Compadres: Lightweight support for distributed collaborators.

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ABSTRACT

Traditional design education relies heavily on passive presence awareness and unfocused interaction. Support for these modes of communication is largely absent from current computing environments. This paper reports on Compadres, a system for support of distributed collaborators through creation of group presence awareness on the web. Compadres provides configurable communications options, in both synchronous and asynchronous modes, including links for messaging, email, chat, and online file management. Compadres can support multiple workgroups or small classes. Two levels of presence awareness are provided: a real-time presence monitor for synchronous interaction, and an extended-time (historical) radar-view for "asynchronous presence" and collaborator engagement through way-laying. The basic system requires very little band-width, but the system extends easily to support desktop or camera image streams for real-time activity awareness. The system supports itinerant, or mobile, users (such as students) as well as situated users (such as faculty). Finally Compadres provides a framework for continued exploration of presence awareness. We have used this to explore a variety of alternative "soft" media presence awareness models.

Our experiences with Compadres, which has been used by several classes and our research group, support those of others regarding the power of presence and messaging in supporting group cohesion, and indicate that it is possible to support infrequent or occasional collaboration as well as frequent interaction via the web.

Keywords

Web, collaboration, presence awareness, workgroup awareness, Compadres

INTRODUCTION

Related Work

Design education, based on "studio" education and "project-based learning," has become something of a model for education in general. Donald Schön (1987) has written extensively about interactions within the studio and the role of what Goffman, (1963) calls "unfocused interaction" in the education of architects. In fact, the traditional design studio format is intended to create opportunities to overhear and observe interactions between others, including the studio mentor. Personal stereo systems and headphones are often banned during class hours (Ching, *et al*., 1999), even though students are working independently.

Digital networks can be used to support interpersonal and group communication, but much of the technology development has focused on digital replication of focused (intentional) communication channels (ftp, email, web browsing, bulletin boards, chat, video conferencing, etc.). Significant advances in Internet speed and connectivity have paralleled the dispersal of the resulting communication tools. Much media attention has accompanied the emergence of "virtual companies," "virtual campuses" (Carnevale, 2000), and distributed workgroups, and while there have been reports of negative consequences (Herbsleb, *et al.*, 2000), pressures continue within Colleges and Universities to replace or supplement face-to-face educational models with computer-supported paradigms.

Only relatively recently have researchers turned to issues of passive communication. One result is "media space" projects such as *Portholes* (Dourish and Bly, 1992), and *Notification Collage* (Greenberg and Rounding, 2001). Group interaction has been examined through messaging projects like *Babble* (Bradner, *et al.*, 1999) and *Hubbub* (Isaacs, *et al.*, 2001). In architectural education, the web-based *Phase-(x)* system (Wenz and Hirschberg, 1997) provides an environment for online coursework. In *Beyond Being There* (1992) Hollan and Stornetta reflect on some of these projects and discuss models of enhanced interaction. More recently attention has been drawn to affordances and social scaffolding "outeraction" benefits of commercial Instant Messaging systems (Nardi, *et al.*, 2000).

Some of the questions that still need to be answered concern the role and importance of unfocused interaction as a supplement to focused interaction in workgroups. Because of its reliance on passive communications, design education may offer suggestions. Within design education a number of experiments have been conducted using Internet and web-based collaboration tools to conduct "virtual design studios" involving design students collaborating on a project from different cities and time zones (Wojtowicz, 1994; Kolarevic, *et al*., 1998; Kvan, *et al.*, 1999). Results have varied. Some indicate that more-nuanced text-based communications may be more

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important to design exploration than high-bandwidth (e.g., video) communications (Kvan, *et al*., 1999). Other research, in computer supported collaborative work (CSCW) and computer mediated communication (CMC), has acknowledged the benefits derived from collocation of team members (Heath and Luff, 1996; Teasley, 2000). These results support the "intuitive" decisions of many managers in work environments to collocate workgroups (Sanders, 1996).

