

Manipulating History in Generative Hypermedia

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ABSTRACT

We continue to develop a generative hypermedia system that uses composition for browsing, collecting and organizing information samples from web pages. The system's generative actions of collecting information samples and composing them visually are conducted iteratively over time, based on an adaptable user model. The system presents the ongoing generation of the composition to the user in an interactive information space. In this space, the user can directly manipulate the composition through interactive design operations, and affect the model by expressing positive or negative interest in each sample.

We are developing mechanisms for manipulating the time-based medium of the evolving information space. Interaction design affords linear timeline traversal and non-linear time travel. Extended tape recorder metaphor controls, including jog-shuttle based navigation, provide the user with flexible means for operating the system's generative functionalities, and linearly traversing session history. We introduce a *door-latch* metaphor that enables one of several considered forms of non-linear time travel. Users can change history by retroactively locking an information sample in position across time.

Categories & Subject Descriptors:

H. 5.2 [User Interfaces]: Interaction Styles

H. 5.4 [Hypermedia]: User Issues, Navigation

General Terms: design, human factors

Keywords: history, non-linear, time travel, generative

1. INTRODUCTION

combinFormation [3] provides a generative information space for browsing, collecting and organizing information from the web [4]. The program generates the space by sampling web pages, extracting images and sentences of text, and composing these samples visually. The information samples represent the web pages they come from and are hyperlinked to. Except while paused by the user, generation proceeds temporally. The resulting form is a time-based medium, like film.

In our mixed initiative [2] interaction model, the user can interact with this same information space to express her/his interests in samples, and to engage in visual design or navigation. The user's interest expression interactions affect the program's model of her/him. A feedback loop is created, from the model, through the visual composition, and the user's expressive interactions, and back to the model. This allows the information space to evolve in response to the user's interests, over time.

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In this paper, we address interactive semantics for manipulating the history of a combinFormation information space. The history is the union of the program's generative actions, the user's design actions, and the user's interest expressions. S/he can traverse the history using extended tape recorder metaphor controls or jog-shuttle with preview. The preview rapidly shows the state of the information space at different points in time, as the jog shuttle is dragged. We also provide the ability to lock information samples in the space across time, using a *door-latch* metaphor. By changing history, latching constitutes a form of non-linear time travel.

2. RELATED WORK

It has been shown that capabilities for navigating history, while authoring, augment a user's ability to engage in design processes [6]. History representation can also be useful when the information space is shared with others to present or exchange ideas. The history system helps by showing the reader how the space has evolved from its beginnings to its current state [8].

Prior studies have shown that in traditional web browsers, use of the 'Back' button accounts for up to 42% of user actions [1]. This demonstrates the importance of the role of going back and forth while seeking information on the web.

Klemmer's Designer's Outpost system provides a timeline annotated with thumbnails. The user can directly click a thumbnail to transport to the associated history state [5]. The system supports branched history, but only the current branch is presented to the user as a linear history. This history is annotated with stubs, indicating the presence and position of other branches.

VKB provides a slider, which the user can move across the timeline to restore the workspace to a prior state [8]. The history system in VKB supports only one branch. VKB history support also features a playback mode. Once the user goes back in time, s/he can hit the play button and choose an appropriate speed to play the sequence of actions that have happened from that point.

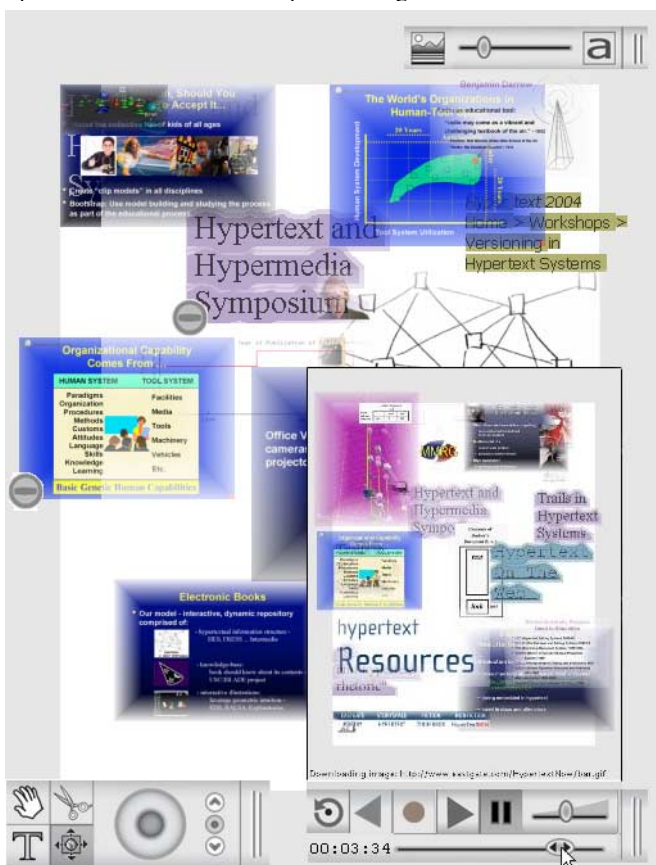
Luesebrink introduced the idea of *interactive time*, to refer to time in which the reader is involved in meaningful exchange with a hypertext [7]. Shipman added *constructive time* [8], addressing the author's writing process, which VKB presents to the user as the timeline. In the prior system, dragging the slider across the timeline does not provide the user with visual cues about each state until s/he releases the slider there, and waits for the system to rebuild that state. A cognitive burden of complex recall, or reading a textual history actions log, is imparted on the user.

