

Usability Testing Virtual Margins

Thesis Proposal

by

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for

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Abstract

How do I know what I think until I see what I say?
-- Edward Morgan Forster

A study considering the usability and effectiveness of a virtual margin (a text input area for personal use adjacent to the forum views and notes) as an additional element in the Knowledge Forum interface. For the study a group of graduate students used Knowledge Forum, with its interface modified to include a virtual margin, in a knowledge building exercise. An analysis was done of their interactions with the application and the use they made of the virtual margin in particular.

Introduction – what is a “virtual margin”

Using the margins of a printed document for annotations has several advantages that alternative locations lack. The first is that the annotations are persistent. Whenever the author of an annotation returns to the page where an annotation was written, the annotation will still be there in the margin. The writer need not make any explicit effort to preserve it. There is no risk that the annotation could become separated from its associated document. This leads to the second benefit which is that the location preserves context. That is, annotations in a margin retain the context which prompted them initially. This helps the author's remembering what prompted them, enabling a train of thought to be resumed. Thirdly, there is a very low barrier to usage. One need only pick up a pen or pencil and commence writing. There is no, or almost no, “getting ready” process that would distract or impede a writer's intentions from being recorded.

Conversely, modern web interfaces generally lack any kind of editable margin-like feature. Anyone wanting to preserve a thought prompted by a web forum article, for example, has a choice. Respond immediately by making a posting to the forum, write that thought using another application, write it down on paper or make a mental note. The trouble with mental notes is that they are too easily forgotten: they lack persistence and tend to lose context quickly. Paper is not much better. While ink and pencil are persistent there is no good way for a piece of paper to retain the web context which prompted its use. As a result paper annotations are often misplaced or forgotten, rendering them ineffective. Using another application has the same drawbacks as paper. The only association between the content of the annotation application and the content of a web forum is within the annotator's head. So again the annotations lose their context and are forgotten. As a result the choice devolves to respond immediately or forget the idea.

Web based knowledge building environments use forums to enable participants to share ideas and collaborate with each other. However, the interfaces do not provide a

convenient means to record spontaneous or transient thoughts for personal use. Everything a forum participant types is either shared with all the other participants or is discarded when a posting is canceled. There is no simple means for a person to preserve a thought for later consideration or to save a note as a reminder. These ideas could be, or could lead to new insights. However, because they are not saved or shared they are lost to the person who had them and the knowledge building community as a whole.

In brainstorming the intent is to share as many ideas as possible so they can prompt more ideas. The culture of the exercise is very spontaneous. The important thing is the free flow of new ideas. Only later is the wheat separated from the chaff. In contrast, in knowledge building the objective is to improve, or build on, ideas. The culture is more structured and deliberate as befitting considered thought. Participants are much more aware of how their contributions advance the group's understanding and how they are perceived by their peers.

When students read Knowledge Forum postings, ideas and impressions associated with the text occur to them. An impulse to make a response based on one of those ideas or associations can easily be side tracked or given up for a variety of reasons. Even if one participates in a Knowledge Forum discussion very intentionally, outside influences can distract and cause potentially valuable contributions to be forgotten. The intent of the virtual margin is to support people's remembering so that these ideas are forgotten less often.

Few web interfaces support ad hoc commentary or annotations. Even those applications that do provide an annotation interface, do so in a cumbersome fashion that impairs their utility. These annotations are usually shared with the others who are collaborating on an assignment or project. The annotations become another intergroup communications medium rather than as a means for a people to remember something significant to them.

Similar to the margins of a book or journal, the virtual margin is envisioned as a simple and convenient way for people to record their thoughts and impressions in a private, context relevant location with a very low threshold to use. Just as margin notes in a book allow one to record and manipulate one's thoughts in a manner that other locations do not; the expectation is that a virtual margin could have similar affordances. In a knowledge building environment, the hope is that the addition of a virtual margin would lead to more and potentially better knowledge building.

Literature Review

There are three potential audiences for one's annotations (Wolfe, 2002, p. 476). The first is other readers of the annotated work. Historically, notes made in a document's margins, were a means for scholars to share information with each other and discuss the meaning of a document's text (Wolfe, 2002, p. 471). With modern print publishing, where each reader has their own "original copy", the practice of sharing commentary via a document's margins has fallen out of favour. It is much easier to share commentary through alternate means such as letters and book reviews. The second potential audience is the author of the work being annotated. This is still practiced in certain well defined relationships such as a writer and editor, and student and teacher. The third audience is oneself. Document margins remain a popular location for scholars and students to preserve their nascent thoughts and ideas prompted by what they read "...as a way of remembering or remembering to remember" (Marshall, 1997, p. 136). So much so, that "...people typically read and annotate printed documents even if they are obtained from electronic sources.. " (Marshall & Brush, 2004, p. 349).

Annotating web pages is not a new idea. One of the earliest web browsers, NCSA Mosaic, had this ability and even included audio annotations on certain types of computers (NCSA, 1993). The annotations were entered and displayed separately from the web page content and were stored on, and retrieved from, a dedicated annotation server (NCSA, 1993). An early investigation into annotation interfaces looked at modifying a site's content to dynamically add annotations in a browser independent way (Schickler, Mazer and Brooks, 1996). This kind of strategy provided the basis for some attempts to commercialize annotations as part of the web interface, eg. ThirdVoice, uTOK, hypernix, and Zadu (Cadiz, Gupta, Grudin, 2000, p. 310). Each of these examples is the kind of annotation where annotators communicate with each other following the historical model. The vendors tried to use annotations to build self supporting communities. However, all failed to find a viable market and have since disappeared. Annotations are now absent from the contemporary web interface with the exception a few specialized implementations that will be discussed next.

The Firefox web browser (Firefox, 2005) provides a facility for 3rd party developers to write extensions (Firefox Extensions, 2005) for it to provide additional features. One of these extensions, called Wikalong, provides a wiki (Wikipedia, Wiki, 2005) environment that enables people to associate comments with web pages. A wiki is a web site that allows its visitors to edit its web pages as well as read them, typically with no editorial review before the changes are made public (Wikipedia, Wiki, 2005). Comments written in the Wikalong extension are stored on the wikalong server that makes them available to everyone who is using the Wikalong extension and viewing the web page associated with the comments. The developers characterize it as a "wiki-margin for the internet" (Cappiello, 2005). It is very much in line with the approach described by the NCSA and the previously mentioned

annotation systems. All comments are public and can be edited by anyone.

