

# Enhancing Electronic Books with Spatial Annotation and Social Navigation Support

Peter Brusilovsky

School of Information Sciences, University of Pittsburgh

peterb@pitt.edu

Jae-Kyung Kim

School of Information Sciences, University of Pittsburgh

ki187cm@gmail.com

Rosta Farzan

Human-Computer Interaction Institute, Carnegie Mellon University

rosta@cs.pitt.edu

## ABSTRACT

Recent projects such as Carnegie Mellon Million Books started the process of rapid digitization of traditional books. With other industrial and academic efforts following this lead the main research challenge for both researchers and practitioner is moving from “how we can scan a million books” to “what we can do” with the newly available “million books”. This paper presents a specific approach, which can extend enriching the experience and productivity of users of digital books by giving them a combination of annotation and social navigation support. This approach was implemented evaluated in several classroom studies.

## 1. Motivation

Recent projects such as Carnegie Mellon Million Books (Reddy & StClair, 2001) started the process of rapid digitization of traditional books. With other industrial and academic efforts following this lead the main research challenge for both researchers and practitioner is moving from “how we can scan a million books” to “what we can do” with the newly available “million books” (Crane, 2006). What is the value of having all these books in digital form? Is it just 24/7 anytime, anywhere access?

Along with other researchers focusing on enriching the experience and productivity of users of digital books, we argue that the availability of many electronic books in digital format can offer unique opportunities to their users.

Our own work on enhancing the experience of electronic book users focuses on supporting the users of electronic books with shared annotation and social navigation functionalities. In our earlier work on Knowledge Sea II (Farzan & Brusilovsky, 2005) and AnnotatED (Farzan & Brusilovsky, 2008) projects we explored the use of these technologies with HTML-based electronic textbooks. The new version of our annotation technology presented in this paper was designed to support the users of fully spatial electronic books – similar to those which are being scanned by the Million Books project. We developed an approach which combines source annotation and social navigation in the context of authentically spatial electronic books. The feasibility of this approach was explored in several classroom studies where a collection of textbook on the subject played the role of a small digital library. This paper provides a brief review of Web annotation tool, demonstrate its application for social navigation, and discuss the results of its evaluation. More technical details can be found in (Kim, Farzan & Brusilovsky, 2008).

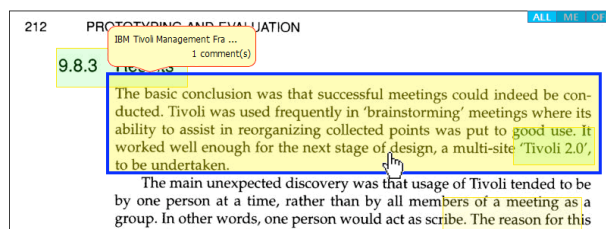


Figure 1: Viewing a selected annotation

## 2. Spatial Annotation for Scanned Textbooks

Our spatial annotation interface allows the user to create a new annotation by clicking and dragging the mouse to create a rectangle of the desired size and, if desired, adding the first comment in this location. The interface also offers students the ability to make their annotations *public or private* as regards visibility of the annotation, and to choose *type of note*, such as praise or general, and *authorship*. We added these options to motivate students to share their feedback with their classmates.

We anticipate two major ways to use annotations: for user own needs (active reading) and to communicate with other users. The interface provides three visibility control buttons *all*, *me*, and *off*, located at the top-right of each page (Figure 1). The “off” button hides all annotations, the “me” button shows only user’s own annotation, and “all” shows also all public annotation made by other users on this page. As shown in Figure 1, when the mouse cursor hovers over an annotated area, it highlights the corresponding annotation to show students which annotation is being currently selected and displays a small balloon containing other information, such as note text and how many notes belong to it.

### 3. Annotation-based Social Navigation Support

The goal of annotation-based social navigation support (SNS) is to guide users to most interesting and popular pages and fragments. Fragment guidance is provided on a page level by changing border and background style of annotations (Figure 2). A filled background means that the annotation or a comment associated with the annotation was created by the current user, while no background shows that the annotations were all created by others. In the case of personal annotations, light orange represents general type annotations while light green represents praise type annotations. Border style represents annotations by other users (not the current user). The border is orange if all the comments associated with the notes are general and green if at least one comment is praise. The thickness of the border represents the number of comments associated with the annotation. The border gets thicker as the number of comments associated with it grows.

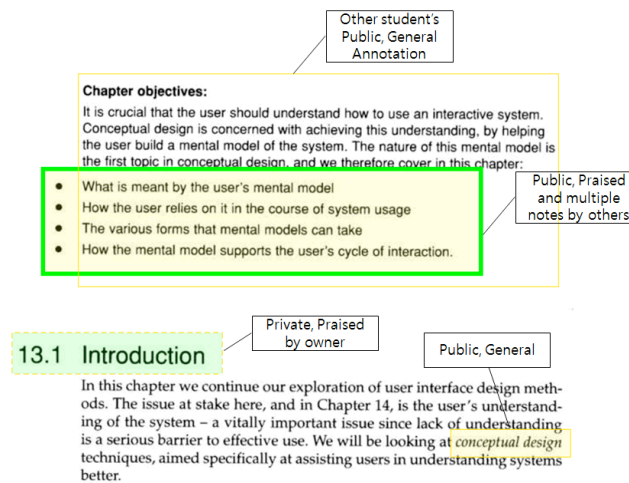


Figure 2: Visualization Properties of Annotations

Page guidance is provided by adaptive link annotation. A good example of its implementation is provided by Knowledge Sea II (Farzan & Brusilovsky, 2005) system, which we used in our courses to integrate several textbooks on the subject. The navigation is facilitated through traffic- and annotation-based SNS. Traffic-based SNS guides the students to resources which attracted a higher number of visits. Annotation-based SNS guides students to resources which attracted personal or group annotations. Access to resources in KnowledgeSea II is done through three levels: map, cell, and page. SNS is provided at all levels. Figure 3 shows the three levels of KnowledgeSea II.

