Group Awareness Support for Past, Current and Future Work in Real-time Collaborative Authoring

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Abstract

Group awareness has become important in improving the usability of real-time, distributed, collaborative writing systems. However, the current set of implemented awareness mechanisms is insufficient in providing extensive and comprehensive awareness in collaborative authoring. This research extends the pool of all known awareness mechanisms (including those yet to be implemented). The research discovered several awareness mechanisms not found and reported elsewhere, through conducting usability experiments with a real-time cooperative editor. This paper describes several mechanisms, such as Task Allocation Tree, User Action List and User-based History Tracking, *discovered from the experiments.*

Keywords

Computer Supported Cooperative Work, real-time collaborative authoring, group awareness.

INTRODUCTION

Real-time, distributed collaborative writing systems (RDCWS) allow distributed authors to work on documents at the same time. In certain circumstances, RDCWS are very useful tools for a group that must carry out tasks on a document simultaneously. An example of the use of a RDCWS is in synchronous composition of essays. Collaborative essays may be used in teaching, such as in learning about negotiation of meaning (see Irvin n.d.).

Group awareness (GA) is an important feature enhancing the usability of RDCWS. GA provides users with sufficient knowledge about the status of a document itself and all activities other users perform upon the document. GA plays an essential and integral role in cooperative work by simplifying communication, supporting coordination (Ellis, Gibbs and Rein 1991), assisting “anticipation” (Gutwin and Greenberg 2002) and supporting “convention” (Grudin 1994).

In face-to-face interaction, it is naturally easy for people to know who is present, what are others’ responsibilities and what others are doing. When group members are geographically dispersed, supporting spontaneous interaction is more difficult. To enrich GA in real-time collaborative authoring, various awareness mechanisms such as telepointers (Greenberg, Gutwin and Roseman 1996), radar views (Gutwin, Roseman and Greenberg 1996) and multi-user scrollbars (Baecker et al. 1993) have been used. Unfortunately, some mechanisms were implemented in editors without prior research on what awareness information users actually need or desire when writing collaboratively; some awareness mechanisms have therefore been implemented in an ad-hoc manner. Although these approaches have found some relevant awareness mechanisms, previous research does not provide a potentially nearly full set of comprehensive awareness mechanisms.

This research involves study of users’ needs and identifies highly suitable candidates for mechanisms in providing GA. This involves conducting laboratory-based, usability experiments with REDUCE—Real-time Distributed Unconstrained Cooperative Editor (Yang et al. 2000). REDUCE is a real-time and multi-user text editor allowing geographically distributed people to interact synchronously upon the same document. This research ensures that awareness mechanisms are developed in the light of users’ needs.

Several new awareness mechanisms have been discovered by this research. These mechanisms have been proposed totally by end-users and have not yet been implemented. Hence, the mechanisms presented in this paper are mock-ups. This paper describes mechanisms discovered in this research, such as: *Task Allocation Tree*, *User Action List* and *User-based History Tracking* mechanisms. For space reasons, the GUI of only one of the mechanisms can be shown in this paper.

RELATED WORK

Telepointers (Greenberg, Gutwin, and Roseman 1996) are a mechanism allowing multiple cursors of users to be shown within the document. Telepointers usefully show all the sections of a document all users are working on in parallel. However, telepointers are only capable of providing other users' cursor positions when they are located in the same portion in the document. Radar views (Gutwin, Roseman and Greenberg 1996) are miniaturisation techniques that provide an overall view of a document to show where all users are working on a document. The major problem with a miniaturisation technique is that of limited scalability; a miniature view of a very large data space contains too little detail to be useful.

A Fisheye view (Greenberg, Gutwin and Cockburn 1996) is a distortion-oriented view that presents a single view displaying both local detail and global context on a continuous "surface". A Fisheye view provides a seamless and smooth transition between local details and the global structure. When more than two enlarged areas overlap they hide one another, so part of the document appears lost. Multi-user scrollbars (e.g., Gutwin, Roseman and Greenberg 1996) allow a user to see the different parts of a document worked on by other users via scrolling within the document. Either each remote scrollbar is located in a different vertical region or all remote scrollbars are located in the same vertical region.