Knowledge Forum™ is designed to support knowledge building communities (Scardamalia, 2004). It has a completely different style of annotation. In this application, annotations are created by opening a dialog window that contains a small text input box, entering the comment and choosing the text with which to associate the annotation. Once the input box is closed, a small yellow icon is placed next to the selected text to indicate the presence of an annotation. These annotations are publicly viewable and can be seen by clicking on the yellow icon. In this way, the comments remain hidden until the reader chooses to see them. This process of creating and viewing annotations is somewhat cumbersome and tends to be used for short comments that don't merit their own posting note.

Fle3 is another application intended to support knowledge building (Leinonen, Virtanen, Kakkarainen, Kligyte, 2002). In this application annotations are added by clicking on an "Add annotation" link at the bottom of an article. This presents a page where annotations can be read and new annotations can be added. Again, annotations are hidden until specifically requested to be seen, and then they are all publicly viewable. While each annotation is associated with a particular article, they are not viewed in the context of their articles. This creates a separation between article and annotation that weakens the relationship between them.

COSE is a Virtual Learning Environment (COSE, 2003) that took another approach to adding comments to web pages. The COSE interface has a margin in which a variety of features are located. Among them is an icon which activates the Margin Notes annotation interface. It opens a dialog box in which the comments may be entered. Once a comment has been entered and the dialog box closed the icon then indicates the presence of a comment. This comment may be kept private or shared publicly (Stiles, 2003). Entering and viewing of the annotations is again a multi-step process.

Recently an annotation feature has been developed for Moodle which "... is a software package for producing internet-based courses and web sites ... designed to support a social constructionist framework of education" (Moodle, 2005). The approach the developer has taken is along the lines of a physical margin which contains the annotations. The main content of the page is on the left side of the browser window and down the right side of the page is a grey box where the annotations are placed. An annotation is created by selecting some text and clicking the "New" button. This creates a numbered entry in the margin with a small input box into which the annotation may be typed. The annotations are publicly editable and may be hidden or visible at the viewer's option by clicking an appropriately labeled button. The grey margin is always present.

All of these annotation and commenting systems require that annotators perform several

actions before starting to type their thoughts. The risk with this is that every step in the process is a decision point where the person can decide not to bother. In most cases once the process of making a comment is complete, the comment is hidden until it is specifically requested to be seen. In only one case does the system support private comments. Generally, the annotations are viewable by other people accessing the same page. Thus these annotations are an additional communications method for the group participating in the web forum. As a result these systems only tangentially support people's remembering. In contrast, the desire for the virtual margin proposed in this study is to get as close to "no interface" as possible. By minimizing the cognitive load (Drommi, Ulferts, Shoemaker, 2005) the barrier of use will be so low that it won't be an inhibitor. People would be able to focus on what they want to remember – not the mechanism for doing so. The goal is for the means to be "transparent".

There are profound differences in the annotations people make for their own use versus annotations they make publicly (Marshall, Brush, 2004). Even private annotations that are later shared undergo significant changes prior to being made public (Marshall, Brush, 2004). This implies that an annotation system intended for private comments requires different affordances than one designed for public annotations. Usability, as defined by the International Organization for Standardization is defined in the 9241-11 standard as: "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" (ISO 9241, 1998). The purpose of the study is, in the context of knowledge building, does the virtual margin, as described above, meet the ease of use goal and is it useful for private annotations in a knowledge building environment?

The researcher demonstrated the technical feasibility of the virtual margin in a pilot study in EDUC 811. The results of that study were presented at the Institute for Knowledge Innovation and Technology during the Summer Institute 2005 (Appendix 1). In the pilot study two potential virtual margin interfaces were compared. The major lessons learned were that the differences between the two interfaces investigated were not significant, additional functionality beyond plain text for margin notes was strongly desired and even though the text input form element was familiar to the participants, the unfamiliar way in which it was presented required some explanation. Responses to these lessons will be addressed in the appropriate parts of the Method section.

Implementation

In implementing the virtual margin several design constraints needed to be respected:

1. No modification to the Knowledge Forum server software. Through negotiation with the vendor access to the source code might have been possible. However, such access was considered unlikely and was not pursued.
2. No modifications to the web browser. Such modifications represent a barrier to use. In effect this meant no new plug-ins or extensions. Existing browser capabilities, and industry standard protocols and features would be used.
3. Contents of the virtual margin are automatically saved and restored for each note and view with no explicit create or save annotation interface controls or dialog. This is in keeping with the desire for a minimal interface.
4. Annotations may only be viewed by their authors. This is in keeping with the desire for a private note keeping area.
5. No dependency on application state. Keeping the virtual margin processing logic separate from Knowledge Forum's processing logic simplifies the programming for both.
6. All development work would be done using Free and Open Source Software (MIT, n.d.) to minimize development costs and the potential for licensing restrictions.

Only one virtual margin interface, as used in the pilot study, will be supplied. Since the participants of the pilot study did not express a clear preference, the choice of which interface will be used will be decided by the researcher. The participants in the pilot study did however, express a desire for more functionality than just plain text. There are a great many What You See Is What You Get, WYSIWYG, rich text web editors (Genii, 2005) available that can provide the kinds of additional functionality that has been requested. It is extremely likely that one or more of these editors can be substituted for the plain text input area. Which of them is suitable for use in this study has not yet been determined.

