Communicating through Handheld Wireless Tablets: Livenotes and Shared Group Awareness

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ABSTRACT

Usability in real-time collaborative applications can be improved with better workspace awareness. In particular, the radar view is the most intuitive user-interface widget for workspace awareness. We extend previous work by developing a radar-like widget to explore how workspace awareness can be supported in *wider* and *non-laboratory* settings that scale to *over two users*. Despite the widget's novelty, test users soon learned to manipulate it with ease.

Prior to introducing this awareness widget, users were observed to perform two types of highly collaborative activities: low-level usage of the user-interface and high-level, visual dialogue between users. As the next step, we plan to employ conversation maps to identify ways in which this widget facilitates such dialogue. We adopt this choice of collaborative practices to analyze due to the profound influence that dialogue bears on learning.

Keywords

Workspace awareness, radar view, conversation map.

INTRODUCTION

Gutwin and Greenberg showed that usability in real-time collaborative applications could be improved with better support for *workspace awareness*, a collective term that includes up-to-the-moment information about the users and what they are doing [1]. In particular, Gutwin et al. found that the radar view, which displays a miniature of the entire workspace and every user's location, is the most intuitive user-interface widget for workspace awareness [2].

Gutwin et al.'s radar widget was demonstrated to facilitate workspace awareness in controlled problem-solving domains (news-paper layout and pipeline construction) for a pair of users. We extend their work by developing a radar-like widget that supports a group of 3-7 users, for the education and design domains. Our goal is to explore how workspace awareness can be supported in *wider* and *non-laboratory* settings that scale up to *more than two users*.

GROUP ACTIVITIES

Our workspace awareness widget was implemented as part

of Livenotes, a Java program for collaborative note-taking and drawing in classrooms. Using Livenotes, small groups of 3-7 students are wirelessly connected to one another via their individual handheld tablets, such that students may annotate and exchange notes synchronously on a multi-user, multi-page whiteboard with peers from the same group.

Figure 1: Page navigation bar in initial Livenotes.

The initial version of Livenotes did not include an awareness widget. Instead, it only came with a navigation bar for users to move between pages (figure 1). After analyzing, in fine-grained detail, transcripts from four sessions in which this version was deployed among multiple participants, we observed that Livenotes was used to engage in two types of highly collaborative activities: low-level interaction with the user-interface and high-level dialogue between users [3].

Low-Level Collaborative Activity

Page navigation is an instance of a low-level activity that is highly collaborative because a user does not move between pages in isolation of other users. Instead, he usually moves to a page where other users are currently writing on, or moves to a blank page in tandem with other users, by exchanging navigation cues with other users. Low-level interaction with the user-interface, even for the local user, is therefore heavily dependent on workspace awareness.
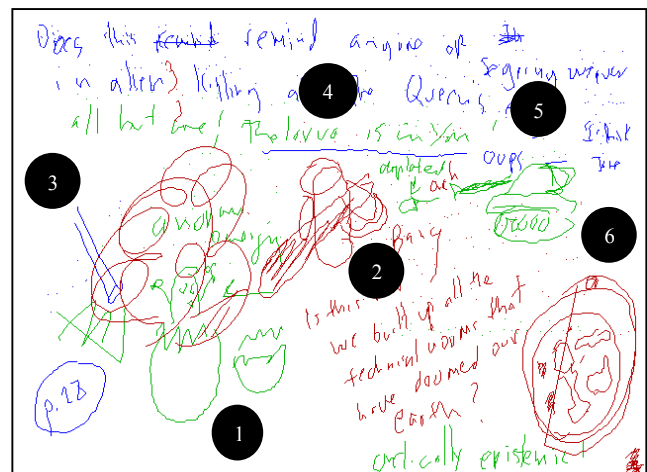

Figure 2: Screen-shot of visual dialogue between 3 users.

High-Level Collaborative Activity

For illustration, figure 2 shows a visual, high-level dialogue between a professor and two users during a seminar class:

1. User A alluded the discussion of socio-technical norms to the *Aliens* film. In response, the professor sketched an egg to represent the hatching of a social norm.
2. User B attempted to kill the fledging norm by drawing Sigourney Weaver's gun aimed at the egg.
3. User A drew a similar gun,
4. To which the professor replied, "The Larva Is In You!", meaning that it is not possible to destroy the social norm because it is part of each person.
5. User A exclaimed his misconception with an "oops."
6. The professor expressed his delight at achieving group consensus by drawing a tank to trump Users A's and B's original beliefs.

Users relied on workspace awareness to employ the user-interface at the low-level for high-level dialogue. These dialogues are visual in nature, and arise when users can see what other group members are annotating and hence respond appropriately. But awareness is impaired in the absence of an awareness widget. As such, introducing such a feature allows us to study ways to enhance user-to-user interaction through better user-interface design.

RESULTS

There are reasons to extend previous work. Several groupware comprise spatial workspaces, in which user interactions may arise as visual dialogues between *more than two* participants. These dialogues are significant for their learning effects, because users seemed to remember more vividly when they actively discussed ideas, engaged in humor in connection with these ideas, or shared the work of debating an idea [3]. Such *spontaneous* behaviors are more likely to take place under non-laboratory settings.
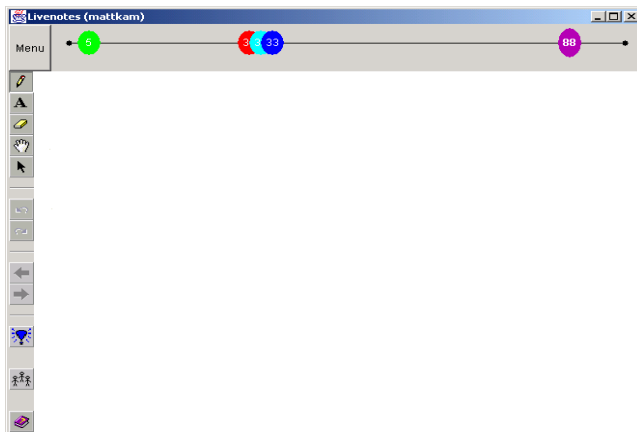

Figure 3: Livenotes with awareness widget.

We implemented a radar-like awareness widget (figure 3) in Livenotes by integrating the original navigation bar with a new awareness display, such that the pages are visually represented using a linear layout metaphor. The widget indicates the current page number of each user with an oval icon shown in the user's ink color at a position relative to other users. By having the user drag his icon to the page he wants to move to, or tap on another user's icon to *teleport* to the latter's page, we aim to achieve a tighter coupling between perception and action [2], so that the widget is intuitive, both to interpret and to use.

This widget results from two iterations in response to user feedback. Users are familiar with the linear layout because it maps very well with pages in paper notebooks, which are ordered sequentially. Moreover, this integrated widget is less distracting since combining awareness perception with navigation action makes it easier to interpret shared state.

In our low-fidelity tests, five participants – 2 males, 3 females from different backgrounds – found the awareness widget to be novel. Nevertheless, they quickly learned to manipulate it with ease after less than 2 minutes of experimentation, on average. We will verify these results with similar high-fidelity tests shortly.

CONCLUSION

In upcoming deployments, we plan to analyze the various dialogue threads in order to identify the ways in which the awareness widget facilitates such collaborative practices. Previously, face-to-face verbal communication was compared with remote computer-mediated conversations [4]. Since dialogues are collaborative practices that span both face-to-face and computer-mediated mediums, we intend to integrate both approaches. By linking the on-tablet dialogue to the live classroom proceedings, we can obtain a more complete "map" of the conversations.

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