CoVitesse: A Groupware Interface for Collaborative Navigation on the WWW

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Abstract

In this paper we present a groupware interface that enables collaborative navigation on the WWW, based on a collaborative navigational task model: the CoVitesse system. The system represents users navigating collaboratively in an information space made of results of a query submitted to a search engine on the WWW using visualisation techniques. We present the results of an ergonomic evaluation of the interface using heuristics.

1 Introduction

As computers become more and more prevalent, the need for systems that support collaboration, such as peer-to-peer or online games, between and within groups increases markedly. In addition computer users are living in a world of information spaces. One of the most critical needs of users is to be able to efficiently search for information in these large spaces.

These two requirements motivate us to investigate collaborative navigation of information spaces. In this paper, we focus on the synchronous collaboration of users while seeking information on the World Wide Web.

Indeed in everyday life, most information retrieval is based on collaboration between individuals. For example researchers exchange references, standing round the coffee machine ("coffee machine phenomenon"). The existence and significance of collaboration in information seeking have been shown. On the web, navigational behavior often relies on the expertise of other users. One typical social behavior on the web consists of asking a colleague about information we assume the other has the pointer too: such observed social behaviors show that web users are striving for collaboration. For example asynchronous tools, such as email, are commonly used for sharing web pointers.

In this paper, we show a new groupware interface, the CoVitesse system, that enables collaborative navigation in a large information space, the World Wide Web.

The paper is organised in two parts. The first part presents the CoVitesse system and the main features of the interface. In the second part, we present the results of two experimental evaluations.

2 CoVitesse system

The CoVitesse system enables the users to navigate synchronously on the WWW. Four types of navigational tasks are explicitly available to the users: guided tour, opportunistic navigation, shared navigation and coordinated navigation. The four types are fully described in (Laurillau, 1999, p. 308) and in (Laurillau & Nigay, 2000, p. 121). CoVitesse is based on a single-user application, Vitesse, which is described in the following section.

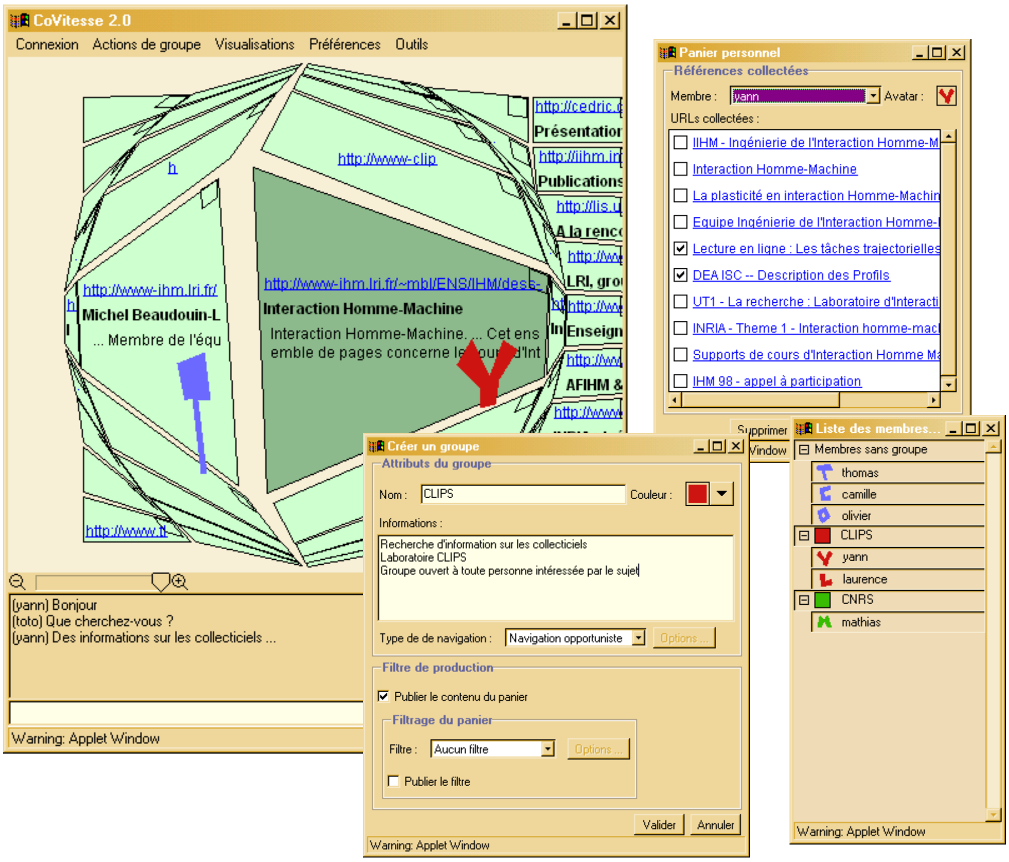

Figure 1: Four windows of the CoVitesse interface.