The basic design of the system is similar to the "new annotation service architecture" used by Schickler, Mazer and Brooks in their annotation study (Schickler, Mazer and Brooks, 1996, p.13). Both systems are implemented using a proxy server that mediates the browser's interaction with the web server. While Schickler et al.'s annotation interface had a dialog to create and view individual annotations and an administrative mode to manage groups and categories, the virtual margin is a single text input area that automatically preserves and restores its contents. This difference leads to several simplifications such as the elimination of administration, notification methods and annotation categorization features. The browser-proxy-server dialog looks like this:

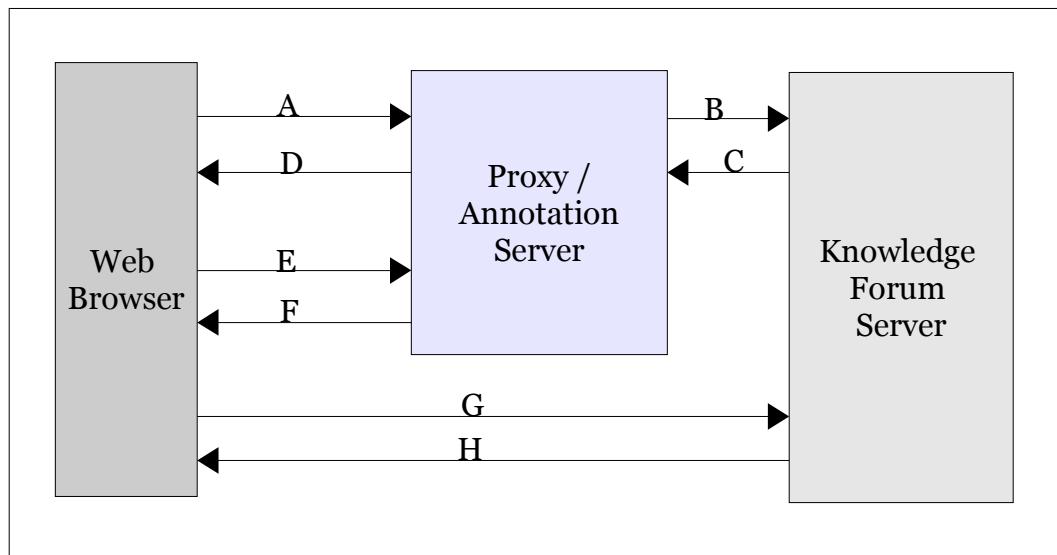


Figure 1. Diagram of system component interactions

Explanation of the interactions:

- A. Web page request – request for a note or a view.
- B. Web page request – forwarded to the Knowledge Forum Server.
- C. Web page response – web page generated in response to the note or view request.
- D. Web page response – web as received from the Knowledge Forum server modified to include the virtual margin and its content.
- E. Margin content save request – request to save the content of a virtual margin.
- F. Margin content save response – confirmation the margin content was saved, or an error message.
- G. Image or other page element request.
- H. Image or other page element delivered in response to the request.

It is not necessary for all requests to be routed through the annotation/proxy server because only the HTML that contains the actual page content needs to be modified to contain the virtual margin for the page. The changes necessary to add the virtual margin are quite small and do not alter the text of the page content. Content that does not need to be modified can be routed directly to the Knowledge Forum server.

The virtual margin is added to a web page by modifying the HTML that describes the page. There are three things that need to be done. The first is the addition of a JavaScript “OnUnload” event handler to the <body> tag. The second is the addition of a form containing a text input area to provide the virtual margin itself. When an OnUnload event handler is defined, the web browser will call it prior to leaving the page containing it. The

OnUnload event handler will capture the contents of the virtual margin text area and send it to the annotation/proxy server. Once the annotation/proxy server has acknowledged receipt of the data, the OnUnload event handler exits and the browser proceeds to the next page as usual. Should an error occur in saving the virtual margin contents, the best the OnUnload event handler can do is display an error message. It is not possible for it to prevent the next page from being loaded. The third change necessary to add the virtual margin is the addition of formatting directives to separate the main web page content from the virtual margin text area and control its presentation.

The annotation/proxy server is implemented using the standard LAMP (Linux, Apache, MySQL and Perl) software stack (Wikipedia, 2005, LAMP). As shown in Figure 1, above, there are two types of requests that the annotation/proxy server handles. Requests for the Knowledge Forum server and requests to store virtual margin contents. The process flow for these requests looks like this:

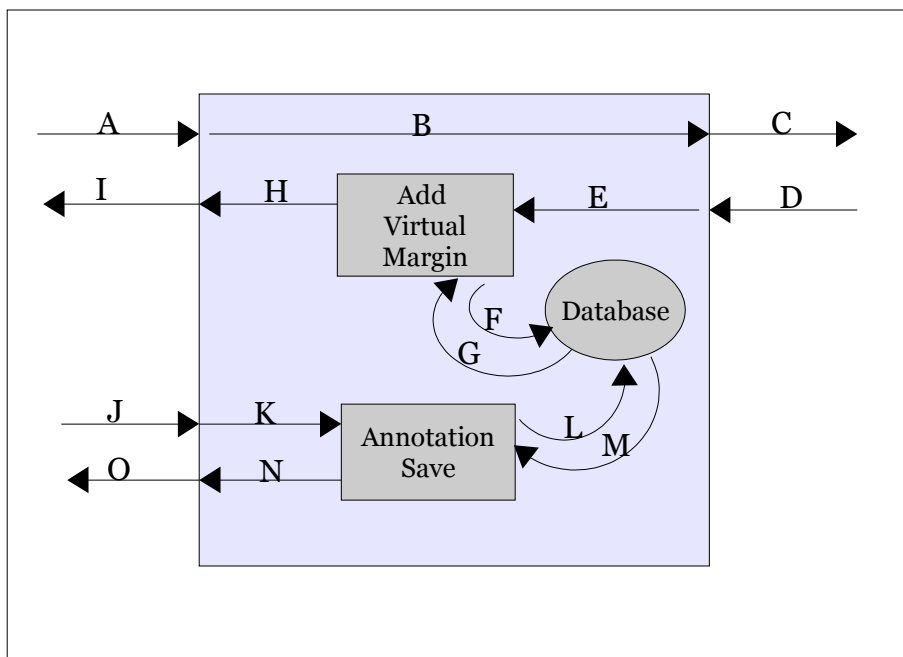


Figure 2. Diagram of annotation/proxy server processing.