Motivation

Based on experience in two "virtual design studio" experiments (Kolarevic, *et al.*, 1998; Donath, *et al.*, 1999), and local use of a bulletin-board system in online classes, we became interested in developing a support system for part-time collaborators, such as might be found in a web-based course or distributed academic research group. A survey of available communication tools suggested that a communications framework was needed, not a new communication tool (Johnson, 2000).

Task-oriented collaboration systems employing awareness have been shown to increase user satisfaction (Gutwin and Greenberg, 1999). It was felt that a general awareness tool might provide these benefits across a varied set of activities through simplified and unified access to a range of communication options. Because students and part time collaborators have such varied and flexible schedules, it was important to support for both asynchronous and synchronous communications. Finally, the near-ubiquity of web browsers suggested use of HTTP as the communication medium. The resulting system, by extending the communication functions of the user's computer environment, supports individual awareness of and participation in the group. It was first implemented in 1998 and has been undergoing informal evaluation and refinement since then.

THE COMPADRES FRAMEWORK

The Compadres system was developed to investigate the hypothesis that support of unfocused interaction, through a web-based presence awareness and communication interface, would benefit open-ended tasks, such as architecture students and professionals completing collaborative design projects and course work, and may be critical to educational and design processes.

Of particular interest is the support of loosely-coupled distributed groups. This encompasses not only full time workers with a low need for collaboration, but also out-of-class students in seminar courses, on-line office hours for educators, distance education groups, and research groups. No particular agenda was presumed for the group. That is, the system is not task-oriented. The goal is to improve communication and cohesion within the group, regardless of the task.

Lightweight Client Interface

In Compadres we sought to create a light-weight client with a focus on communication and group presence awareness. No special hardware is required and limited screen space. A graphical web browser provides the client interface. Data processing is handled by a web server application and "back-end" database. As in the Portholes system, existing CMC tools (email, ftp, and chat) are used for focused communication. Users may use any networked workstation, including those in shared labs, and access Compadres by simply directing the browser to the correct URL.

The current client interface (the window to the left in Figure 1) uses a web browser host window. The choice of a browser supports itinerant users (such as students) because web browsers are widely available. Storing users' personal data and preferences in the central Compadres database further facilitates mobile use. Users may sit down at any networked workstation with a web browser and access Compadres by simply directing the browser to the correct URL. Further, browser features, such as forms, and navigation mechanisms are generally familiar to users, reducing cognitive load associated with using the system.

The Compadres window is intended to be narrow, so that it can be located to one side of a user's monitor. It is divided into three frames. The top frame houses the presence monitor. Below this is a command console, and below this is space in which various transient interactions take place.

