Dazzle: Supporting Framing in Co-Located Design Teams Through Remote Collaboration Tools

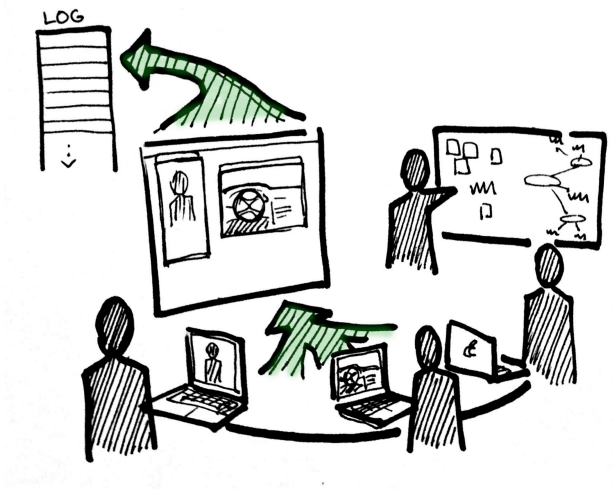

Figure 1: Dazzle supports co-located design teams through a shared display and an implicitly constructed file archive.

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Abstract
Distributed collaboration systems use cloud computing services to support synchronous and asynchronous distributed collaboration. We are investigating how the benefits of these remote collaboration technologies can be applied to *collocated* creative teams. We are building Dazzle, a collaboration system to support product design teams during face-to-face user research and brainstorming meetings. Product designers share information on a common display that is driven by file and screen sharing services. The principal benefit over current display sharing techniques is that the team automatically builds a real-time archive of all viewed files that can be revisited. By applying distributed collaboration technologies to face-to-face meetings, Dazzle facilitates information sharing and provides automatic meeting documentation.

Keywords
Creativity Support Tools, Design, Shared Understanding

ACM Classification Keywords
H.5.3 [Information Interfaces and Presentation]: Group and Organization Interfaces

Introduction

Distributed collaboration technologies have become ubiquitous, thanks to access to high-bandwidth internet connections and browser-accessible applications. Some technologies such as video conferencing strive to approximate the affordances of face-to-face interaction; others (e.g., file sharing, asynchronous messaging) introduce benefits not available in collocated interaction — they go *beyond being there* [4]. While an increasing amount of professional work is performed by globally distributed teams, face-to-face meetings are still the preferred format for many creative teams. Could these collocated meetings also go *beyond being there* by adopting (and adapting) distributed collaboration technology?

We are investigating this research question through the development of Dazzle, a shared display system to support creative team work (Figure 1). With Dazzle, the shared display acts as a silent team member: users share files or screen content with this team member (and, as a consequence, with the entire team). Two principal benefits arise: 1) *Wireless sharing and automatic display switching* frees users from having to negotiate or delegate access to a shared display; 2) *implicit activity records* create a timestamped archive of all files reviewed by the team.

We focus on supporting the work of student engineering design teams at our university. During their design work, members of these teams collect research or ideate individually. These different perspectives then have to be reconciled in team meetings. Because team members do not work in the same physical office, distributed individual work and co-located meetings are the locus of their coordination.

Background: Framing in Design Teams

We grounded our research by conducting a formative study of product designers at work during early-stage design tasks; we conducted interviews with 17 professional and 17 student designers and observed student teams during face-to-face and distributed meetings. The following process summarizes engineering design as taught at our university, informed by industry practice:

When a team approaches a design problem, they must first agree upon a shared problem frame. To understand the problem, the team sends out individuals or pairs to conduct fieldwork with target users. The team reconvenes, and each individual shares their user research; the team then creates a shared frame from individual points of view [3]. Building on insights from user research, the design team then identifies possible solutions. After the team members work individually to generate a large quantity of ideas, they brainstorm again as a team to improve the team's shared understanding of the solution space.

While some companies formally mandate specific information infrastructures, student team members and freelancers may not share any infrastructure beyond Web access. Even with shared infrastructure, design team members often differ in their notetaking practices [7,8]. As a result, we are focusing on a flexible groupware system that can utilize a variety of information media types and computing platforms.

Based on our formative study, we identified three requirements that groupware should satisfy to support the framing cycle: 1) *Enable individuals to present their frames to the rest of the group*. Individuals must select

Figure 2: Users share files from laptops by dragging them onto the Dazzle client application.

