Use of Social Navigation Features in Collaborative E-Learning

Jaakko Kurhila[1], Miikka Miettinen[2], Petri Nokelainen[2] and Henry Tirri[2]

[1]Department of Computer Science
University of Helsinki, Finland
jaakko.kurhila@cs.helsinki.fi

[2]Complex Systems Computation Group
Helsinki Institute for Information Technology, Finland
firstname.lastname@hiit.fi

Abstract: EDUCO is a system for collaborative learning that uses real-time direct social navigation. Social navigation means making the navigation of other users visible to everyone else in the system. The paper discusses the social navigation features of EDUCO and reports empirical results regarding the collaborative behaviour of the students in a university-level Web-course. Contrary to our research hypothesis and the common wisdom in the research area, the data gathered showed that making other users' navigation visible did not have an effect on navigation in this experiment.

Introduction

Social navigation (Munro, Höök and Benyon 1999) provides interesting opportunities in collaborative e-learning. When simplified, social navigation means that the users of an environment are dynamically provided with the information of the actions of other users of the same environment. A trivial example is a counter on a Web page, showing how many other people have visited the page. In their seminal book about social navigation, Munro et al. (1999) use an on-line grocery store as an example when classifying different types of social navigation: if people visiting the store are given recommendations what other people have bought, it is a form of *indirect social navigation*. If a shopper in the grocery store has a sense of other people moving about the store and can engage in seeking e.g. assistance, it is a case of *direct social navigation*.

Experiments with social navigation in educational setting have mostly fallen into the category of indirect social navigation (see e.g. Dieberger 1999). However, EDUCO is a system for collaborative learning to employ real-time direct social navigation. Real-time aspects of EDUCO create the feeling of live companions in the system (Kurhila et al. 2002). Other important facilities include tools for synchronous and asynchronous communication, and support for forming study groups and publishing their work. The purpose of the paper is to demonstrate how the tool was applied to a real-life situation, and describe how the features of social navigation are empirically evaluated from a data gathered from a university-level course of 46 students.

System Description of EDUCO

EDUCO is a system for both the learners and the teachers, to be used with standard web-browsers. From a technological point-of-view, EDUCO consists of a socket server along with cgi-scripts, and a Java applet for every user. From the user point-of-view, the key issues are navigation towards useful information, synchronous and asynchronous communication, group forming and publishing group works.

There is no direct metaphor for the use of EDUCO in traditional classrooms. A learning area in EDUCO consists of the EDUCO tool itself, a view to a document, and comments for the document. The user interface of EDUCO tool consists of different views of which only one is visible at a time. The most important views are map, chat, search and alarm (Fig. 1).

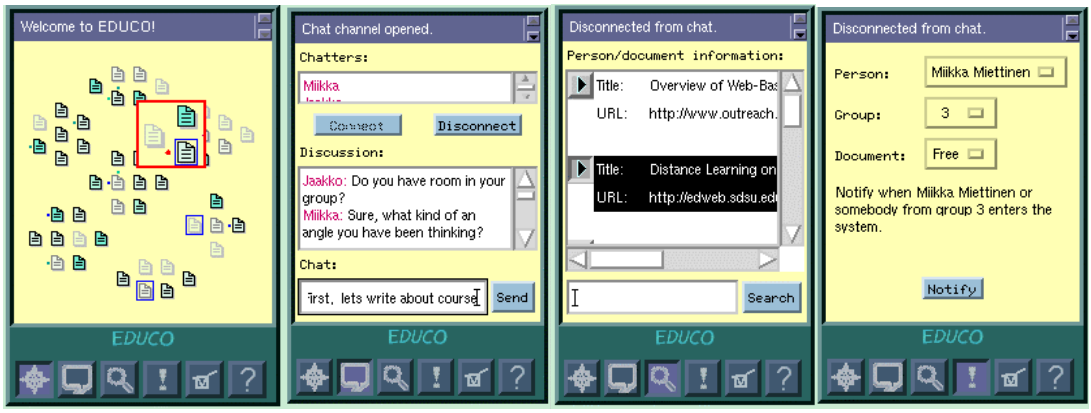

Figure 1: From left to right, four different views of EDUCO: Map, Chat, Search and Alarm.