The Split Window View (Tran, Raikundalia and Yang 2002) is a mechanism that allows the user to view both working and viewing areas of other members of the group. In some cases, a user's working and viewing areas can be different as the user may be working on a particular part of the document, yet be looking somewhere else in the same document. The purpose of the Modification Director (Tran, Raikundalia and Yang 2002) is to show to a user that another user is modifying their work. The mechanism is helpful in conveying who the other user is that is altering their work and how they are altering it. The Dynamic Task List (Tran, Raikundalia and Yang 2001) is a task-based technique for supporting document-related awareness. The mechanism provides a frequently-updated list of group members' tasks. These mechanisms have yet to be implemented.

RESEARCH METHODOLOGY

The usability experiments were carried out in the Swinburne Usability Laboratory of Swinburne University of Technology in Melbourne, Australia, in April 2004. The experiments involved twelve pairs of subjects working on three writing tasks, including *creative writing* (CW) (e.g., writing short essays from scratch), *document preparation* (DP) (e.g., writing a manual on REDUCE) and *brainstorming* (BS) (e.g., generating ideas). This research used these three categories because these categories represent a wide range of collaborative document authoring tasks and the categories require different styles of collaboration. The twelve pairs were allocated to perform the three tasks as such: 4 pairs worked on CW, 4 pairs worked on DP and 4 pairs worked on BS. An example of a task is the CW task: "Fido is a dog living in Melbourne and owned by a boy, Jamie. Write a fictional story about the adventures of Fido."

Subjects worked in pairs where each member of a pair was located in one of two separate subject rooms. Subjects could not see each other from their rooms. A research assistant observed each pair from an observation room. Each pair participated in a two-and-a-half hour session that included half-an-hour of training in REDUCE and:

- *Experiment* (1 hour): Subjects worked in pairs to work on one task with verbal communication (verbalisation) for thirty minutes and on another task without verbal communication (silence) for thirty minutes.
- *Questionnaire and interview* (1 hour): Subjects filled in a questionnaire, which included nineteen six-point scale (closed-ended) questions and thirteen open-ended questions. The closed-ended questions were questions asking subjects if they believed certain types of awareness were or were not important in collaborative authoring. The open-ended questions sought from subjects mechanisms they would appreciate being available for supporting GA. *It is from the open-ended questions that the proposed mechanisms of this paper were discovered.* For space reasons, the questionnaire cannot be shown in this paper. Each subject filled in a questionnaire during an interview (recorded onto audiotape) held by the research assistant.

AWARENESS MECHANISMS

A mechanism was suggested during an interview that is useful for supporting awareness of future work. This mechanism, which the authors have named *Task Allocation Tree* (TAT), is used to assign responsibilities of users to the document. Such support allows users to be fully aware of what parts of the document other users will work on during a session. As a result, users are clear about who will contribute which parts of a document. If users need to make use of this information, they are able to discuss (for example, via a chat tool) with each other these parts of the document.

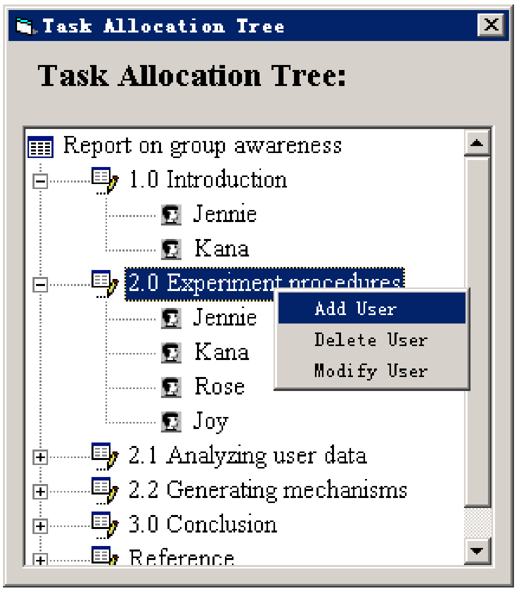

Figure 1: Allocation of document tasks to group members

Figure 1 shows one of the GUIs for allocating tasks to users (used by the chair of the group). The chair will first provide a title to the document (e.g., "Report on group awareness") through right-clicking the invocation of a menu. After this, the same GUI is used to right-click and invoke another menu to add the first task of the document (being the same as a section of the document) as shown in Figure 1 ("1.0 Introduction"). Similarly, other sections of the document are added using the TAT. Figure 1 shows a menu invoked to insert the name of the user responsible in writing content to a section.

