Expertise Management:
Towards Flexible Sharing and Exchange of Expertise

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Introduction

The use of the computer has drastically changed during the last decades—from a machine mainly used for calculation and automation to an information and communication device. This change went hand in hand with great progress in support for information processing and communication. Several of the early visions of pioneers of these areas such as Vannevar Bush [1945], Douglas Engelbart [1963], or Joseph Licklider [1960; 1968] have already been and are put into practice.

Nevertheless, it is still rather difficult to immediately get the information wanted in an adequate quality and quantity from the computer. One possible way to tackle this problem is to support direct interaction among humans. In many cases humans are able to adapt to contingencies (e.g., the recipients' speed of the capturing of information, format and contents that are understandable for the recipients) in a more flexible way than computers and are therefore very efficient information providers for other humans. Sometimes it is even impossible to formulate precise queries that can be interpreted and answered by computers. A typical scenario is a situation, in which a person suffers from an anomalous state of knowledge (ASK)—that is, the person knows that she has a lack of information and has only a rough idea of the information needed [Belkin 1980]. In still other cases the information is not stored in the computer, because it is tacit in the heads of the people, because it can not be formulated in a way that can be stored in a computer, and so forth [Ackerman 1994]. Here, it is essential to find a human expert who can help eliciting the question and answer the question or give advice how to find the answer.

In my research work I aim at developing concepts and systems supporting spontaneous dialogues between humans allowing effective and efficient sharing and exchange of information. This support is an extension of support for human-computer interaction and human-computer-human interaction rather than their replacement.

In the remainder of this paper I will discuss some aspects of expertise and sharing and exchange of expertise. I will then present two prototypes supporting the flexible sharing and exchange of expertise.

Expertise

In this paper, I have so far only talked about information; however, with different meanings. Although a thorough discussion of epistemology would go beyond the scope of this position paper, it is important to clarify some basic notions of human knowledge. In this paper I will use the notions as follows: data is raw; information is data with meaning; and knowledge is verified information [Gross 1997b]. Expertise is seen as the 'embodiment of knowledge and skills within individuals' [McDonald & Ackerman 1998, p. 315]. Whereas data and information can be easily processed by and exchanged via computers, the verification that is inherent in knowledge is typically a human activity, which can only be delegated to computers to some extent. Expertise is *per definitionem* human. Therefore, sharing and exchanging expertise cannot be automated totally.

In the area of computer science these aspects—although in other areas such as epistemology they have been discussed for centuries—have been neglected for a long time. For instance, classic information theory took a probabilistic approach (e.g., Shannon and Weaver [1963], Carnap [1962]). Later, several authors contradicted the information theory of Shannon and Weaver and primarily focused on the processing aspect (e.g., Newell and Simon [1972]). In the 1990s the ecological concept has been trying to combine aspects of these two concepts into a more holistic approach (e.g., Devlin [1991]). In some areas of computer science this ecological concept has been adopted. For instance, in parts of the human-computer interaction community it is used in situation theory. Here humans (and to some extent robots) are seen as systems that have to adapt to their environment and therefore constantly have to capture information about their environment and process it (e.g., Maturana and Varela [1984]). An important point in situation theory is that constraints vary in different environments and situations and that therefore, information and knowledge are dependent to the respective setting. Jean Lave calls these situative specifics and understanding under these conditions 'local epistemologies' [1991]. As opposed to computers human experts often easily—sometimes subconsciously—adapt to the respective settings.

Sharing and Exchanging Expertise

In many situations, in which the constraints are constant, users can find the information needed without contacting others. Particularly because of the huge technological progress it is often even faster to use technology rather than contacting others. Nevertheless, there is—despite this technological progress—quite some evidence in literature that even today in many cases humans want or need to contact other humans in order to get the expertise needed.

Twidale and associates [1994] report on an informal observation of a group of students using OPAC terminals. They found that students did free queries as solitary activities, but also had chance encounters with other students. Furthermore, they did

coordinated search and also joint search. Ackerman [1994] enumerates similar forms of social interaction among information seekers in digital libraries.