Map view presents documents currently available in the learning environment and provides a way to navigate to them directly. By double clicking a document a user can open it in the rightmost frame in the browser window. A user is represented as a coloured dot around the document he or she is currently viewing (Fig. 1). Other users are visible to every user in real-time, so that their navigation is visible to everyone present.

The documents change their brightness level and colour on the map depending on how much they have been viewed relative to the other documents, as seen in Fig. 1. The total time all users have spent viewing each document is recorded every hour. The change in the brightness and in the colour of an individual document are determined by the distance of its moving average for the last 24 hours from the same average for all documents.

In other words, map view provides the users of EDUCO two social navigation features. Colouring the documents according to how much they have been viewed is a form of indirect social navigation. Presenting users as moving dots next to the documents they are currently viewing is a form of direct social navigation. Both of these features can help the users to follow the footsteps of the others. The direct social navigation also adds to the sense of not being alone in a web-course (Kurhila et al. 2002).

EDUCO has a built-in *chat* functionality integrated to the map view to enable synchronous communication between peers and other users of the environment. The chatters can be picked up from the map view by clicking the dots representing users. The number of participants in the discussion is unlimited, but one person may use only one chat channel simultaneously. Figure 1 shows an example of the use of chat. In addition to synchronous discussions, EDUCO uses two types of document-specific *asynchronous communications*: areas for general comments and hierarchical newsgroup-type discussions for meaningful knowledge building.

The *search* function of EDUCO can be used in finding persons or documents. The search is targeted to the titles of documents and names of users, both online and offline. The search results are shown in the search view (Fig. 1), but also in map view by highlighting the document with a blue rectangle, as it can be seen in Fig. 1.

The *alarm* offers each user a possibility to set "triggers" into the documents, groups and the overall system. In other words, a user can set EDUCO to alarm when certain conditions occur. This feature is useful in a case where a user searches for a companion showing interest to a certain document or topic, or wants to contact a particular person when he or she enters the system. The alarm function also enables making combinations of triggering events. Figure 1 shows an example of a combination of triggers: the alarm will beep if "Miikka Miettinen" or somebody from group 3 enters the system".

An important feature in EDUCO is the *support for forming groups*. Alarms, chat and navigational patterns can be used when screening for potential partners for group work. Another feature is a list of available (not yet in any group) participants in a Web-course. Every user can form a group by clicking a button "Add a new group". Other people can join an already existing group, or they can start a new group. After producing a joint work, it can be published in EDUCO for comments.

The group-forming feature of EDUCO is designed for Web-courses where the learning process involves writing reports in groups. Document icons in the "map view" of EDUCO can each represent a collection of student reports.

Empirical evaluation

Study setting

A valuable feature in systems like EDUCO is that they make it possible to accumulate large amounts of interesting information through completely unobtrusive observation of the users' activities. Whenever someone moves to another page, starts a chat discussion, joins a group, or uses any other of the available functions, the details of the event are registered in the log. This allows extensive re-construction of the conditions under which the action took place, and facilitates the analysis of the users' behavioural patterns as they occur in real-life e-learning situations.

The data set was collected during the Spring 2002 semester from a course entitled "Computer Uses in Education" with a subtitle of "Web-based learning"'. The course was given at the Department of Computer Science, University of Helsinki, Finland. The course was a web-based course without face-to-face meetings and the use of EDUCO was mandatory. Forty-six students were active in the course. Some of the students were adult learners with varying backgrounds and degrees but most of them were Computer Science majors.

The format of the course was unique compared to the other courses at the Department. The students had nine weekly reports to produce from nine different topics. It was not allowed to produce the report alone. At least a working pair was required, and a group of three was also recommended. Moreover, the groups were not allowed to stay the same during the course. A student had to be involved with at least three different groups.

Apart from the documents containing the reports of the student groups, the documents in EDUCO map discussed the issues covered during the first eight weeks. The documents were organized to eight different clusters under a common theme. The themes were close to the weekly topics but not completely the same. The document cluster sizes varied from two to ten, giving a total of ca. 40 documents. The exact amount of documents varied during the course, since new resources were added occasionally.

Results

In this paper, our empirical analysis focuses on social navigation and the formation of groups. We first attempt to examine if the presence of one or more users around a certain document attracts others to navigate to that document as well. This is the real-time aspect of social navigation as implemented in EDUCO. As stated earlier, the document icons also change their brightness/colour based on their popularity. In order to evaluate the role of the colouring mechanism, we compare overall navigation patterns to periods when a new weekly assignment was published so that the colours had not yet changed to influence the users by guiding them to the most relevant documents.