It is be expected that the TAT would be learnt quickly by users familiar with the WIMP interface, particularly those who use the folder system through Windows Explorer. Because of the simplicity of the TAT interface, major problems in its usability are not foreseen. However, if users personally do not like this type of hierarchical interface found in Windows Explorer and elsewhere, they may feel hesitant about using the TAT.

The *User Action List* (UAL) is a mechanism for showing users' actions upon the document being taking currently as well as in the past during the authoring session. The UAL shows the content authored by users. The UAL contains a "User action list" which shows what events are occurring, which users are involved in those events and at what time the events are occurring. When a user is writing text into the document, stops writing text or highlights text, the text is available from the "User action detail" box.

Various different reasons exist for knowing what actions other users are taking. Some examples are the following. First, users do not want to be ignorant of what other users may be doing with the document. Users, at the least, feel that having such a facility available to them will potentially come in handy in knowing what others are doing. Second, user *A* wants to know if another user, user *B*, may possibly be deleting text that belongs to user *A*. User *A* has the right to know if user *B* has changed user *A*'s contribution to the document, or may have accidentally removed user *A*'s contribution. This mechanism strongly focuses on and highlights other users' actions in a manner that other mechanisms described in the Related Work section simply do not.

It was found from the experiments that a mechanism for keeping track of all modifications of different sets of text maybe useful (support focusing on past work). Such a mechanism allows all users to access all previous versions of that text, much in the way that many versions of a document can exist. The mechanism is *User-based History Tracking* (UHT). All these versions are available chronologically. Reasons for providing this support include the following examples:

- Users believe their opinion or contribution to document is important. If user *B* changes user *A*'s text, then user *A* has the right to know their text was changed and how it is different to their previous version. User *A* has the opportunity to change the text back to their own version.
- If there is accidental deletion of details from text, these details can be recovered with this mechanism.

This functionality is similar to the Track Changes feature in Microsoft Word. The difference is that UHT supports synchronous interaction and is updated continuously during a collaborative session. Also, the mechanism supports different colours for different authors so that if an author's contribution is split over different places in the document, the entire contribution can be viewed "in one go" according to that author's colour.

The *Structure-based Multi-page Preview* (SMP) mechanism presents users with all the document's pages in one window. To a large extent, SMP's GUI is similar to "Print Preview" found in word processors. However, each page viewed in SMP does not show *all* the page's text; each page's view is formed by first sentence of each paragraph only. The user can highlight a page's view and double-clicking that view will take the user to that exact page in the RDCWS. This mechanism assists in determining past and current work of users.

The *Point Jumping* (PJ) mechanism was suggested by an experimental subject as a useful way to access where another user is currently working on the document. The mechanism shows all users' contributions to the document in a miniaturised fashion. The use of a different colour for each user facilitates viewing of all users' contributions within the document. User *A* can go straight to the page that user *B* is working on currently by double-clicking on user *B*'s name in the user list. This click changes user *A*'s view in the RDCWS to that of user *B*'s current working area. This means user *A* can instantly access and view the changes to the document that user *B* is making currently to the document (whether user *B* is adding content, deleting content, or such).

CONCLUSION

Certainly, some of the mechanisms presented in this paper are influenced by current interfaces or functionality. However, telepointers and multi-user scrollbars, which have been researched a number of years ago and are well-known mechanisms, have also not been total innovations in that single-user pointers and software using scrollbars preceded telepointers and multi-user scrollbars. In fact, familiarity with pointers and scrollbars has assisted the acceptance of those mechanisms and made them easier to learn. The authors argue that the new mechanisms of this paper are generally easy-to-learn and that this would make them more acceptable to real-world users. Indeed, implementation and experimentation is important in determining the effectiveness of these mechanisms.

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