Explanation of the annotation/proxy server processing:

- A. The browser sends a Web page request. There are two kinds of requests: GET and POST. GET requests are used to obtain a note or view content. POST requests are used to make new notes or views.
- B. The GET and POST requests are forwarded unchanged to the Knowledge Forum server.
- C. The Knowledge Forum server receives the GET and POST requests as though they

- had been issued directly by the web browser. The presence of the annotation/proxy server is “transparent” to the Knowledge Forum server.
- D. The response from the Knowledge Forum server is sent to the annotation/proxy server.
 - E. The response is received by the Add Virtual Margin component.
 - F. The Add Virtual Margin component interrogates the database for an annotation associated with the request URL and Knowledge Forum username.
 - G. The database responds with the annotation content, if any. The Add Virtual Margin component alters the <body> tag and adds the virtual margin form including the text input area supplying the annotation content provided by the database.
 - H. The modified response is forwarded to the web browser.
 - I. The browser receives the response from the annotation/proxy server as though it had been supplied by the Knowledge Forum server.
 - J. The browser is about to change web pages and sends the annotation content of the virtual margin text area to the annotation/proxy server.
 - K. The Annotation Save component receives the annotation along with the Knowledge Forum username and which page (URL) the annotation is for.
 - L. The annotation, username and URL are saved in the database.
 - M. The database acknowledges receipt of the data.
 - N. The Annotation Save component formats and sends a response to the request.
 - O. The annotation/proxy server sends the response to the browser.

Method

Participants

The participants in this study will be recruited from the members of the 2004 and 2005 Masters of Education and Technology cohorts. These students were chosen for this study because they are already familiar with the Knowledge Forum interface. Permission has been granted to introduce the researcher and this study to them at one of their EDUC 809 classes in January, which they are taking together. During the introduction the researcher will give a demonstration of the virtual margin and answer any questions they might have. Afterwards volunteers will be requested to participate in the study. Once a person has agreed to participate, a mutually agreeable time and location for an individual session can be arranged.

Location and Timing

The individual sessions could take place in either the Centre for Educational Technology, CET, or a near by lab or office. These locations have access to the necessary computers

and recording equipment. They are also familiar to the participants and convenient for them as they attending evening classes during the winter semester. It should be possible for them to participate in the study at one of these locations prior to attending class.

Data Collection

Each of the cohorts has completed EDUC 804 in which they spent a semester using Knowledge Forum to hold discussions of their readings. EDUC 804 is a hybrid model course where a new reading assignment was given most weeks and was discussed in a Knowledge Forum view prior to class. In class, the discussion was reviewed and summarized by the students. Permission has been granted to use their Knowledge Forum server and their databases to provide ready made, and pre-populated, notes and views. Presenting the participants with their own EDUC 804 discussions recreates a familiar and authentic environment for them. The major differences between this environment and how they experienced Knowledge Forum previously, is the addition of the virtual margin, the presence of the researcher and the location at which they access the discussions, eg. The Centre for Educational Technology instead of at home.

The participants will be asked to complete a knowledge building exercise that will require them to read several notes within a view (the particular view for each cohort are still to be chosen) and compose their strongest contribution to that view, eg. A rise-above, build-on or new note. This task is typical of what a Knowledge Forum participant would be expected to do in the pursuit of "...furthering the understanding of the group" (Mackellar, F., personal communication, November 2005). From that perspective this task could be considered a Reference Task as proposed by Whittaker, Terveen and Nardi (Whittaker, Terveen and Nardi, 2002, p. 176). It is sufficiently ill-structured that participants have a range of options available to them in how to approach it, yet not so open-ended that they would spend an inordinate amount of time on it. For the purposes of this study the salient feature of the task is that it will afford the participants with multiple opportunities to use the virtual margin.

The data obtained from the actions of the participants originates from five sources:

1. URL request log – each request for a note or a view is recorded along with a time stamp of when the event occurred.
2. Virtual Margin content – the information the participants write in their virtual margins is preserved in the database.
3. Session Interview – through the course of an individual session the researcher will ask questions and make notes on a sheet containing the "Session Protocol" (Appendix 2).
4. Video record – the individual sessions will be video taped with one camera aimed at the computer screen (an LCD monitor), and one aimed at the participant (subject to approval).

5. System Usability Scale (Brooke, 1996) – filled out by the participants after they have finished the task (Appendix 3). [Note. This was not part of the original ethical review.]

Once the data has been collected the researcher will anonymize the Knowledge Forum usernames by replacing them with popular names assigned at random.

Data Analysis

The expectation is that all the participants will at least make some entries in the virtual margin just to gain familiarity with using it – to gain confidence that it really does work the way they imagine it to work. The initial analysis will need to separate this “getting acquainted” time from the actual “working on the task” time. At this point it is not clear how that should be done. However, assuming that the participant's reading and writing characteristics would be different, there should be some “change in strategy” that can be detected that signifies the transition.

There are two closely related factors to be considered: the usability of the virtual margin and its usefulness. In general if the virtual margin isn't useful then regardless of its usability, people will tend not to use it (past the getting acquainted period). Conversely, if it is useful, people will continue to use it (past the getting acquainted period). If it is sufficiently usable for them they will try to use it, but if it isn't usable then they will discontinue its use. The contrast between these cases highlights Bevan's observation that usability is synonymous with quality of use (Bevan, 1995, p. 2). That is, how well the participants can use the virtual margin is indicative of how usable it is.

There are two scenarios anticipated:

- If the participants tend not to use, or stop using, the virtual margin, then the assumption is that it is not useful or not usable enough. The data will be analyzed to determine:
What were they trying to use it for?
Why wasn't it useful or usable? and
What, if anything, can be done so the feature would be useful or more usable?
- If the participants do make use of the virtual margin, then the assumption is that it is useful. The data will be analyzed to determine:
What were they able to do that they couldn't do previously?
How did this affect their approach to completing the task? and
What implications might this have for knowledge building?

The expectation is that distinguishing between these two scenarios will be straightforward. The questions on the Session Protocol and the System Usability Scale together with the video record should provide sufficient data to inform answers to the scenario questions.

The general approach will be to associate participants with similar problems and achievements into common groups. At this point we don't really know what to expect from the participants, so an emergent coding method will be used to categorize and classify the participant's actions.

