, implement, evaluate, and refine user interface and interaction in iterative cycles. The evaluation will mainly consist of user studies. Techniques such as observation, eye-tracking, and screen recording may be incorporated when appropriate

in order to analyze how people interact with design elements. Both qualitative (e.g. interview and questionnaire) and quantitative (e.g. user rating) data will be collected to provide better understanding in values of design elements and help discover useful, maybe unexpected, insights.

Throughout my project, different types of temporal media will be investigated, preferably on different kinds of devices. All design elements and gathered data from prototypes will help me construct a theoretical knowledge for comparative design of visual temporal media. At the same time, they support and demonstrate values of the theory through practical systems and specific interface features backed up by the theories being shaped.

Dissertation Status

I spent my first year working on a system to facilitate alternative stories comparison in the context of storyboarding. I found that, in media production (e.g. animation, commercial or movie), a team typically works with multiple alternative stories but selects only the best one for production. This task relies on comparison which has not been supported by existing tools. Therefore, I proposed a new user interface and interaction to support the task. The interactive web-based system was implemented, featuring a composition of the overall story graph and the switchable side-by-side views (Figure 1), including a traditional storyboard view along with a strong color-coding to easily differentiate the alternatives in a generic way. This system was then user-tested with 10 participants and I recently presented the findings at OzCHI 2016.

Results from the user study demonstrated potential of using the combination of UI elements to support story comparison for decision making as well as encouraging the users to be more creative. Also, it highlighted a challenge in temporal

synchronization between the contents being compared. Duration and order of frames are important but at the same time prevent similar frames from being displayed together and compared. We assume that this issue exists in other visual temporal media and therefore the expansion of the design to other media is a worthwhile endeavour.

As the next step, I plan to refine the design and apply design elements identified so far to more general, daily comparison tasks and would appreciate any feedback regarding possible future prototypes for temporal media comparison.

Expected Contributions

During my Ph.D. study, I will contribute design and discussion to problems related to visual temporal media comparison. Those problems should support end-users in regular activities and serve as representatives of different types of visual temporal media. The prototypes and results will help in understanding and suggesting design guidelines for other temporal media applications. This knowledge may be applied to other sequential and temporal data, as well as contribute to general comparison support tools.

In addition to comparison task, I will also investigate its relationship with understanding, discovering, evaluating, and improving the process. I believe the implications from this will help improve the way people produce and consume media.

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