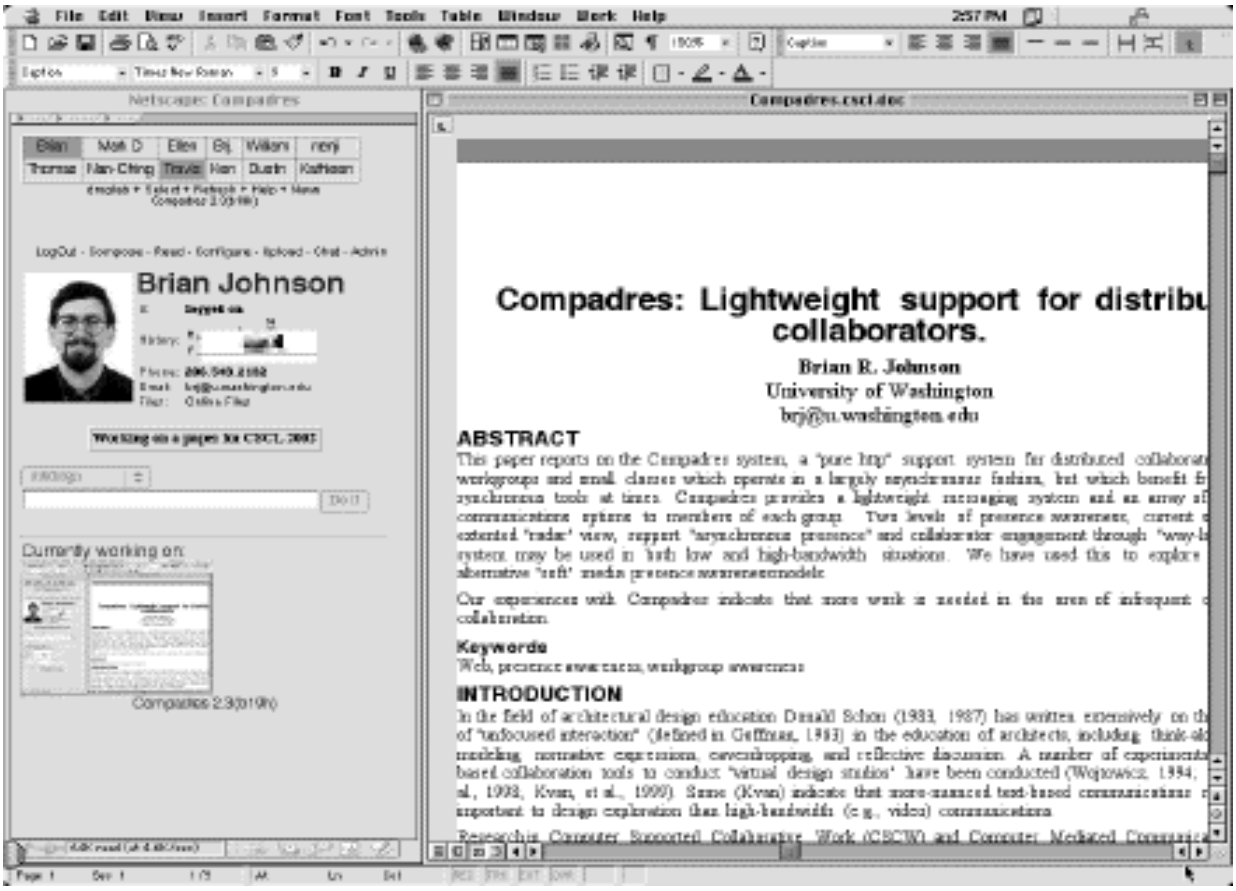

Figure 1. Compadres in use along-side a primary-task application window

The Presence Monitor

While it is web-based, Compadres access is limited to registered users. Usernames and passwords are used to verify user identity, and their use may make users feel more comfortable with personal information and pictures being on the web. This has been shown to encourage use (Nunamaker, 1997). It also allows the system to monitor user presence over time. One product of this tracking is the real-time presence monitor (Figure 2), another is the History graphic, or past-time presence monitor (visible in Figure 4).

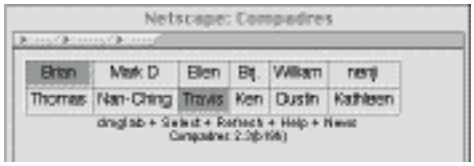

Figure 2. The Compadres presence monitor. Connected users in green (dark grey), absent ones in pink (light gray)

The presence monitor simultaneously shows current group ("cadre") membership and individual connection status (through varied background colors–green for connected users, pink for absent ones). This page automatically refreshes several times a minute, driven by a "meta refresh" tag in the HTML.

An individual is visible (present to) each cadre of which they are a member, though they will see only one cadre at a time in their own display. The “Select” option (Figure 2) is used to switch between cadres for those users who belong to more than one.

The Command Console

Figure 3. Command console, showing the user's global options

The thin central frame of the interface (Figure 3) provides the user with certain global options that are always available, as enumerated in Table 1.

Table 1. Command console options

Command	Action
Logout	Terminate Compadres services.
Compose	Compose and send a message to one or more users selected by checklist from the Cadre's membership.
Read	Display (and dispose of) any received messages.
Configure	Display your own configurable user data for modification.
Chat	Link to URL for group chat-room (if available)
Admin	[displays for sys-admin only] Provides links for removing users, modifying users, stopping the CGI, viewing logs, etc.)