Conclusion

The appearance of a virtual margin in a knowledge building web forum application is exciting for its potential to re-enable a document feature that has been dropped in the transition from paper based communication media to web based communication. This study will investigate whether the virtual margin feature is something that would be useful to add to the Knowledge Forum user interface and assesses the usability of a means for doing that. The study has been designed to minimize the differences between the way the participants have experienced Knowledge Forum in the past and how they will experience it in a study session. So the results of this study should be indicative of how useful and usable the virtual margin would be in a real knowledge building environment.

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Appendix 1.

Usability Testing Virtual Margins

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Abstract

This study explores the feasibility and usability of a "virtual margin" feature in a knowledge building environment by comparing two possible implementations in a simulated discussion forum. The subjects were graduate students in an Education and Technology program. The paper contains an explanation of the motivation and key design considerations concluding with a discussion of the study results and suggestions for further exploration.

Introduction

Knowledge building (KB) applications are intended to enable people to share and build on each other's ideas. A guiding concept is "improvable ideas". Because it takes time to improve one's ideas, it is often desirable to be able to easily associate a thought or piece of information with something one has read so one can come back to it at a later date. Ideally, the KB application interface would supply the means to do this because people's memories are far too fallible and managing pieces of paper is far too cumbersome. Unfortunately, in KB applications annotations are difficult to use and everything one writes is immediately shared with the rest of the community. While sharing ideas is central to KB, often people have ideas that they aren't ready to share. They want some time to work with them and consider multiple perspectives. Yet, with no convenient way to record these thoughts, the ideas aren't put into words and so are easily forgotten—lost to the people who had them originally, and their KB community.

In the physical realm of books and journals, margin notes, or annotations, provide an easy way for people to record their thoughts for later reference. When a person returns to a page, any comments made earlier are also present. The comment automatically retains its context and so supports the person's remembering what prompted it. This allows the person to collect information and privately reflect on their ideas.

By adding a "virtual margin" to a knowledge building environment, the members of the community will be able to save their thoughts in a convenient location without giving them the weight and visibility of publishing them for everyone else to see. This gives people the ability to better consider their thoughts and "talk to themselves" before they talk to others. This removes the anxiety of exposing their nascent ideas to the KB community before they are ready to do so. Implicit in this, is that a virtual margin is a private area for each person. No one can see the contents of anyone else's virtual margins. This allows people the freedom to say things to themselves that they wouldn't allow themselves to say to anyone else. As a result people have the ability to express things they otherwise wouldn't which enables them to come up with ideas that they otherwise wouldn't.

This study explored the feasibility of the virtual margin feature. The idea was to enable "writing in the margin" as in a real book or journal. There were three key design decisions.

The first decision was that the virtual margin would allow editing web pages without opening a new interface element to do so. By not presenting a new interface element, people would be able to focus on what they wanted to record, without having to also think about how it is being recorded. The second key design decision was that clicking in the virtual margin should not cause the presentation of the web page to move in any way. The reason for this is that if the margin were to scroll partly out of the viewable area, then clicking in it could make the browser scroll the web page down so the input cursor would be visible. Additionally, allowing the virtual margin to scroll completely out of the viewable area would defeat its purpose. Either result would be distracting. In effect, this means that the virtual margin must remain fixed within the browser window. This led to the third design decision; to make the virtual margin as tall as possible to make the best use of the viewable space. The margin had a fixed width of 200 pixels which takes up approximately $\frac{1}{4}$ of the horizontal space on an 800x600 monitor. On monitors with higher resolution, this would be proportionately less space. This seemed a reasonable compromise for the purposes of this study.

With the basics of the virtual margin decided, the issue became how to present the actual page content next to it. The study compared two possible implementations to learn which of the two is more usable. Usability is a relative concept indicating how easily used an object or feature is. The intent was to discover which virtual margin implementation works more in the way people expect the feature should work. Or to put it another way, which implementation is more predictable and less surprising [Raymond, 2003; Wikipedia, 2005].

Literature Review

The idea that it would be useful to be able to associate comments with an arbitrary web page has been around from the earliest days of the World Wide Web [NCSA, 1993]. Yet the web as we know it today, does not have this feature. This seems strange considering the time and effort that has gone into developing web browser and web server functionality. It seems the annotations feature has almost been ignored until very recently.

The Firefox web browser provides a facility for 3rd party developers to write extensions to it which can provide additional features. One of these extensions, called Wikalong, provides a wiki environment that enables people to associate comments with web pages. A wiki is a web site that allows its visitors to edit its web pages as well as read them, typically with no editorial review before the changes are made public. [Wikipedia, 2005]. Comments written in the Wikalong extension are stored on the wikalong server that makes them available to everyone who is using the Wikalong extension and viewing the web page associated with the comments. The developers characterize it as a “wiki-margin for the internet” [wikalong, 2005]. It is very much in line with the approach described by the NCSA. All comments are public and can be edited by anyone. Both the Wikalong developers and NCSA talk about provision for private group servers.

The key design points here are that the comments are stored completely separately from the

web pages—it is the browser that brings them together, and all comments are publicly editable.

Knowledge Forum™ is designed to support knowledge building communities. It has a completely different style of annotation. In this application, annotations are created by opening a dialog window that contains a small text input box, entering the comment and choosing the text with which to associate the annotation. Once the input box is closed, a small yellow icon is placed next to the selected text to indicate the presence of an annotation. These annotations are publicly viewable and can be seen by clicking on the yellow icon. In this way, the comments remain hidden until the reader chooses to see them. This process of creating and viewing annotations is somewhat cumbersome and tends to be used for short comments that don't merit their own posting note.

Fle3 is another application intended to support knowledge building [Leinonen, 2002]. In this application annotations are added by clicking on an “Add annotation” link at the bottom of an article. This presents a page where annotations can be read and new annotations can be added. Again, annotations are hidden until specifically requested to be seen, and then they are all publicly viewable. While each annotation is associated with a particular article, they are not viewed in the context of their articles. This creates a separation between them that weakens the relationship between an article and its annotations.

COSE is a Virtual Learning Environment [COSE, 2003] that took another approach to adding comments to web pages. The COSE interface has a margin in which a variety of features are located. Among them is an icon which activates the Margin Notes annotation interface. It opens a dialog box in which the comments may be entered. Once a comment has been entered and the dialog box closed the icon then indicates the presence of a comment. This comment may be kept private or shared publicly [Stiles, 2003]. Entering and viewing of the annotations is again a multi-step process.

