Supporting Collaboration and Cooperation in Digital Information Environments

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Abstract. In this position paper I argue that the behaviour of information seekers is multifarious on at least two dimensions: on the one hand it continuously shifts between solitary activities and asynchronous as well as synchronous collaboration and cooperation; on the other hand it includes seeking, but also the administration and maintenance of information. I will identify various types of behaviour of information seekers; describe some existing collaborative digital information environments; and present a prototype supporting solitary information seeking, spontaneous interaction among users as well as working with information in a group.

1 Introduction

In general, visitors of libraries search information and new material on their own. However, they also communicate with colleagues for corroboration, new interpretations, and new methods of finding information. Whereas this kind of behaviour is possible in traditional libraries, it is often not supported in digital libraries (or digital information environments, DIGIEs). In fact, DIGIEs have often been designed from a single-user perspective where information seeking is seen as a purely solitary activity [Gross 1997b].

Only few authors have argued that libraries are social places [e.g., Ackerman 1994; Levy & Marshall 1994; Masinter & Ostrom 1993]. Masinter and Ostrom argue that electronic libraries should be meeting places and locations for exchanging informal information. Levy and Marshall even claim that ‘support for communication and collaboration is *as important* as support for information-seeking activities, and that, indeed, support for the former is needed to support the latter’. Ackerman argues that information seekers can benefit from *social interactions* with others through selected information, informal information, specific information, and chance encounters. Most of these possibilities are not realised in current DIGIEs—despite the fact that mechanisms for social exchange and interactions are easy to implement.

In the remainder of this paper I will identify types of behaviour of information seekers that should be supported by DIGIEs. I will then describe some systems which more or less support these types of behaviour. Finally, I will present the CSCW3 prototype, which exemplifies the implementation of support for the whole range of behaviour for the WWW.

2 Behaviour of Information Seekers

Basically, information seekers do solitary information seeking, have spontaneous interactions with other persons and ask for help, and work with information in a group.

2.1 Solitary Information Seeking

Several studies of strategies and behaviour of users of DIGIEs have been carried out. In most of these studies searching (users seek some specific information) is distinguished from browsing (users navigate through a DIGIE and expect to find some useful information). Browsing can have various forms such as search browsing (users determinedly navigate through a DIGIE), general purpose browsing (users navigate through nodes with a high probability of interesting information) or serendipitous browsing (users randomly surf through a DIGIE) [Cove & Walsh 1988]. Furthermore, browsing to solve a task—either a closed task with a specific answer or an open task with no specific answers—has to be distinguished from open ended browsing [Marchionini 1989]. In most situations browsing—especially when it is open ended—occurs when users either have enough time or lack a specific goal. In general, this is a solitary activity, which has to be supported by DIGIEs.

2.2 Solitary Information Seeking with the Help of Others

Searching and browsing to solve a particular task is more specific and more goal- and output-oriented. In these situations information seekers take various strategies, which often involve other persons. In a study Taylor [1968] found that inquirers basically decide at the beginning, if they discuss their problem with colleagues or if they search for literature themselves. A study of the information search process done by Kuhlthau [1991] revealed that during the selection stage subjects were very likely to confer with others. According to Sheperd [1983], information seekers often consulted with colleagues to obtain references at an early stage. For these reasons, DIGIEs should also support spontaneous interaction among users—especially when the information seeker only has a vague idea of the information she is looking for or has difficulties in formulating specific queries (anomalous state of knowledge; cf. [Henninger & Belkin 1996]).

2.3 Beyond Solitary Information Seeking—Working with Information in a Group

So far, I only discussed occasions, where information seekers basically have to solve a solitary task and either seek information alone or by contacting others. However, in many settings collaboration and cooperation is more effective than solitary work. This is

particularly the case when augmentation of capacity, differentiation and combination of techniques, as well as the integration of heuristics is required [Schmidt 1990].

This augmentation of capacity, differentiation and combination of techniques as well as integration of heuristics produces shared knowledge, which is often called community memory. Marshall and associates [1994] define community memory as 'shared understandings of what they are doing: the task, the pertinent body of material, preliminary findings, progress, and methods […] open-ended set of shared interpretations and understandings developed and maintained by the group'. They argue that 'collaborations, and their associated community memory, have the capacity to greatly extend the reach of the individual'. Therefore, DIGIEs should also support collaboration as well as cooperation among information seekers and allow users to create and maintain a community memory.

3 Related Work

The invention of the Internet and its widespread use have led to an explosion of DIGIEs (e.g., Internet Gopher, WWW, Hyper-G or HyperWave). At the beginning all DIGIEs and particularly the WWW were based on the assumption of anonymous and isolated single-users. Recently, an increasing number of collaborative DIGIEs have been developed. Often they are collaborative extensions of the WWW [Gross & Traunmueller 1997].

Examples of DIGIEs supporting mutual help of users are shared global information spaces (e.g., BSCW [Bentley et al. 1995], Mushrooms [Kindberg 1996]); annotation systems, which allow users to annotate Web pages (e.g., HyperNews [LaLiberte 1995], ComMentor [Roescheisen et al. 1995]); and social filtering systems, which support the recommending of information by other users (e.g., GroupLens [Konstan et al. 1997], Self-Enriching Library Facilities (SELF) [King et al. 1994], Group Asynchronous Browsing (GAB) [Wittenburg et al. 1995]).