The idea of our analysis of real-time social navigation was to compare the frequencies and lengths of visits to documents that were already being read by at least one person ("occupied documents"), and visits that started without there being others present at the particular document ("unoccupied documents"). Only a rough indication of the tendency of people to move together could be obtained this way, since there were other factors with obvious effects on the results. In particular, the assignments given during the course directed most of the activity to a small number of documents, making social navigation almost unavoidable during the busiest periods. The validity of data gathered from a real course more than compensates for the lack of control, however, when it comes to evaluating the usefulness of a real system.

In order to calculate the relevant statistics, we re-constructed the navigation activity that took place during course from the log file. This involved stepping through the log one row at a time and moving users from one visitor list to another the way they moved when they were actually using the system. The number of visits to occupied and unoccupied documents as well as the lengths of the visits were computed along the way. Our hypothesis was that occupied documents would be somewhat more popular than unoccupied ones. Another intuitive guess was that visits to occupied documents would be shorter, because people would go and take a quick look at things that others seem to find interesting.

Table 1 shows the main results of the re-construction. The 48 students are sorted into 5 groups according to the distribution of their visits to occupied and unoccupied documents (group 5 has 8 students and the other groups 10). The last row of the table contains the overall figures for all students.

	Occupied % of visits	Occupied Average length	Unoccupied % of visits	Unoccupied Average length
Group 1	60%	11	40%	8
Group 2	53%	11	47%	7
Group 3	49%	10	51%	5
Group 4	43%	9	57%	5
Group 5	32%	10	68%	5
All	48%	10	52%	6

Table 1: The number and average length of visits to occupied and unoccupied documents.

The numbers in Table 1 do not indicate a preference to occupied documents over unoccupied ones, since the proportions are practically equal in all groups. The minor differences in the average lengths of the visits do no justify any conclusions either. Therefore, the log data did not provide support for our idea of the usefulness of real-time social navigation.

Another essential mechanism for social navigation is the colouring of the document icons according to their popularity. During the course, there were almost always some documents shining brighter than the others. Since they were generally the most relevant documents for the weekly assignment, the amount of guidance provided by the colouring could not be assessed in isolation under normal conditions. However, after a new assignment was published, there was a period of a few hours, during which the documents that had just become important did not stand out yet. Our analysis is based on comparing the navigation patterns observed during the first six hours following the publication of an assignment to the average patterns of the entire course.

According to our hypothesis, visits should be shorter on average when the colouring does not guide the users directly to the most useful documents. Unfortunately, it turned out that this is not the case. The average length of a visit was 7.5 minutes for periods following the publication of an assignment, and 7.2 minutes in the whole data set. From an intuitive point of view, colouring should help finding relevant documents, but as in the case of real-time social navigation, the log data did not provide support for our intuitive views.

Conclusions

The paper presented a system for collaborative Web-based learning that supports social navigation and described a real-life situation where it was used. Common wisdom has been that allowing a user to see the navigation steps of other users has an effect to the navigation of the user, although valid empirical evaluations are somewhat lacking. However, the effects of synchronous and asynchronous features of social navigation in EDUCO appeared to be non-existent in this study. The result was surprising, especially when a previous study with the same system (with less functionality) showed slightly opposite results (Kurhila et al. 2002). Further studies are necessary to separate the effective factors.

References

Dieberger, A. (1999). Social Navigation in Populated Information Spaces. In A. Munro, K. Höök & D. Benyon (Eds.), *Social Navigation of Information Space*, 35-54. London: Springer.

Kurhila, J., Miettinen, M., Nokelainen, P., & Tirri, H. (2002). EDUCO - A Collaborative Learning Environment using Social Navigation. In P. de Bra et al. (Eds.) *Proc. Adaptive Hypermedia and Adaptive Web-Based Systems (AH 2002)*, 242-252, Berlin Heidelberg: Springer.

Munro, A., Höök, K. & Benyon, D. (1999). Footprints in the Snow. In A. Munro, K. Höök & D. Benyon (Eds.), *Social Navigation of Information Space*, 1-14. London: Springer.