Under active development is an annotation feature for Moodle which “... is a software package for producing internet-based courses and web sites ... designed to support a social constructionist framework of education” [Moodle, 2005]. The approach the developer has taken is along the lines of a physical margin which contains the annotations. The main content of the page is on the left side of the browser window and down the right side of the page is a grey box where the annotations are placed. An annotation is created by selecting some text and clicking the “New” button. This creates a numbered entry in the margin with a small input box into which the annotation may be typed. The annotations are publicly editable and may be hidden or visible at the viewer's option by clicking an appropriately labeled button. The grey margin is always present.

All of these annotation and commenting systems require the person to perform several actions before starting to type their thoughts. The risk with this is that every step in the process is a decision point where the person can decide not to bother. In most cases once the process of

making a comment is complete, the comment is hidden until it is specifically requested to be seen. In only one case does the system support private comments. As a result these systems only tangentially support people's remembering. In contrast, the desire for the virtual margin proposed in this study is to get as close to “no interface” as possible. That is, to make the barrier of use so low that it won't be an inhibitor. People would be able to focus on what they want to express – not the mechanism for doing so. The goal is for the means to be “transparent”.

Methodology

The study took place over two days in the Centre for Education Technology in the Education building at Simon Fraser University. Four graduate students of a Masters of Education and Technology program used a prototypical web forum application, that has a virtual margin feature. They read forum postings and made notes using the virtual margin.

The web forum application was written in two parts: A Linux server running an Apache web server using Perl and Mason (a suite of Perl libraries) accessing a MySQL database, and a browser interface written using HTML, CSS and JavaScript. For purposes of the study, the participants used the Firefox web browser on Mac OS X. Other browsers, and operating systems, could be used, but this was not pursued due to time constraints.

The web forum was “pre-loaded” with views and notes from a Knowledge Forum database that the graduate students had created in a previous course. This provided the participants with content on familiar subject matter and a familiar structure. The names in the forum (author names and names in the postings) were anonymized by using the list of the 10 most popular boys and girls names in 2004. The assignment of real names to new names was done at random.

The participants, two men and two women, were asked to review postings of their choice and make notes in the virtual margin as they went. The expectation was that this would take about 5-10 minutes for each person. Instead the sessions lasted 25-35 minutes as the participants read and took notes avidly.

For each page request the server randomly chose one of two presentations as represented in the diagrams below. The blue-grey (left) is the document text area, the light-grey (right) the virtual margin (annotation) area, and the dark grey areas are the scroll bar controls. As usual, the scroll bars only appear as needed to view content outside the viewable area.

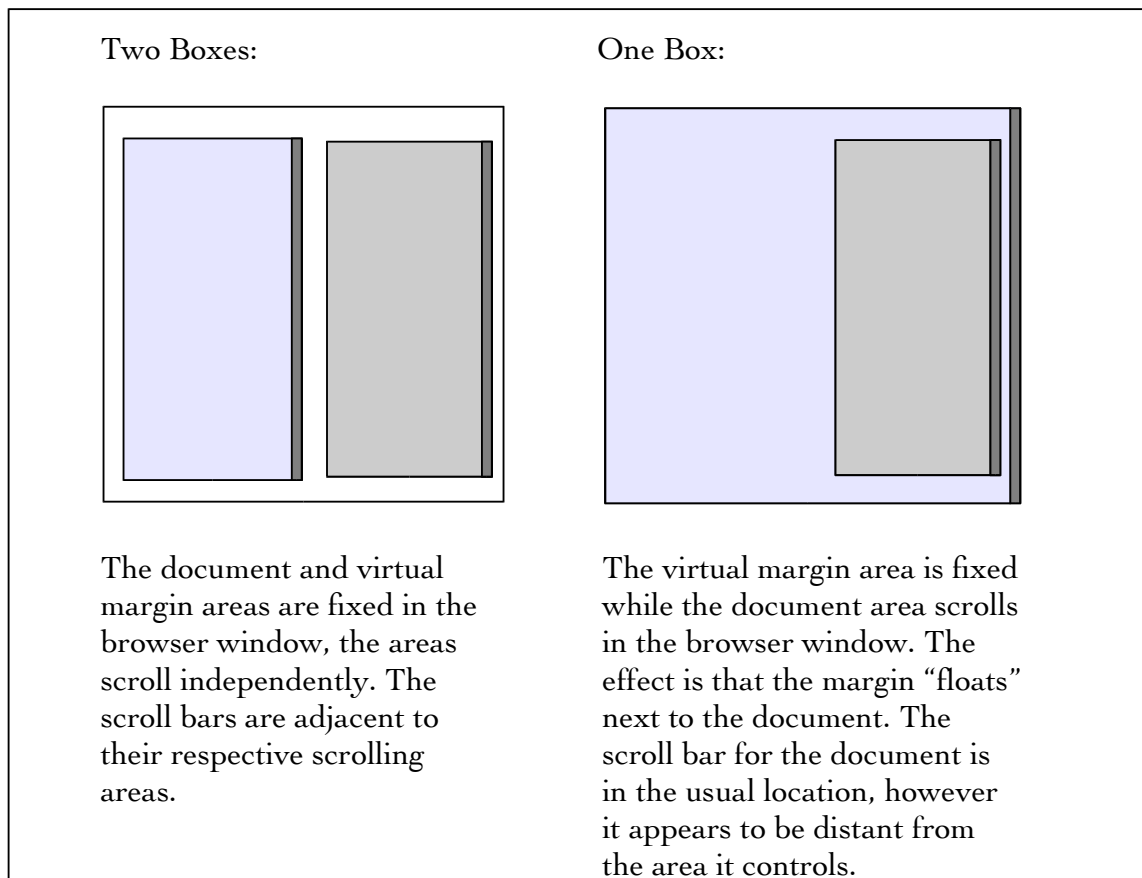


Figure 1 Comparison of the two virtual margin implementations

While the participants were using the web application the observer took notes on a survey form (Appendix One) which was designed to capture some basic demographics and record observations about the participant's interactions with the web forum application. The demographic information was intended to provide context for understanding each participant's responses/behaviours in the expectation that these might correlate with one or more of computer experience, web comfort level or gender. Another possibility considered was that there could be a demographic split, which would suggest that in a real application it would be appropriate to provide both interfaces and allow people to choose their preference.