2.1 The Vitesse system

The Vitesse system visualises the results of a query submitted to a search engine on the WWW. As shown in Figure 1(top-left window), the overall graph structure of the results is displayed: each retrieved page (node) is displayed. One retrieved page or node is displayed by a polygon. The selection of a node (double click) enables the user to access the web page. We performed a usability study to identify the relevant information to be displayed inside a polygon (Nigay & Vernier, 1998, p. 37). The 2D space is obtained by placing the most relevant retrieved page at the top left of the space.
In Vitesse the user has the choice of the seven visualisation techniques of the result space: birdeye view, polar and cartesian fisheyes. In Figure 1 (top-left window), the current visualisation technique of the information space is the spherical view. At any time the user can freely switch from one visualisation technique to another one (menu "visualisations").

2.2 Covitesse system

When starting a session, a CoVitesse user defines his/her avatar by a shape and a name. The user then either selects an information space or specifies a query that will be sent to a selected search engine. The results of the query define a new information space. The user can then navigate in the information space, observe other users (top-left window in Figure 1, two users are navigating), create or join a group. At any time, a user can see all other users moving in the space, use the chat box (which is below the information space) to communicate with other

users, or organize her/his own caddy which contains the marked pages (top-right window in Figure 1).
The user can make visible an additional window containing all the single users and the groups in the information space (bottom-right window in Figure 1). Selecting a group will make the corresponding members observable on the information space. The user can then opt to only observe some of the members of the group by selecting their corresponding icons. A group is represented by a colour and a name. If a user belongs to a group, her/his shape will be displayed in the colour of the corresponding group; else a predefined colour is automatically assigned to a user.
Additional windows are available through the menus at the top of the main window. The windows are organised according to five sets of tasks: connection tasks, group tasks, visualisation modalities selection, preferences management and tools. One of the main group tasks is the creation of a group (middle-bottom window in Figure 1): at any time, a single user can create a group, its objective and its style of collaborative work by selecting one of the four types of navigation. In the current version of the system, four kinds of groups, i.e. collaborative navigational tasks, are available: guided tour, opportunistic navigation, shared navigation and cooperative navigation (Laurillau, 1999, p. 308) (Laurillau & Nigay, 2000, p. 121). According to the group type, different functionalities are available. For example, within a group defined as an opportunistic navigation group, a member can take control of the navigation of the other members; such functionality is not possible with a Shared navigation group. Moreover, access rights to data are different according to group types; rights are imposed on the group caddy (i.e. the pages gathered by the group) as well as on the group preferences. Group preferences include the information related to the group, the choice or not to publish the gathered results and the publication filter applied on the results. For example, any member of an opportunistic navigation can modify the group preferences. At the end of the session each user collects the findings of the group gathered in his/her caddy of collected results (top-right window in Figure 1). In addition, the collected results are emailed at the end of a session.
CoVitesse provides persistent access to all the data, modified or produced during a session. These data include information about users and groups such as the avatar shape, the gathered results and the preferences. These data are protected with a simple mechanism of username/ password. Then, when a user starts a new session, she/he recovers her/his own private data.

3 Experimental evaluation

We carried out two complementary experimental evaluations of CoVitesse.
The goal of the first experiment was to evaluate the time response between two users around the World. We wanted to verify if synchronous interaction is possible when users were distant. One user was in the United State, while the other was in France. We selected the guided tour as the appropriate navigational means because the two users are tightly coupled. The results in terms of time response were good: the frame rate was high and we obtained a real time WYSISWIS. Nevertheless this first experiment also stresses the problem of communication between users: a text based chat room was not sufficient enough and the two users quickly established a phone connection that lasted for the duration of the experiment. In addition, we also performed an experiment measuring the crowding impact and the server capacity for managing a large number of users. These observations were confirmed by another experimental evaluation detailed below. We performed an informal experiment with ten robots according to random behaviors (Laurillau, 2002, p. 180). It was easy to build these robots because the CoVitesse system is based on our Clover architecture model (Laurillau & Nigay, 2002, p. 236) and on our Clover platform for groupware development (Laurillau, 2002, p. 129). The experiment was convincing and the server did not collapse. However, it appears that the interaction events exchanged between two remote clients are delayed when robots send events at a rate lower than 200 ms. This may not happen with human users because the Fitts law tells us that expert users interact at a rate of 340 ms. These values were confirmed by

the following evaluation. Nevertheless, we are working on the Clover platform in order to obtain better rates.