In another study Twidale and associates [1997] identified several tactics of information seekers. Information seekers can consult colleagues and ask them for information and references; they can wander around to search for information and hope to meet others coincidentally; they can do brainstorming to generate numerous ideas; or they can bibble—that is, they can look for existing bibliographies to the same or a similar topic (this strategy is often used on the WWW, when users use the bookmark list of other users with similar interests).

This empirical evidence shows that—amongst other consequences—flexible switching between solitary work and information seeking and spontaneous contacts and dialogues with others is a core requirement for flexible sharing and exchange of expertise. Kuhlthau [1991] developed the notion of zone of intervention as an area, in which this is possible. She defines a zone of intervention as follows:

> The zone of intervention is that area in which an information user can do with advice and assistance what he or she could not do alone. Intervention within this zone enables the user to move along in the information search process. Intervention outside this zone is inefficient and unnecessary; experienced by users as intrusive, on the one side and overwhelming, on the other.

This zone of intervention is an area in which users are very efficient in gathering the information needed.

Supporting the Sharing and Exchange of Expertise

We have developed two prototypes—the Computer-Supported Cooperative World-Wide Web (CSCW) and the awareNESS envIronmEnt (NESSIE)—that support flexible sharing and exchange of expertise including features of a zone of intervention.

The CSCW3 prototype constitutes a Web browser with vast collaborative functionality [Gross 1997a; Gross 1998]. The fundamental metaphor is the room metaphor. A room consists of a Web page and all users, who are logged in on the same CSCW3 server and who visit the respective Web page at the same time. The CSCW3 prototype provides support for single-user activities as well as for asynchronous, for synchronous, and for semi-synchronous collaboration. Single-user features include the transfer and display of documents (e.g., Web pages), a history mechanism, a private bookmark list, and so forth. Asynchronous features include the exchange of private bookmark lists, group bookmark lists, asynchronous group awareness information (e.g., persistent users' history lists provide information about navigation paths), and annotations of Web pages. Synchronous features include synchronous group awareness information (e.g., the room view with group awareness information about CSCW3 users in the same room), room chats (IRC-like text chat tools in each room), tracking (coupling CSCW3 browsers), and group chats (IRC-like text chat tools for groups of users of coupled CSCW3 browsers). Semi-synchronous features support easy transitions between single-user activities, asynchronous collaboration, and synchronous collaboration and include people overviews (overviews of all CSCW3 users and the rooms they are in) and rooms overviews (overviews of all populated rooms and their visitors), find user buttons (special buttons to search for other CSCW3 users), and business cards (with Email and talk addresses, etc.).

The awareNESS envIronmEnt (NESSIE) is a generic extendible awareness environment, which includes simple but powerful and lightweight mechanisms for the generation and user configurable presentation of notifications at the standard desktop interface [Prinz (to appear)]. We have integrated the awareness contexts into BSCW. The BSCW system is former research prototype which has become a commercial product for the organisation of shared objects and links on the WWW [Bentley *et al.* 1997]. In its current version it provides a lot of functionality for cooperative work such as shared workspace with access control based on the notion of groups, communication tools such as Email lists, group scheduling tools, and so forth. In a first attempt we used workspaces for awareness contexts. Such awareness contexts gather a group of users, a shared task, shared objects, and shared tools. In each awareness context awareness information can be provided about the presence of users and the activities going on in it.

Conclusions

In this workshop I would like to discuss approaches for the support of the sharing and exchange of expertise. The CSCW3 and the NESSIE prototype, which both support awareness, communication and cooperation of users of the WWW, can be seen as a little step towards this direction.

Biographical Information

Tom Gross recently joined GMD, where he is currently working in a project on an awareNESS envIronmEnt called NESSIE. In the years 1993-9 he was working at the Institute of Applied Computer Science at the Johannes Kepler University of Linz, Austria, where he received his Ph.D. in 1997. His research interests include CSCW, HCI and global Internet-based information systems.

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