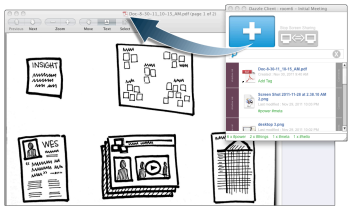

Figure 3: The dropped file is opened locally in the default viewer or editor.

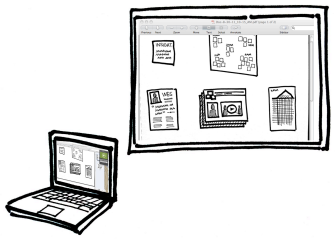

Figure 4: The local application is then shared with the wall display.

relevant information to share with the team, as well as how it should be presented to others. 2) *Allow for shared meta-analysis of information.* After individual designers share their information contributions, the team must understand, analyze, and prioritize information in order to make shared decisions. 3) *Record and Reference Shared Decisions*. Team decisions represent a shared frame — such decisions are frequently revisited during later iterations.

Related Work

Several systems have explored how teams can exchange information on shared displays, e.g., by sharing pointer and keyboard access to desktop applications on a single computer [11]; by providing a video cable to each meeting participant [6]; or by leveraging screen-sharing software [10]. Other systems specifically target sharing of design ideas, e.g., using multiple tablets for digital sketching [2]. Such systems do not provide meeting capture.

Design rationale systems capture the history of how something was designed [9]. Some groupware systems also provide history [5] or focus on capturing co-created meeting artifacts — e.g., video of the team's dialogue, or whiteboard content [1]. However, rich multimedia is rarely revisited. We focus on capturing the *files* that individuals bring to the meeting in addition to co-created artifacts.

Vision: Dazzle

Dazzle is a shared display system to support product design teams during face-to-face meetings on user research and brainstorming. It leverages distributed collaboration technologies for screen sharing and file sharing. The **shared display** is a large, wall-size display where individuals on the team can bring the team's attention to specific content. Team members control Dazzle through **client applications** for laptops and smart phones. Digital content can be dragged and dropped on to the laptop client to share the content with team members and show it on the shared display. Sketches or other physical content can be digitized using a **whiteboard camera** or **smart phone app**. Whenever clients share or annotate a file, that activity is recorded, along with metadata about the sharer. Any file shown on the shared display is stored in a **shared folder**, accessible to the entire team.

Usage Scenario

Dan needs to debrief the rest of his design team on an in-home interview he did last week. At their meeting, Dan pulls up a folder full of interview photographs on his laptop. He drags the first photo into the drop zone on the Dazzle Client (Figure 2). Once he drops the file, it is opened locally on his laptop (Figure 3), and Dazzle initiates a screen sharing session to project his desktop on the Shared Display (Figure 4). In the background, the file is added to a log and copied into a shared file system folder. When his collaborator, Julie, wants to return to that photo later in the meeting, she can drag drag and drop the photo back into the drop zone from the activity log below and begin screen sharing again.

The team has also filled a whiteboard over the course of their discussion. To record this in their shared archive, Dan presses a button on the whiteboard – this takes a photo of the board with an overhead-mounted camera, uploads the photo to the shared folder, and adds this event to the activity log.

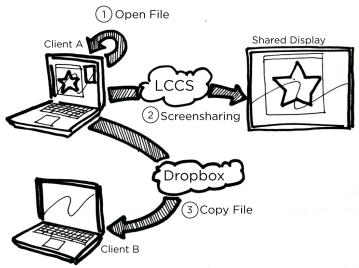

Figure 5: Dragging a file into the client 1) opens the file locally on the client machine, 2) initiates screensharing with the Shared Display over Adobe LCCS, and 3) makes the file accessible to others' by adding it to a shared Dropbox folder.

Ongoing Implementation

We are implementing Dazzle using Adobe Live Cycle Collaboration System (LCCS), a cross-platform, hosted toolset for screen sharing and messaging (Figure 5). We are using Dropbox as a backend for peer-to-peer file sharing. When a user of our system drags-and-drops a file, the file opens locally, the client initiates screen sharing with the shared display, and the file is copied to Dropbox to share with others.

We are currently developing a history view for Dazzle clients which enables users to annotate and prioritize files they have discussed through tags, comments, and ratings. We are also developing a whiteboard camera that can post images to a team's shared history. Finally, we are interested in developing smart phone interactions to post, manipulate and annotate shared information on a large-scale display.

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