Each session took place in the Centre for Education Technology in the Education building at Simon Fraser University using an eMac computer with a Firefox web browser. The first session was video taped. The recording captured both the audio and interactions on the computer screen. Unfortunately, the result was unusable because the video images of the computer screen were so severely distorted. For the remaining sessions, a tape recorder was used instead.

Virtual margin notes are associated with a username so before the start of each session the

observer loaded a “log in” page in the web browser and pre-filled the username and password fields. The observer also readied the tape recorder to record the audio of the session. At the start of a session the participant sat in front of the eMac with the log in page displayed while the observer sat on a chair where he could easily see the screen and make notes. The observer then explained that the web application would display the EDUC 804 postings with a virtual margin in which they could write whatever they wanted. He did not mention that there would be two different presentations. The observer filled out the demographic information on the survey and asked them to ask any questions and voice any confusions they had while they used the application. Next the participant signed the consent form. (Appendix two) With that done the tape recorder was started and the participant clicked on the log in button. The first page after logging in presented a list of views next to the virtual margin. Selecting a view displayed a threaded list of postings in that view. Selecting a posting displayed the content of that posting. The participants were not able to alter or edit the views and postings – only the contents of the virtual margin displayed on each page after logging in was editable.

For the data analysis, the intent was to group the observations according to what particular feature caused difficulty. This turned out not to be useful. Instead, the observations and responses were grouped into four broad categories: Comments, Questions, Requests and Difficulties. While there is some overlap between them an effort was made to classify each response according to how it was expressed by the participant.

Results

The primary result of the study is that difference between the two virtual margin interfaces was of no consequence. None of the participants noticed that there was two different presentations. Until it was pointed out to them that sometimes the page was constructed one way and sometimes another, no one noticed. After the difference was pointed out to them, two participants said that they preferred the two boxes format with one person offering that he felt more control with that presentation. One person said that both formats were easy to deal with.

In addition to this result, much feedback was received that hadn't been expected. This was grouped into the categories: comments, questions, requests and difficulties.

Comments:

The comments centred around the usefulness of the virtual margin: What it is and what it is good for. As Ryan (names are fictitious) said “this is a place to collect my thoughts,” or as Hannah put it, “It's a thinking pad. Whenever a thought comes I can get it down.” Olivia voiced the idea that she “...could use this to code my own thoughts.” Olivia and Hannah both voiced the opinion that the virtual margin would have been useful in 804, with Hannah adding that “it would probably improve my posting quality and quantity.”

Questions:

The questions fell into two categories. The first could be characterized as “trust.” Hannah was concerned about the presence of public and private information in one web page. She wanted to understand how content of the private space, the virtual margin, could be moved into the public space, the web forum. Olivia wanted to know “How long do the comments stay?”

The second category is questions about features for working with the text within the virtual margin. As Matthew asked “Why is the input position always at the top?” and “How do I move the text down?” Ryan and Olivia were more specific and asked if it was “...possible to relate a comment to a specific point in a note?”

Some feature questions had a “word processing” flavour to them. Two people asked if there was a spelling checker. Another asked if it was possible to use italics or colour to differentiate text pasted into the virtual margin. Hannah asked if graphics and tables were available.

Other feature requests related to working with virtual margin comments on their own. Hannah wanted to be able to take notes from one page to another. Taking this idea a little further, Olivia asked if she could “.. look at all the comments in one spot?” She also wanted to be able to sort her comments.

On the interface element level, Ryan asked if he could have the margin on the left and Hannah asked if it could be resized. Matthew wanted to know if it was possible to “apply this to an arbitrary web site.”

Requests:

There were two things that were specifically asked for. That is these were not just expressed as questions, but put forward as essential functionality that should be present. The first one is a “margin-note” indicator attached to the view and note titles. That is, if a note or view has a margin note associated with it, some visual indication should be added to their titles. The second request was for a “summary” view or some means for the “margin note to 'bubble-up' to the next level” as Hannah phrased it.

Difficulties:

The participants did have some difficulties. Two things gave them pause. The first concerned the ability to use cut and paste within the virtual margin. Initially the participants were hesitant to use this feature. It took a couple of usages before they gained confidence that it worked in the usual fashion.

The second issue that the participants had trouble with was that the “content” and margin notes reflow and scroll independently. Some of this was hinted at earlier in the questions

around positioning the cursor within the virtual margin. The virtual margin contents are not “fixed” to the page text as in a physical document. This break in the metaphor requires some conceptual re-adjustment.

Discussion

This study looked at the usefulness and usability of a virtual margin feature in the context of a Knowledge Building forum. Gratifyingly, all the participants thought it was very useful and were enthusiastic about the idea. One person liked it so much that he asked if it was possible to use it in conjunction with arbitrary web sites.

The usability issues that were anticipated were completely missed by the participants. They simply did not notice the variations in presentation. The fact that the content scroll bar was sometimes to the right and sometimes to the left of the virtual margin seemed to be of no consequence until it was pointed out to them. The observation recorded during Matthew's session was that the vertical scroll bar was a “strong attractor”. That is, whenever he wanted a vertical scroll bar; he found one and used it. This was consistent with the behaviour of the other participants. This strategy was successful because there was only the one scroll bar — there wasn't enough text within the virtual margin to cause a scroll bar to be displayed there. It could be then, that the presence of a vertical scroll bar on the virtual margin might cause the kind of usability problems that were anticipated at the beginning of this study.

The subtext heard from Olivia's question about how long the virtual margin notes last and the separation between public and private content is “can I trust this thing?” This is a valid concern with any new interface. It is likely that the question of trust is also behind the participants' apprehension over using cut and paste. The virtual margin is an unknown quantity. It will take people some acclimatization time before they become comfortable with it. This means that the issue of trust is of central importance. Before people will use it to record their unvarnished private thoughts, they must trust that those margin notes will not show up in some unexpected place. People also need to develop the confidence that what they put in the virtual margin will come back. Any failure in either of these areas is liable to jeopardize its acceptance and thus its usefulness.

