Workspace Awareness

Carl Gutwin and Saul Greenberg
Department of Computer Science, University of Calgary
2500 University Dr. NW, Calgary, AB, Canada T2N 1N4

[gutwin, saul]@cpsc.ucalgary.ca
http://www.cpsc.ucalgary.ca/~gutwin

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Abstract

Support for awareness in collaborative systems is becoming a popular idea, but awareness is not a concept that is easily used by groupware designers. We describe workspace awareness, one variety of awareness in shared spaces, and our efforts to operationalize it for use in groupware design. We outline elements and mechanisms of workspace awareness as a starting point for exploring information requirements, and note several issues that complicate the search for awareness design principles.

Introduction

Awareness is mentioned more and more often as an important factor in the design of collaborative systems. However, these statements often come without clear conceptions of what awareness is and how to apply it, and designers are often left without any clear sense of what, exactly, they are supposed to do to their applications to support awareness.

This paper describes our attempts to make awareness a useful concept in situations where collaboration occurs in a shared computational workspace. We have identified some of the important elements and mechanisms of workspace awareness, and are in the process of creating operational guidelines that can be used by groupware designers.

The paper also identifies some of the issues that complicate our efforts: the difficulty of isolating awareness requirements from domain knowledge, social situation, and expertise; and the difficulty of evaluating and measuring awareness.

Definitions

The first problem in using awareness is deciding what it is. Awareness is often defined in terms of knowledge, of being cognizant of some fact, but we are more interested in awareness as informedness, a sense that implies three qualities. First, awareness is knowledge about a dynamic environment, and must be maintained as the environment changes over time. Second, awareness is maintained through perceptual information gathered from the environment. Third, awareness is generally secondary to some other goal; that is, it is generally *for* something else.

This conception of awareness has been investigated by researchers in human factors psychology, who have named the phenomenon *situation awareness* (Gilson 1995). In general terms, SA is the up-to-the-minute knowledge required to maintain a dynamic system or operate in a dynamic situation (Jager Adams et al. 1995). If we allow this knowledge to be about people as well as physical systems, then different kinds of awareness in collaborative systems can be seen as types of situation awareness, and work on SA can form a theoretical and methodological base for explorations of awareness in CSCW.

We apply these ideas to a setting that occurs commonly in group work-collaboration over a shared workspace. In the real world, a shared workspace is a physical space where people can undertake some joint activity. We restrict ourselves to flat, medium-sized surfaces on which objects can be put, and around which a small group of people can collaborate. This kind of workspace includes control panels, whiteboards, desks, navigation charts, and tabletops.

Shared workspaces define a specific kind of awareness that relates to people's interaction with the workspace and the artifacts in it. We call this *workspace awareness*, the up-to-the minute knowledge a person holds about another's interaction with the workspace (Gutwin and Greenberg 1996). This includes understanding of who is in the workspace, where they are working, what they are doing, and what they intend to do next. Workspace awareness reduces the effort needed to coordinate tasks and resources, helps people move between individual and shared activities, provides a context in which to interpret other's utterances, and allows anticipation of others' actions.

Workspace awareness in groupware design

Having narrowed our scope to workspace awareness, we begin to operationalize the concept to make it useful for groupware designers. We base this process on three steps that must be taken to support awareness in groupware. First, we must determine what people need to know about others in the workspace. Second, we must consider how that knowledge can be gathered from the information available in a groupware setting. Third, we must determine how to present that information so that people can obtain and use the knowledge easily and naturally.

To explore the question of what information people need, we have constructed a conceptual framework of the elements of workspace awareness. Table 1 shows these elements and corresponding questions that a participant might ask themselves during a shared activity. Many of the elements fall into two rough groups: those that deal with *what* is happening with another person, and those that deal with *where* it is happening.

Element	**Relevant Questions**
Presence	Who is in the workspace?
Location	Where are they working?
Activity Level	How active are they in the workspace?
Actions	What are they doing? What are their current activities and tasks?
Intentions	What will they do next? Where will they be?

Changes	What changes are they making, and where?
Objects	What objects are they using?
Extents	What can they see? How far can they reach?
Abilities	What can they do?
Influence	Where can they make changes?
Expectations	What am I to do next?

Table 1. Elements of workspace awareness

There are two primary mechanisms by which workspace awareness is maintained. The first is communication, either indirect or direct. A person may say "I'm going to work on the top-left corner," which informs others of where they are going to work; it may also inform them of what that person is going to do, if they know what artifacts are located in that area. People can also communicate awareness information nonverbally, through gestures and body language.

The second mechanism is observation. People can gather awareness information by watching others work, or by noticing the effects of their actions. For example, if I see you holding the scissors, I may infer that you are going to cut something; and if I see you reaching for an artifact that I just completed, I may anticipate your actions and move to prevent you from changing it.

Issues and problems

There are a number of issues, however, that complicate the search for general and transferrable awareness requirements.

1. Domain specificity. Although some general requirements can be ascertained through the constraints and affordances of the setting (such as a physical workspace), much of what a person needs to know about others depends heavily on the application domain. The exact information requirements can only be determined by conducting a task analysis. For example, it is true but not useful to say that an operator needs to know what her colleagues are doing in a power transmission facility; what is useful is determining that she needs to know that another operator has shut down a generating station, within five seconds of the event.
2. Information importance. Some awareness information is crucial for the completion of a shared task, and these requirements are often obvious; however, other information is beneficial but not critical. People are adaptable, and they can often make up for the lack of certain information, perhaps by communicating more, or simply by repairing conflicts instead of avoiding them. This kind of non-critical awareness information is harder to determine, as its effects are more subtle; groupware that provides this kind of information is also harder to evaluate.
3. Changing requirements. Awareness requirements change over the course of a shared task, and it may be impossible for a groupware system to ascertain the phase of the task. For example, in a shared workspace, people often shift their focus back and forth between shared and individual work. When someone is focused on individual work, they may want only general information about the other person ("she's working over there"); when they are focused on the same task, awareness information must be much more specific.

4. Effects of expertise. As people become more familiar with a domain, a task, and a group of collaborators, they are able to infer more and more about other people's activities from smaller and more subtle perceptual signals. For example, I may learn that another person always does a particular task a certain way, which allows me to anticipate their actions based on what they are doing now. Awareness requirements are therefore not fixed by the domain and the setting, but must also consider individual expertise and the familiarity of the group with each other and with the task.
5. Evaluation. Awareness is not a quality that can be easily measured, and showing the benefits of awareness support in groupware is difficult at the best of times. Evaluation is complicated by the lack of a clear cognitive theory of what awareness is and how it works, and by people's ability to adapt to different group work situations and succeed in their tasks even when there is little awareness information to be had. Studies of awareness support in groupware cannot rely only on time and errors; a wider range of measures must be used to pin down the areas in which awareness benefits group work.

Conclusions

This paper has introduced workspace awareness, one kind of awareness that affects group work over shared workspaces, and has outlined some of the issues and concerns surrounding our attempts to make the concept usable in the design of groupware interfaces. While awareness in groupware remains an appealing idea, much more work needs to be done in making the concept a usable one in groupware systems.

References

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