

Supporting Private Information on Public Displays

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ABSTRACT

The research area of Single Display Groupware (SDG) looks at how to best support multiple users collaborating around a single computer [4]. One outstanding issue in SDG research concerns how to display private information on shared displays. This paper discusses a mechanism by which private information can be selectively displayed to specific users that are gathered around a shared display. A prototype system is presented that implements the mechanism through the use of adapted stereographic hardware.

Keywords

Single Display Groupware (SDG), private information, public information, Computer Supported Cooperative Work (CSCW)

INTRODUCTION

It is common in our everyday world for people to work together on a project. It may be a team of architects gathered around a drafting table, discussing a design, or a group of students sitting around a table solving math problems. In each of these cases a group of collaborators is gathered around shared physical artifacts, and the members are able to interact freely in a natural manner. This type of interaction is not supported by most computer systems, which are designed to be used by a single user. The result is that in workplaces and schools, computer users are often isolated from one another, and cannot collaborate naturally.

The research area of Single Display Groupware (SDG) focuses on how to design computer systems so that groups of users can collaborate comfortably around a single machine [4].

One outstanding issue in SDG research is how to support the display of private information on a shared screen. This paper first discusses the question of private information support in SDG systems, and presents some previous work

on the topic. It then describes a mechanism by which private information can be supported on a shared display. Finally, work related to a prototype system demonstrating the mechanism is discussed.

PUBLIC INFORMATION, PRIVATE INFORMATION

In distributed groupware systems, all information is by default private. Each user has a private display on which private information is displayed. A large body of research exists that concerns how to best make information public amongst remote users, so as to promote awareness between collaborators[1].

In SDG systems, the situation is reversed. Users are gathered around a shared display, and all information is by default public. Every user has the same view of the same screen, and has an automatic awareness of everything other users see. This is one of the main benefits of Single Display Groupware environments, but it is not always desirable. In physical world settings, people are free to reference private notes or make private sketches, while collaborating around a public artifact. At any time, people can choose to make private information public or public information private. This ability to have both public and private information is an aspect that is lacking in existing SDG systems.

Existing public/private SDG systems

There are a few SDG systems that have private information support. Most of these systems provide support by allowing each user to have a small private personal digital assistant (PDA) on which private information is displayed. These private displays are networked with a large shared display, on which public information is displayed.

Greenberg has developed and studied such a PDA enhanced SDG system [2]. In this system, mobile individuals carry PDAs and can create personal notes at any time. When these individuals gather in a meeting, they can selectively publicize these notes by transferring them to the shared display.

Rekimoto has developed a similar system involving a shared display and private PDAs [3]. With this system, a PDA is used as a tool palette and data entry palette. At any time a user can pick up private information from the PDA

with a special stylus and place it on the shared, public display.

TRUE PRIVACY ON A SHARED DISPLAY

Although the use of PDAs provides support for private information, the information is not actually available on the shared display. The cognitive overhead required to coordinate two different workspaces may be significant. Also, the need to constantly shift focus between distinct workspaces may be unnecessarily taxing.

The mechanism discussed in this paper involves the filtering of information on the shared display, so that private information can be displayed to each user, and still be kept private. Each user will see public information as well as his or her own private information on the shared display, but no one else's private information.

THE PROTOTYPE

A prototype system is being developed that supports privacy on a shared display through filtering of data. This prototype system adapts stereographic display technology so that privacy can be supported in an SDG environment.

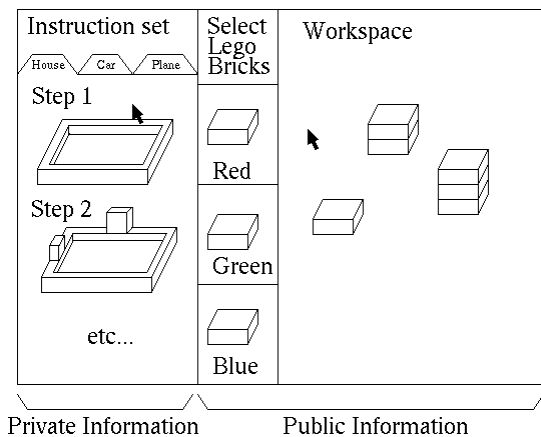


Figure 1. Diagram of prototype screen layout

The Hardware

The original intended use of stereographic display technology is to provide separate left and right eye views of the same screen. In essence, the technology provides private views of one screen for each of the two eyes. This is done by providing a user with a special pair of glasses that filters the screen output so that, for any one screen refresh, only one eye can see the output.

The stereographic technology described has been adapted to provide private views on a shared display for two users. In the initial iteration of the prototype, each user wears a pair of StereoGraphics CrystalEyes glasses [5]. One user has the left eye covered up, and the other user has the right eye covered up. The result is that information drawn on both even and odd frames is public, whereas information drawn on only one of these frames is private to one user.

The Task

The task given to the users in the current prototype is the construction of predefined structures out of virtual LEGO blocks. As seen in Figure 1, one section of the screen is the working area, within which blocks can be placed to form structures. This area is public, both users see the same thing. The other section of the screen contains instructions for building the LEGO structures. There is a different set of instructions for each LEGO structure. The instructions section contains private information, so that each user can independently browse instructions for different LEGO structures. It is thought that this task lends itself well to the privacy mechanism because it will make it possible for users to either function independently, working on different structures, or cooperatively, working on the same structure.

THE STUDY

A study is planned, to assess how well users can interact with the prototype system. It is expected that generalizations concerning the attitudes of users towards having private information available on a shared screen will be obtained. If a more mature prototype is available, more concrete results will be obtained.

FUTURE WORK

Future technical work will focus on finding alternatives to 3D shutter glasses. Either custom shutter glasses will be constructed so that users aren't limited to monocular vision, or another technology will be used. Future usability related work will focus on discovering what kinds of tasks lend themselves to this type of privacy mechanism.

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