

Design and Analysis of Groupware for Large Displays

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ABSTRACT

Despite the proliferation of large-scale displays in the workplace, creating groupware applications that take advantage of their potential for collaboration and communication remains challenging. Interactions with large displays yield user experiences that are different from interaction with conventional desktop groupware. Thus, unique hurdles exist for designing large display groupware applications (LDGAs) that are integrated into actual work practice. Our research addresses these challenges through experimental design based on studies of workgroup practices, the formation of a framework of heuristics for LDGA adoption, and its application to the design and analysis of LDGAs.

Author Keywords

Large displays, awareness applications, CSCW, groupware.

ACM Classification Keywords

H.5.3 Group and Organization Interfaces

INTRODUCTION

Large displays hold great potential for supporting workgroup interactions; their physical characteristics make them appealing technologies for supporting shared content for group viewing and collaboration on shared artifacts. Our research addresses the unique challenges for the design and adoption of large display groupware applications (LDGAs). In his seminal CSCW article, Grudin outlined a number of challenges for the creation of groupware applications for desktop systems [1], many of which apply to the design of groupware for large displays. However, several unique features of large display systems that distinguish them from desktop applications heighten existing groupware challenges and present new ones: 1) *Form factor* – the size and visual impact of large displays cause users to perceive and interact with them differently, 2) *Public audience and location* – their location in shared space affects the amount of attention users direct at LDGAs as well as the visibility and privacy of interactions, 3) *Not in personal workspace* – their location outside of users' personal workspaces affects the amount and type of interaction and exploration in which users engage, and 4) *Not individually owned*—the lack of personal ownership of LDGAs affects the extent to which people use them or interact with the content.

Our research contributes to the field of HCI by:

- Addressing some of the difficulties of creating successful LDGAs through experimental application designs,
- Constructing a framework of LDGA adoption factors, and
- Validating that framework as a tool to inform both design and analysis of LDGAs.

EXPERIMENTAL DESIGN

Designing LDGAs that enhance group interaction is a challenge as such technologies must integrate well with workgroups' existing practices for collaboration and information sharing in order to become useful tools. To this extent, we have designed, deployed, and evaluated several experimental LDGAs to support the needs and practices of specific workgroups. These designs are informed by formative studies of each workgroup's characteristics, social norms, and existing communication and collaboration practices. Evaluations of these projects reveal that large display applications can indeed be effective tools for fostering awareness, even when group members are co-located, and that users can be amenable to certain types of awareness information being shared within the workgroup.

Semi-Public Displays

One context that we chose to study was that of a small, co-located workgroup. Although these types of workgroups typically have strong awareness and information sharing practices, communication problems can arise from the lack of information persistence. The goal of Semi-Public Displays is to enhance awareness between group members by taking advantage of the visibility of large displays and leveraging the group's existing communication practices such as email and word-of-mouth [2]. Reminders culled from email persist in the environment help to improve general awareness and prompt face-to-face conversation. The application also provides lightweight abstract visualizations of recent and upcoming group activity to further promote awareness.

The Awareness Module

The Awareness Module [4] addresses the information sharing needs of a large workgroup in a corporate environment. Our initial studies of the group found that co-workers felt unaware of each others' activities and wanted to know about high-level milestone information. Participants thought that information sharing techniques such as email, newsletters, and web pages required too much effort. The Awareness Module provides a forum to share and access

information in a lightweight fashion. Large displays in shared space show blurbs about commercializations, ventures, and conference activities of group members in an ambient fashion. Passersby can read the blurb and obtain detailed information at the kiosk, swipe their ID badges at a card reader to have the full text of the document emailed to them, or ignore it altogether.

FIVE FACTORS FOR LARGE DISPLAY ADOPTION

A primary challenge in designing LDGAs lies in the hurdle of adoption. We aimed to uncover the factors that affect adoption by studying the adoption success of nine existing external research and commercial LDGA systems. Our study uncovered five key factors that impact LDGA adoption differently than conventional groupware. The factors form a set of heuristics that can serve as guidelines in designing and deploying LDGAs to encourage adoption, as well as a framework for analyzing the adoption of LDGAs. A detailed description of our study and the origins of these factors can be found in [3]; a summary is as follows:

- **Task specificity and integration** – Value and usefulness must be more immediately evident than for conventional groupware because users will spend less time experimenting with LDGAs.
- **Tool flexibility and generality** – LDGAs that support general practices may be adopted by new user groups or for novel tasks.
- **Visibility and exposure to others' interactions** – The interactions of others demonstrate usage and value because the form factor and public nature of these applications can make user behaviors highly visible.
- **Low barriers to use** – Barriers must be low so users can quickly discover value because LDGAs are less amenable to exploration and have a lower frequency of use than desktop groupware.
- **Dedicated core group of users** – Advocate users help others perceive usefulness and reduce hesitancy to use the system stemming from their form factor and location.

APPLYING THE FIVE FACTORS

To solidify the contribution of the five factors described above, we are in the process of validating their usefulness as design guidelines and an analytic framework. We are continuing to iterate upon the factors in the process.

LDGA Design Heuristics

Although the factors were derived from an examination of existing large display groupware systems, the designers of those systems may not have designed for them consciously. We therefore designed and deployed an LDGA using the factors as explicit design guidelines to assess their value in the design process and their impact on system adoption. We designed IM Here (Fig. 1) to facilitate informal communication in workgroups by extending instant messaging (IM) beyond the personal workspace. IM Here makes IM available shared workspace through the use of large displays in the environment. Several design decisions, including the choice to allow users to send messages without undergoing an explicit login process, were made in adherence to the five factors. In our post-deployment evaluation, we found that many of these decisions had a

positive effect on the amount of use that the system received. Details on design, the integration of the factors, and evaluation are found in [3].



Figure 1. IM Here deployed near a conference room.

An Analytic Framework for LDGAs

We are currently applying the framework to the analysis of existing, deployed LDGAs. We are conducting a study of the NASA MERBoard deployment to understand its adoption and use patterns. NASA makes use of large display technologies for the purposes of planning, coordination, and collaboration, notably in the MERBoard project for the Mars Exploration Rover (MER) missions [5]. This system aims to support group practices by providing tools that allow multiple users to create digital artifacts on a shared surface, making group-relevant information about the missions visible in the environment, and migrating information between laptops and group displays. We are examining the use of the MERBoard to understand the extent to which the various tools have been integrated into everyday work tasks in the MER Mission. Specifically, we aim to understand how the adoption success of the various features correlates to the five heuristics we have put forth.

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