3. LINEAR HISTORY TRAVERSAL

Our system adds a visual preview, as the jog-shuttle slider is dragged. We expect this will increase the user's sense of orientation while rapidly traversing linear history. Based on these previews the user can decide whether s/he wants to go to that state, or traverse further. This can help to streamline the experience of interactive and constructive time in the generative hypermedia.

Previously, combinFormation tape recorder controls only enabled turning information space generation on and off, and changing its

rate [4]. Now, with the history mechanism, we have extended this metaphor to enable improved navigation of the time-based medium. Our goal was to provide rapid access to the history of each browsing and collecting session. In our new linear history controls design (bottom right of figure); the *record* button generates the visual information space: it adds new information samples to the space, removes some old ones, and transforms the composition of remaining elements. *Pause* stops the playback or recording of the information space. *Reverse* replays a previously recorded information space generation sequence, with reverse chronology. *Play* replays a sequence with forward time. The *rate slider* (next to *pause*) controls the speed of the playback or recording. The *jog-shuttle* slider (bottom row) enables rapid interactive linear traversal of the timeline in either direction. As the knob is moved along the slider, small key frame previews of the information space are displayed to show the user how the space looked at intermediate points along the timeline.



An information space on hypertext research. While the user drags the jog-shuttle, a preview window is shown, overlaying the current information space. Two samples are latched, locking their positions across time, regardless of history.

4. NON-LINEAR TIME TRAVEL

After extending the linear history traversal controls, we considered: what does it mean to go back and forth in time in a generative hypermedia? What situations that interleave history traversal with interaction are possible? What courses of action could be available to users? We foresee several possible scenarios:

1. The user goes back in time. At some point s/he changes the interest state of some elements, and starts recording again. In this

case, it is necessary for the system to restore the complete user interest model, as well as the media collection (from which the information samples to be displayed are chosen) from the previous point. This would ensure that the system is exactly in the same state; it can start building the information space as if nothing had happened after that. Since the interest state on some information elements has been changed, it is likely that the new information space produced will be different from the previous one. Thus, this is a start of a new branch. The previous branch may or may not be maintained, depending on the implementation.

2. When the user goes back to the past, s/he may see a sample that disappeared, but which s/he now wants in the composition. Instead of starting a new branch, the system needs to edit the existing one, by bringing elements from the past into the present. In this case, it is not necessary to restore the model and media collection, as the user just needs to move the elements across time.

3. The user might be interested in “editing” the history. That is, s/he might want to remove, add, resize or change the position of information samples in the space, after going back in time.

Because they change the history of the information space, each of these scenarios can be construed as forms of non-linear history. These forms of non-linear history can enhance generative information space experience, by giving the user new mechanisms for manipulating the composition across time.

The current implementation provides a solution only to scenario 2. It introduces interactive affordances based on a *door-latch* metaphor. We provide a latch tool that locks an information sample at a fixed position *across time*. The latch overrides history replay operations that would have removed or modified the sample. It can be used to bring information samples from the past, back to the future, or vice-versa. For example, in the figure, two samples, one text element and one image were locked using the latch. After jogging forward, information space generation continued, and changed with time. When the user jogs back using the slider, s/he can see the previous information space state in the preview, which shows the locked samples in the same position.

5. REFERENCES

- [1] Cockburn, A., McKenzie, B, Smith, M. J., Pushing back: Evaluating a new behavior for the back and forward buttons in web browsers, *Intl Journal Human Computer Studies*, v 57:5, 397-414, Nov 2002, 397-414.
- [2] Horvitz, E., 1999. Principles of mixed-initiative user interfaces, *Proc CHI 1999*, 159-166.
- [3] Kerne, A., Interface Ecology Lab, combinFormation, <http://ecologylab.cs.tamu.edu/combinformation>
- [4] Kerne, A., Sundaram, V., A Recombinant Information Space. *Proc COSIGN*, 2003, 48-57.
- [5] Klemmer, S., et al, Where Do Web Sites Come From? Capturing Design History. *Proc CHI 2002*, 1-8.
- [6] Lee, A., Investigations into history tools for user support. CSRI-271, University of Toronto, April, 1992.
- [7] Luesebrink, M. C., The moment in hypertext: a brief lexicon of time, *Proc Hypertext 1998*, 106-112.
- [8] Shipman, F.M., Hsieh, H., Navigable History: Reader’s View of Writer’s Time, *New Review of Hypermedia and Multimedia*, 2000, 147-167.