Workspace History and the Structure of Hypertext Activity

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Introduction[1]

Recent efforts in spatial hypertext have added the constructive notion of time by recording authors' edits so that they may later be replayed [Shipman, Hsieh 2000]. This workspace history, at least as provided in the Visual Knowledge Builder, provides readers with a variety of methods for navigating through the history of the workspace. They may replay the events in order, they may go back to a particular session or date/time, or they may go back to a particular event on a particular element in the hypertext. With a navigable workspace history, readers get a partial record of authors' activity – partial because it is only the edit events that are recorded.

In "The Structure of Hypertext Activity" [Rosenberg 1996], Rosenberg describes hypertext readers' actions in terms of actemes, episodes, and sessions. Actemes are the individual actions that readers perform in the hypertext. Episodes are sets of actemes that cohere to have meaning to the reader. And sessions are the periods of interacting with the hypertext that may have multiple episodes. This model of reader activity allows a discussion of how individual interactions with the hypertext may combine to meet certain (potentially implicit) goals of the reader.

These are two models of hypertext activity – one emphasizing authors and one emphasizing readers, one from a system perspective and one from a (more) human perspective. This position paper uses discusses existing models of information-centered activity and how they might inform further research into the nature of hypertext activity and systems supporting it.

Reading and Writing but No Arithmetic

Spatial hypertext is used for many different tasks including note taking, literature reviews, conference organization, and project management [Shipman et al. 2001]. Many of these tasks center around collecting, organizing, and annotating information. Spatial layout and visual attributes (e.g. color) are used to non-verbally express attributes, categories, and relationships in these activities. As a task proceeds, the visual language emerges and evolves. Thus, comprehending the spatial hypertext requires understanding the state of the visual language when the activity of expression occurred. This is in contrast to relatively fixed hypertexts, such as most on-line documentation or published hypertexts, which have been the focus of much of the existing theoretical analysis. It is the dynamic nature of the visual languages used in spatial hypertext that led to the addition of navigable history.

Another characteristic of common spatial hypertext tasks is that readers are also authors. When a group of people shares a spatial hypertext, individuals "read" the work of others but also generate new content. This dual role of the person working with the spatial hypertext implies that we must think of both types of activity.

[1] This paper briefly introduces models of hypertext activity and how they relate to navigable history. It is meant to provide background for discussion (activity) at the workshop rather than to be a self-contained document.

Models of knowledge work include both information production and consumption. For example, Fischer, Henninger, and Redmiles [1991] describe an information life cycle for software artifacts where activity proceeds through a cycle of location, comprehension, and modification. Mapping this model of information work to hypertext, a person will navigate or search through a hypertext or set of interconnected hypertexts until they locate information they desire. Then they will comprehend this information, which includes reading, listening, or watching the content of the information, and developing an interpretation of its meaning. For a spatial hypertext, this includes developing an understanding of the semantics of the visual representation. They might then edit the information by authoring new information, or editing and annotating existing information (including the visual properties and spatial structures in a spatial hypertext.)

Different tasks will start at different places in this cycle. A new spatial hypertext begins with authoring and modification, which may include subtasks of locating and comprehending information from other sources in tasks that involve collecting and organizing materials. When a spatial hypertext is passed from one person to another, the recipient's activity will begin with comprehending the material and later consider modifying that content or looking for related content. A person who has a particular question or information need but does not already know where to find that information will initially emphasize location then move on to comprehension. The collection, organization, and annotation tasks so common in spatial hypertext will cycle through all three phases, as users perceive the need for new information and express interpretations based on new conceptualizations of the content.

Activity and History in VKB

History in VKB is represented as a list of events that led to the current state of the hypertext. The first implementation of the VKB history mechanism recorded all user activity. Due to the large number of "non-edit" events (moving in and out of collections, scrolling, opening information objects,), it was decided to record just the edit events [Shipman, Hsieh 2000]. This decision meant that movement through the history of a VKB space would be related to the rate of its creation, rather than its use. This matched the goal of navigable history at that time – allowing readers to better understand the intention of authors. The limitation is that non-edit events that an author performs while deciding what edits to make are not recorded. Unfortunately, this limits other uses of history, e.g. the activity of other readers might be useful much like trails of readers' navigations can be in navigational hypertext.

Fischer's information life cycle provides a high-level view of activity but users interact with the system at a much lower level. Rosenberg's actemes and VKB's edit events are user actions that cannot be further decomposed. These actions are composed into higher-level structures of activity – episodes in Rosenberg's model. Our current work modifies the navigable history mechanism to support the representation of higher levels of activity. The features described are currently in the internal research version of VKB (not in any of the versions released to date.)

The new VKB history mechanism enables higher levels of activity to be identified. Users can group edit events into a hierarchical edit history, e.g. groups can include atomic edit events and other groups. These groups can be named and annotated. By grouping edit events, the user is identifying a Rosenberg episode, or sub-episode. Naming and annotating this activity may help others comprehend the task being performed during a particular period and how the author perceived that task.

Rosenberg goes on to describe sessions as being periods of activity with the hypertext that may include multiple episodes. VKB history includes heuristically determined sessions, recognized by time gaps between edit events rather than application executions and exits. This method of identifying sessions was chosen since an application may be terminated for many reasons, including system errors, perceptions of the need to restart, etc.

Activity as a Navigational Destination

Links through time were introduced in VKB but as yet there is little experience with their use. These links allow authors to create navigational opportunities where the destination is not just a set of information, but information at a particular point in time. The intention is to allow links to activities within a hypertext, or at least the states of the hypertext right before or after particular activities.

Authored links through time, as opposed to implicit links through time such as the "return to state when …" feature in VKB, are not found in other systems. Their use was originally motivated by the idea that spatial hypertexts should be able to include reflection about their own creation. An example where such reflection would be beneficial is documenting a design process. Consider a hypertext containing both the design of a computer network and the documentation of how that design came to be. The network, if it is like most computer networks, has evolved over a long period of time. Earlier design decisions may not make sense given new organizational goals or new technology. In such a case, links from components of the network design to the design activities that generated the design will facilitate comprehension.

Within the context of distributed hypertext, links through time have additional advantages. By linking to an external hypertext at a particular time, the author of the link identifies a particular state of that document that their reader should see. Given an environment of distributed authorship like the Web, such functionality becomes particularly powerful. In the VKB model of distributed spatial hypertext, links between spatial hypertexts can request a particular state of the destination but the provider is not constrained to provide a history with their on-line hypertext. When a link specifies a state that is no longer available, the reader can be notified that they are about to see a result that may be different from the link author's intention.

While the hypertext community has talked much about being "lost in hyperspace", becoming "lost in hypertime" might be even more problematic. People browsing a distributed spatial hypertext, following links that take them to prior states of documents, have the potential to generate distorted views of the information space. For instance, they will not know about corrections to information that they are viewing. Much work remains to be done in making apparent the temporal characteristics of links to the casual browser of a distributed spatial hypertext.

This paper provides a brief description of models of hypertext activity and the design of the VKB history mechanism. It is meant to open the door for discussion of the role of history and issues that surround it.

References

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