The map is an 8 by 8 table in which every cell includes links to online tutorials. A set of keywords represents the content of the material linked to the cell. The adjacent cells present similar materials. Traffic-based SNS is presented through the background color of the cell. A higher number of visits is represented by a darker color. Cells including any resource with students’ annotations are augmented with a yellow sticky note. Cells including positive personal annotations are augmented with a red sticky note. Overall viewpoints of the annotations are visualized with a thermometer. The temperature grows warmer as the resources inside the cell attract more positive annotations. A cell shows a list of resources, which are augmented with visual cues representing traffic- and annotation-based SNS. A human icon inside a colored square represents traffic-based SNS. Annotation-based SNS is represented by an annotation icon in a colored square. The icon represents the type of personal annotation, with a sticky note for general annotation and thumbs up for positive annotation. The color saturation of the icon represents the number of personal annotations. Darker colors represent a higher number of annotations. The background color represents the type of group annotation and the density of the color represents the number of annotations.

### 4. Evaluation

The system was evaluated in the context of interactive system design course which about 30 students enrolled. The student created several hundred annotations during the course. Most of them were created for bookmarking a region of interest while the others were used to leave simple notes, as reminders or to share opinions. Comparative log analysis of this course and a previous version of the course which has not use spatial annotations demonstrated that the availability of spatial annotations significantly increased the number of comments made by the users as well as their reading activity. As expected, social annotations demonstrated their ability to guide users to annotated pages. We also observed that the majority of annotations appeared on important pages and important fragments within the page. The users regarded new functionality very positively all aspects of new interface. At the same time, some students mentioned that the icons and style of annotation are not familiar to them and it might cause cognitive loads. It seems like that more intuitive way to represent the icon and annotation is required for the students who have little experience with social navigation functionality

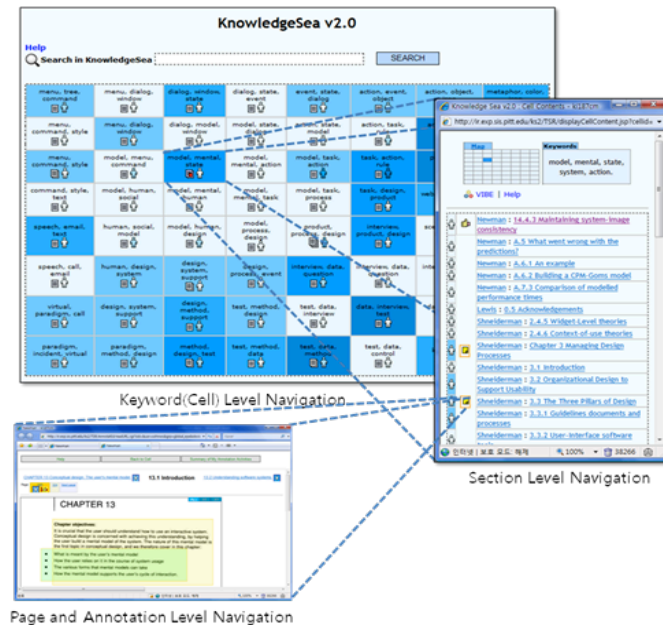


Figure 3: Navigation support functionality in Knowledge Sea II

## 5. Conclusions

The paper presented our attempt to extend the value of scanned electronic books with spatial annotation and social navigation support. With this approach, users create regions on the electronic textbooks as a bookmark, leave notes and exchange ideas with the community of readers. Annotations are used to enhance social navigation support and to guide readers to most interesting pages. Our results show that our approach is useful at least in one context of using electronic books – in the classroom. We expect, however, that this approach can improve the reader's experience in many other contexts.

## 6. Acknowledgements

This work is supported by National Science Foundation under Grant IIS-0447083 and the Korea Research Foundation Grant funded by the Korean Government (MOEHRD). KRF-2007-357- D00231.

## 7. REFERENCES

- Crane, G. (2006) What Do You Do with a Million Books? *D-Lib Magazine* 12 (3), <http://www.dlib.org/dlib/march06/crane/03crane.html>.
- Farzan, R. and Brusilovsky, P. (2005) Social navigation support through annotation-based group modeling. In: L. Ardissono, P. Brna and A. Mitrovic (eds.) *Proceedings of 10th International User Modeling Conference*, Berlin, July 24-29, 2005, Springer Verlag, pp. 463-472, also available at <http://www2.sis.pitt.edu/~peterb/papers/FarzanBrusilovskyUM05.pdf>.
- Farzan, R. and Brusilovsky, P. (2008) AnnotatEd: A social navigation and annotation service for web-based educational resources. *New Review in Hypermedia and Multimedia* 14 (1), 3-32.
- Kim, J.-K., Farzan, R., and Brusilovsky, P. (2008) Social Navigation and Annotation for Electronic Books. In: J. G. Shanahan, et al. (eds.) *Proceedings of BooksOnline 2008 Workshop at the 17th ACM conference on Conference on information and knowledge management: CIKM '08*, Napa Valley, CA, USA, October 30, 2008, ACM Press, also available at <http://research.microsoft.com/workshops/BooksOnline08/>.
- Reddy, R. and StClair, G. (2001) *The Million Book Digital Library Project*. On-line paper, Pittsburgh: Carnegie Mellon University,