An unexpected benefit of this study is an awareness of the ways people envision using a virtual margin. This has broadened the scope of its applicability. It is capable of much more than just supporting people's remembering. It provides a new way for people to work with their own ideas. The implications of this are worth exploring further. How would people really use this feature, and what would they actually use it for?

Another unexpected benefit is the list of features that the participants desired in a virtual margin. Some of these would be easy to add, such as aggregating margin notes for postings to their view level. Others such as word processing features are more difficult, but are still possible in some browsers. The challenge here is how to provide this kind of functionality in a

confined space without introducing a degree of clutter that compromises the basic functionality and interface transparency. Some lessons from the development of wiki markup languages could be useful here.

Conclusion

A knowledge building environment is defined as “[a]ny environment (virtual or otherwise) that enhances collaborative efforts to create and continually improve ideas” [Scardamalia & Bereiter, 2003]. Adding a virtual margin to a web forum application opens up new ways for people to interact with their own ideas as well as the ideas of other community members. By supporting individual people's remembering, the expectation is that virtual margins have the potential to improve a community's knowledge building.

The differences between two virtual margin implementations went completely unnoticed. In addition, the presence of a virtual margin next to typical forum content (notes and views) did not cause the participants any difficulties. The response of the participants enthusiastically supported the virtual margin idea and offered many suggestions for improving its usefulness.

This study was fairly limited in scale and scope as the participants were merely reading and recording their thoughts. There was no expectation, or pretense, that they would revisit their virtual margin notes at a later date. An expanded study could add a virtual margin, designed with some of the feedback obtained, to a knowledge building environment to learn how this feature would be used in a real knowledge building effort with more participants.

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Appendix One: Survey Form

Task:

Use the web application to review a collection of web forum postings and use the virtual margin to make notes.

Questions:

1Sex: M / F

2Computer experience: 1-5 5-10 10-15 15-20 years

3Web comfort level: low 1 – 2 – 3 – 4 – 5 high

4Initial reaction to the format of the postings?

5Any trouble understanding the interface components?

6Able to add/alter margin notes?

7What “issues” arose?

8Participant questions?

Appendix Two: Consent Form:

Simon Fraser University

Faculty of Education
8888 University Way
Simon Fraser University
Burnaby, BC V5A 1S6

Informed Consent By Participants In A Research Study

Title: Virtual Margin Annotation Interface Comparison
Investigator: Carl Forde, cjf@sfu.ca
Department: Faculty of Education

Purpose:

To investigate the relative usability and affordances of two methods of adding a virtual margin to the interface of a web forum.

Procedures:

Each participant will use a web browser on a computer to access a discussion forum. Participants will be able to view the postings and record annotations directly on the screen. (Each participant's annotations will not be viewable by any other participant.) The researcher will take notes on the participant's interaction with the web page components. The computer screen during the sessions may be video taped and audio recorded, subject to the participant's approval.

Risks to the participant:

There is minimal risk to participants. The activities are non-threatening and non-invasive. Any participant who feels uncomfortable may choose to stop participating at any time and have the record of their session destroyed.

Benefits of the study to the development of knowledge:

The information obtained will help to improve the researcher's understanding of the affordances of virtual margins for annotations in Knowledge Building.

A copy of the results of this study, upon its completion, may be obtained by contacting Carl Forde at cjf@sfu.ca

The University and those conducting this research study subscribe to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of participants. This research is being conducted under permission of Cheryl Amundsen, Associate Professor of Simon Fraser University's Faculty of Education. The chief concern is for the health, safety and psychological well-being of research participants.

Should you wish to obtain information about your rights as a participant in research, or about the responsibilities of researchers, or if you have any questions, concerns or complaints about the manner in which you were treated in this study, please contact Cheryl Amundsen by email at cheryl_amundsen@sfu.ca or phone at 604-291-4853.

Any information that is obtained during this study will be kept confidential to the full extent permitted by professional ethics. Knowledge of your identity is not required. You will not be required to write your name or provide any other identifying information on research materials. Materials will be maintained in a secure location.

Having been asked to participate in the research study named above, I certify that I have read the procedures specified in the Study Information Document describing the study. I understand the procedures to be used in this study and the personal risks to me in taking part in the study.

I understand that I may withdraw my participation at any time. I also understand that I may register any complaint with Cheryl Amundsen or Carl Forde.

Participant Last Name

Participant First Name

Participant Contact Information

Participant Signature

Date: (mm/dd/yyyy)

Appendix 2.

Session Protocol

Through each session the researcher will answer questions posed by the participant. The intent is to assist the participant in finding an answer rather than telling the participant a particular answer.

--- camera aimed at participant & camera aimed at screen ---

Pre-Assignment questions

1. M / F
2. What was the first language you learned to speak?
2. How many years have you used computers?
3. How many computer operating systems are you familiar with?

--- Review Virtual Margin ---

--- Introduce the assignment ---

4. How have you approached this kind of assignment previously?
What tools did you use?
What frustrations did you experience?

--- Perform assignment ---

Prompt the participants if they get "stuck" or appear confused.

eg. what are you thinking? what it is you want to do?

Record observations of participant's behaviour.

--- Post assignment questions ---

5. What did you use the virtual margin for?
6. Did it help? In what way?
7. Did it hinder? In what way?
8. Was there something you wanted to do but couldn't?

Appendix 3.

System Usability Scale

© Digital Equipment Corporation, 1986.

	Strongly disagree				Strongly agree
1. I think that I would like to use this system frequently	1	2	3	4	5
2. I found the system unnecessarily complex	1	2	3	4	5
3. I thought the system was easy to use	1	2	3	4	5
4. I think that I would need the support of a technical person to be able to use this system	1	2	3	4	5
5. I found the various functions in this system were well integrated	1	2	3	4	5
6. I thought there was too much inconsistency in this system	1	2	3	4	5
7. I would imagine that most people would learn to use this system very quickly	1	2	3	4	5
8. I found the system very cumbersome to use	1	2	3	4	5
9. I felt very confident using the system	1	2	3	4	5
10. I needed to learn a lot of things before I could get going with this system	1	2	3	4	5