The second experiment aimed at driving a heuristic evaluation of the interface using ergonomic properties. This experiment has been driven with 10 master's students in computer science using ergonomic rules such as Nielsen's heuristics for single-user interfaces (Nielsen & Molich, 1990, p. 249). A synthesis of the observations dedicated to collaborative activity is shown in Table 1:

Ergonomic properties	Observations	
Observability	(+)	users are observable in the information space
	(+)	users and groups identified by an avatar, a color and a name
	(+/-)	colors are used to make the difference between members or not of a group. Problems occur if two colors are very close (ex: blue)
	(+)	collected results are stored in a caddy and emailed at the end of the session.
	(+/-)	the history of visited web pages is seen as gray polygons in the information space. The information is lost at the end of the session
Published observability	(+)	caddies and preferences are observable
	(+)	published information may be filtered
Consistency	(+/-)	labels are explicit but icons are missing
	(-)	the menu's content for group actions is unstable
Feedback	(+/-)	group modifications are only observable in the member's list window
	(+)	group joining action provides good feedback
WYSIWIS	(+)	strict and relaxed WYSIWIS are mixed (ex: strict WYSIWIS in guided tour)
	(+)	multiple visualisation modalities are available (relaxed-WYSIWIS)
	(+)	group caddy modifications are observable as relaxed-WYSIWIS
	(-)	there is no WYSIWIS for the mouse pointer
Reciprocity	(+)	any avatar is observable in the information space
	(+)	text exchanges are fully observable in chat room
	(-)	preferences and caddies may be filtered
Privacy	(+)	filters may be applied on personal data (cf published observability)
Flexibility	(+)	users and group preferences are available
	(-)	the set of preferences is minimal
Time response	(+)	the interaction time response is very low ("real-time")
	(-)	the system is slow at connection time and no status feedback is given
Task migration	(+)	the navigation control may be given to another user
	(-)	access rights or roles may not be transferred to another user
Reachability	(-)	Other user's work space is not accessible for the shared navigation task

Table 1: Synthesis of observations.

We can extract the following conclusion according to this experimental evaluation. It appears that the use of heuristic rules designed for single-user interactive systems works fine. Indeed, a collaborative interface is also build with elements of single-user interface. For example, the consistency property is not well supported by the CoVitesse system: as show in Table 1, the menu dedicated to group actions must be stabilized because the number of items is different according to the collaborative navigational task. However, the use 'at is' of heuristics designed for single-user applications may lead to contradictions. For example, the reachability property is not well supported by the CoVitesse system when users are member of a group based on a shared navigation: the information space in divided in several parts and each part is assigned to a particular user; in this case, a user is not allowed to navigate in a part assigned to another user. This point is a consequence of the used navigational task model, the shared navigation, which allows strict-WYSIWIS in the information space and relaxed-WYSIWIS locally.

A complementary approach is to evaluate a groupware interface using the extended set of Nielsen's heuristics (Gutwin & al., 2001, p. 123) for groupware. Our evaluation of the CoVitesse system will be completed with the use of these heuristics. However, here are the first observations as shown in Table 2.

Rules	Observations	
Means for intentional and verbal communication	(+/-)	Textual communication only (no audio or video)
Means for intentional and gestural communication	(-)	no means provided
Means for "body"	(-)	no means provided

communication		
Means for communication through artifacts sharing	(+/-)	moving an avatar in the information space
Protection	(+)	filtering for published observability, concurrency control and role policies when a user is member of a group
Management of coupling	(+)	mixed WYSIWIS defined by our collaborative navigation task model
Coordination of actions allowed	(+) (+/-)	awareness through the avatars, the collaborative tools and the chat negotiation when joining a group or coordination between users according to a kind of collaborative navigation task
Easy user finding and contact making	(+/-)	Users are identified in the information space by their name and avatar. The list of users is given in the user's list window.

Table 2: First observations using extended Nielsen's rules for groupware (Gutwin & al., 2001).

4 Conclusion and further work

In this paper, we focused on collaborative navigation on the web that is a concrete and observed phenomenon although few tools support it. CoVitesse is a tool that supports synchronous collaborative navigation. In addition, we have presented two experimental evaluations of this system. Further experimental evaluations of CoVitesse must be carried out, in particular, based on extended Nielsen's heuristics for groupware. Currently, we are improving the interface based on these experimental studies.

5 References

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