The Personal Data Page

Each user of Compadres has a personal data page. This page, as shown in Figure 4 and enumerated in Table 2, displays the information that the user wishes to share with other group members, as well as certain system information and an input line for sending a message to this individual.

Figure 4. Personal Data Page, showing default values for a new user

User data pages present the following configurable fields:

Table 2. Individual user-alterable preference fields

Compadres User Preferences	Contents
Head-shot (IMG)	URL
Head-shot destination (link)	URL
Name (permitting use of nick-names, etc.)	Text
Phone number	Text

E-mail address	Text
Personal files	URL
"Door Sign" text (shown against a yellow background)	Text
Personal HTML (arbitrary)	Text
Current work (IMG)	URL
Current work destination (link)	URL
Cadre subscription list (listing cadres to which the user belongs)	Text
Default cadre (establishes initial presence monitor)	Text

Users may change their preferences through selection of the "Configure" command console option.

The "Past-time" Presence Monitor

Part of this display consists of a "radar view" of presence over time, (see "History" field in Figure 1, detailed in Figure 5). A grey-scale density map shows the pattern and relative amount of time the user was connected during the previous two weeks on an hourly basis (darker indicates more connectivity during the hour). Similar in purpose to the Babble timeline (Erikson and Laff, 2001), it is included here as part of each individual's data page to provide better support for collaborator engagement through "way-laying" behavior, and to provide an "extended presence" indicator. The triangular markers along the edges indicate the current hour and day of the week, while the tick-marks along the top and the line across the bottom denote the standard Monday-Friday, 8 am to 5 pm work week (to which this user clearly adheres fairly closely).

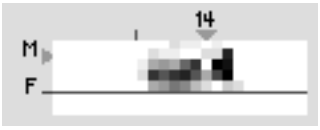

Figure 5. History graphic for a user, showing days of the week vertically and hours of the day horizontally

Quick-messages / Door Sign

When viewing the data page of a user, the one-line form in the middle may be used to write them a quick note. However, when viewing your own data page, this same input field is used to quickly update the Door-sign message displayed with a yellow highlight on your data page for all to see.

Messaging

When messaging multiple recipients, the "Compose" console command may be used. It presents a list of cadre members and a message composition text box. The user selects recipients for his or her message, checks off recipients, and sends it. All messages are queued for their recipient in the user database and announced the next time the individual's presence monitor refreshes, whether that is several seconds later or several hours. The recipient may then delete the message, reply to it, or transfer it to email. Messages which have not been otherwise disposed are automatically forwarded via e-mail each night and then deleted.

Each time the presence monitor is refreshed the user database is queried for new messages. If present, an HTML fragment is appended to the standard presence data generating a (configurable) alert event. Several of these options include the use of audio alerts, helping insure that messages will be noticed even if the Compadres window is covered.

Server Side Structure

The Compadres system consists of a standard (Macintosh) web server, some HTML files, the Compadres (Applescript) CGI applications, and a (FileMaker Pro) database of user and system data. Individual user images and files may exist anywhere on the web, only links are stored in the Compadres database.

The Compadres application processes all requests on the database, displaying and updating user data as needed. It logs connectivity data to the individual history fields, and selected event information to a system log. Periodically a utility is run to convert the history data into the history graphics, forward messages, etc.

AUGMENTED CONFIGURATIONS

A number of interesting enhancements are possible if the prohibition against client-side software installation is relaxed. These can significantly improve individual presence data and overall system attractiveness when used, but are not required for basic operation.

Live views

One of these is shown at the bottom of Figure 1. Here, the "Current work" graphic consists of a live image of the user's desktop (suitably scaled to reduce detail) streamed in real-time from an auxillary application, *WebCam Turbo* (Paperjet). A related application, *WebCam Too* can make the "head shot" graphic into a live view.

Background Applications

Idle Time Monitor:

A client-side "log on/log off" script that performs the appropriate action based on (mouse and keyboard) idle time, eliminating the need for the user to explicitly log in/out.

Jeeves

A client which, retrieves the presence data in the background, scans it for newly-connected or disconnected users, and, when they are found, speaks an announcement through the host sound system to the effect that the individual has arrived or departed.