Examples of DIGIEs supporting working with information in a group are combinations of Internet Gopher and MOO (e.g., MOO-Gopher [Masinter & Ostrom 1993]); Virtual Places, which adds human presence to the WWW through avatars of users on Web pages and so forth [Scott 1995]; GroupWeb, which is a shared Web browser [Greenberg & Roseman 1996]; Sociable Web, which is a Web browser including an extra communication window [Donath & Robertson 1995]; and Awareness protocol for the WWW, which is a protocol for capturing the presence of users on a Web page [Palfreyman & Rodden 1996]. MetaWeb [Trevor *et al*. 1997] and CoBrow [Sidler *et al*. 1997] are excellent toolkits for awareness on the Web.

All these systems support one or more kinds of user behaviour described above. However, they do not support the whole range. In the next section I will present the CSCW3 prototype, which tries to support the whole range of user behaviour as described above.

4 The CSCW3 Prototype

The CSCW3 prototype constitutes an extension of the WWW with vast functionality for collaboration and cooperation. The fundamental metaphor is the room metaphor—each WWW page is treated as a room. A room consists of a WWW page and all users, who are logged in on the same CSCW3 server and who visit the respective WWW page at the same time. A house consists of all users, who are logged in on the same CSCW3 server at the same time and the pages they are visiting. In general, the CSCW3 prototype provides support for solitary information seeking, solitary information seeking with the help of others, and working with information in a group [Gross 1997a; Gross 1997b].

Features for *solitary information seeking* include the transfer and display of documents (e.g., WWW or Gopher documents), a history mechanism, a private bookmark list, a private cache, and the integration of helper applications

Features for *solitary information seeking with the help of others* include asynchronous information about other users (e.g., persistent users' history lists provide information about navigation paths), synchronous information about other users (e.g., the room view with information about CSCW3 users in the same room), find user buttons (special buttons to search for other CSCW3 users), and business cards (with Email and talk addresses and buttons to launch the respective applications), room chats (IRC-like text chat tools in each room), annotations of WWW pages, and the exchange of private bookmark lists. Figure 1 shows an example of a CSCW3 browser window with the CSCW3 room view.

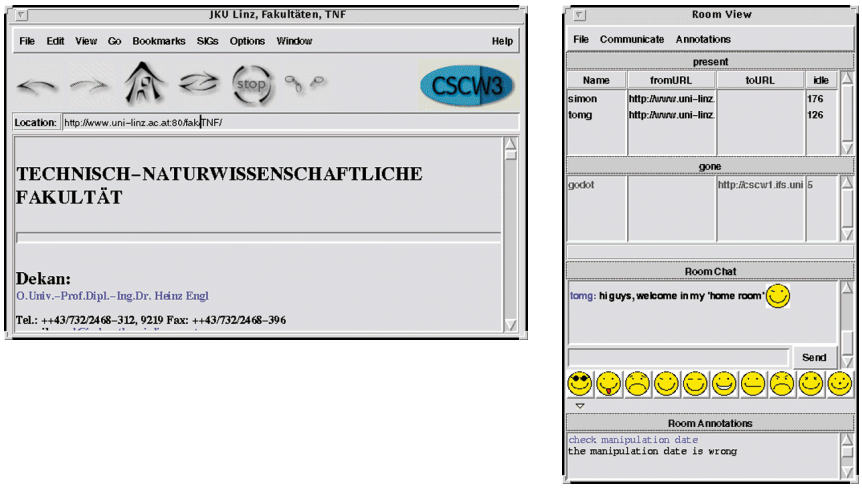

Figure 1. CSCW3 browser window with the CSCW3 room view.

Features for *working with information in a group* include shared caches (common caches of users who are likely to access the same WWW pages), tracking (coupling of CSCW3 browsers), group chats (IRC-like text chat tools for groups of users of coupled CSCW3 browsers), house views (vid. Figure 2) like people overviews (overviews of all CSCW3 users) and rooms overviews (overviews of all rooms in a house). Support for community memory is supported by group bookmark lists or SIGs (special interest groups; i.e., Usenet news-like bulletin board systems with text and URLs).

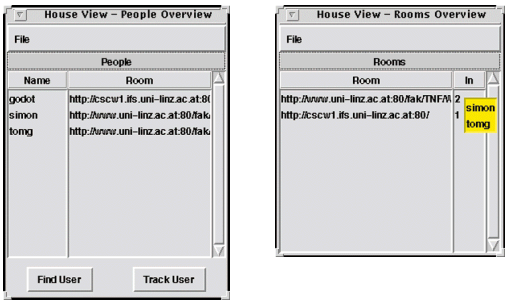

Figure 2. CSCW3 people overview and rooms overview.

The *CSCW3 architecture* represents a client-server construction consisting of CSCW3 clients managing the visualisation of the CSCW3 main browsing window and the different rooms, navigation, and so forth; a shared cache daemon serialising and processing users' requests and administrating the shared cache; a CSCW3 server daemon administrating central user data, group bookmarks, and annotations, broadcasting messages within rooms, and so forth. The HTTP daemons of WWW servers do not have to be changed. The CSCW3 prototype is implemented in Tcl, Tk, and Tcl-DP [Welch 1997].

5 Conclusions

In this paper I presented some aspects of behaviour of information seekers and an example of a prototype supporting them. In the workshop I would particularly like to discuss the behaviour of information seekers and ways in which existing knowledge from research in the field of CSCW could help solving these challenges. For instance, results from recent research in group awareness could be applied to these kinds of challenges. Research on informal group awareness information about the presence, activities, and availability of other persons could be very helpful for information seekers in an anomalous state of knowledge [Totter *et al*. 1998].

My research interests include Computer-Supported Cooperative Work, Human-Computer Interaction and global Internet-based information systems. I am teaching CSCW and HCI at the Universities of Linz and Vienna, Austria. In 1993–7 I did my Ph.D. thesis on 'Supporting Collaboration in Global Information Systems'.

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