Pacifica

A "calm media" client which uses infra-red communications to play a user-specific sound on remote miniature "Cricket" computers, generating unique tone sequences at intervals whenever monitored individuals are on-line.

USER EVALUATION

Researchers in CSCW have previously noted that evaluation of passive awareness systems used by groups is difficult because direct attention interferes with their unfocused nature (Dourish and Bly, 1992) and because the complexity of the surrounding "social, motivational, economic, and political dynamics" (Grudin, 1994) may mask results.

Table 3. Comments from several student users of Compadres

#1	"Works as well as any other instant messaging service"
	"A great feature is having the person's picture and bio on the page"
	"It would have been nice to have a place to archive messages, "
	"I [found] it annoying that any messages that [were] sent to you offline pop up instantly as you log in"
#2	"I think Compadres works very well "
#3	"Compadres ... is a wonderful communication tool. I believe the two things I most appreciated were including the picture of the person you are talking to and the 'connected/disconnected' green buttons."
	"You could enable a 'history of messages received'"
#4	"I knew then that I was part of some group"
	"Most of our discussions … occurred face to face"
#5	"Compadres was not used [extensively] because we could get up and talk to each other and see what our peers are working on."
	"My family is spread all over the U.S. … I think it would be interesting to bring us together (virtually) [in] … a network situation such as Compadres"
#6	"We didn't use Compadres … much because we basically knew where people were all of the time."
	"I could see where members of a team … could really rely on [it] for basic communication."
#7	"When-ever I've logged in, no one else is logged in"

Compadres has been made available experimentally as part of several courses (a total of around 40 people), and by members of our research group. In each case, potential users were encouraged to use the system, but were not required to, and usually had ready access to face-to-face communications as an alternative. After using the system for a period of time ranging from a few days to several months, they were asked to provide feedback. Table 3 shows some of the comments received.

These responses reflect the challenge of constructing suitable "distributed workgroup, long timeline" test situations in a residential university, given the availability of face-to-face alternatives. Nonetheless, these preliminary results suggest that Compadres does contribute to group identity and cohesion, and does present users with recognizable benefits. Even the preference for face-to-face interaction can be seen as an indicator of the value and importance of workspace awareness, whether focused or unfocused.

FUTURE DIRECTIONS

The current system responds to some of the above feedback, especially in the area of message management. The comment by #7 reflects one of the challenges of part-time or asynchronous use: Who wants to hang around in an empty room, after all? One response was creation of the "past-time presence" or "history" graphic. Informal feedback regarding this feature is quite positive and suggests that it is important for an "occasional" group to be able to sense "potential presence" as well as real-time presence in the communication zone.

Suitable research protocols from which to perform other-than-anecdotal assessment have been difficult to establish or find in the literature, given the assumption of a long time-line for use of the system. However, we are exploring work in this direction, too.

Additional features of "unfocused interaction", including fully passive activity monitoring and automated desktop thumb-nailing, conversational eavesdropping and expansion, and issues of perceptual symmetry are also of interest, as is the possibility of integrating presence data into additional desktop. Microsoft's .NET environment may well supply many of these features. In any case, concerns about privacy and employee workplace monitoring will almost certainly obscure or cloud observation of benefits associated with enhanced passive awareness.

SUMMARY

Distributed groups, including professionals, students, faculty, and researchers using CMC, benefit from shared presence awareness. In this paper we have presented the Compadres system and shown how it supports presence awareness using a light-weight client interface requiring only a standard web browser. We have also described how the Compadres framework can take advantage of a range of hardware and software configurations. Compadres delivers awareness in both the "real-time" and "past-time" temporal domains. Personalization features such as the Door sign, photos, and "current work" images help individuals express themselves, and contribute to cohesion in the group. The presence monitor, history graphic and integrated communication links, are all welcomed by users.

We also find that additional research is needed into the effect of CMC technology on the pace of interaction in a group setting, particularly as it relates to group size, group bonding, and time-line.

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