Unfocused Interaction in Distributed Workgroups

Establishing group presence in a web-based environment.

Brian R. Johnson
Design Machine Group, University of Washington

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Abstract: Face-to-face human interaction is divided into "focused" and "unfocused" types. Unfocused interaction often conveys important content and context information and contributes to group cohesiveness and effectiveness. Research in Computer Mediated Communication (CMC) and Computer Supported Collaborative Work (CSCW) is also concerned with human interaction. CMC tools, such as electronic mail, and CSCW tools, such as Decision Support Systems (DSS) and Group Support Systems (GSS) provide for focused interaction among members of distributed workgroups. However, little has been published regarding unfocused interaction in distributed workgroups, where group members' primary work activities hold "center-stage" and communication activities are peripheral, though this describes many distributed educational and work situations. A framework for studying this type of support using standard web browsers and server applications is described, and informal preliminary results are discussed. Opportunities for future support of peripheral awareness and unfocused interaction are also discussed.

1. INTRODUCTION

Architecture has always been concerned with physical space and the ways in which people use that space to work, learn and play together. Recent advances in computer networks have made it possible for people to conduct much of their lives online, and given rise to terms like "cyberspace," "media space" and "virtual space." Through telecommuting, distance education and the like, these metaphorical spaces promise to alter how we build and inhabit physical space, but perhaps the sensitivities and experiences of those who study the human use of environments would benefit the new electronic

worlds as well. One particular area of consideration involves "unfocused interaction".

1.1 What is Unfocused Interaction?

During the 20th century sociologists, anthropologists and others have studied the interaction of individuals in common social and work settings, including task-oriented work groups, semi-formal groups such as classrooms, and casual assemblies of individuals in public places. In his 1963 book *Behavior in Public Places* Erving Goffman characterizes interaction along a number of axes. One axis involves the distinction between "unfocused interaction … the kind of communication that occurs when one gleans information about another person by glancing at him", and "focused interaction, the kind of interaction that occurs when persons gather close together and openly cooperate to sustain a single focus of attention, typically by taking turns at talking." (Goffman, 1963, p24).

1.2 Importance of Unfocused Interaction

Thus, face-to-face human interaction can be divided into "focused" and "unfocused" types. Unfocused interaction, also referred to as *peripheral awareness*, *passive awareness*, and *peripheral monitoring*, is unintentional but often conveys important content and context information and contributes to group cohesiveness and effectiveness. One classic example involves two London railway workers and the information passed passively between them simply because they could overhear each other's phone conversations (Heath and Luff, 1996).

The education of designers has leaned heavily on unfocused interaction. In *Educating the Reflective Practitioner*, Donald Schön argues that the passive forms of communication are critical to the socialization process which is part of educating designers (and, by extension, performing design). While an individual "desk crit" is largely a focused interaction, he and others also see significant value in the unfocused interactions, involving overhearing, student-to-student interaction, and spontaneous discussion. This is why schools of architecture utilize the costly studio process, and identify "studio culture" as one of their valuable assets. In an era where more and more emphasis is shifting to on-line education (Carnevale, 2000) it is important to understand which aspects of our educational process might be compromised or supported by deployment of these technologies.

1.3 Impact of Computers and Networks

With the development of computer networks in the 1970s, programmers began exploring ways of using them for human-human interaction, giving rise to the field of Computer Mediated Communication (CMC). Many CMC applications, such as electronic mail, provide generic communication tools which might be applied in a variety of situations. Other research focused on supporting shared tasks over distance, spawning the field of Computer Supported Collaborative work (CSCW). Within CSCW decision-making in distributed work group situations has been studied using Decision Support Systems (DSS) or Group Support Systems (GSS).

1.3.1 Focused Interaction

This area of computing has tended to focus on the technical aspects of communication, enabling more and more modes of exchange, from text messages to spoken words, to video images. Most of the software created to date addresses the need for direct, person to person(s) communication. These systems share an orientation to Goffman's "focused interaction". They fulfil an interpersonal communication need when consciously sought by the participants. They are not generally intended to facilitate the indirect or passive forms of communication described as "peripheral monitoring", eavesdropping, and so on.

The common interaction tools available today provide most of the conceivable modes of focused interaction (Johnson, 2000a). Their availability has also demonstrated that CMC creates a social interaction space (Turkle, 1995). Research by Turkle and others has looked at the impact of CMC tools on individual behaviours. This attention has focused on behaviours in the "public" places of the Internet, by looking at how people use Multi-User Dungeons (or Domains) (MUDs), Internet Relay Chat (IRC), and email in their social, discretionary lives. It has not examined as closely the use of these tools in professional practice or education domains.

1.3.2 Unfocused Interaction

We know individuals interact in unfocused ways. However, "there is little research on what role passive awareness itself plays in group work activity and cohesion" (Dourish and Bly, 1992). When available, formal evaluations of GSS tend to ignore the long-term team-building aspects of the systems (George and Jessup, 1997). Nonetheless research has moved forward on the intuition that these interactions are important. Projects which have incorporated support for unfocused interaction include the *Portholes*

project at Xerox (Dourish and Bly, 1992), *Beyond Being There* (Hollan and Stornetta, 1992), and recent work demonstrating higher rates of user satisfaction when using a task-oriented CSCW system incorporating presence elements (Gutwin and Greenberg, 2000). Researchers also are exploring the ways in which peripheral awareness matters in technologically mediated communications (Monk and Watts, 2000).

1.3.3 Benefits of Passive Awareness in Shared tasks.

As indicated above, researchers have begun to look at the use of CMC to enhance and support users accomplishing shared tasks in Computer Supported Collaborative Work (CSCW) and have demonstrated that appropriate "workspace awareness" tools can, indeed, enhance worker satisfaction and productivity in focused tasks (Gutwin & Greenberg, 1999).

1.3.4 Benefits of Passive Awareness in Social Interaction

Examples of benefits deriving from a general passive awareness are more anecdotal. Turkle recounts the story of a tele-commuting software tester who was only able to work well once they established a habit of opening a chat window with a colleague (Turkle, 1995).

2. THE COMPADRES FRAMEWORK

The Compadres system was developed to investigate the hypothesis that support of unfocused interaction in open-ended tasks, such as students and professionals completing collaborative design and course work, is beneficial, and may be critical to the success of human interaction involved in educational and design processes.

Of particular interest is the support of loosely-coupled distributed workgroups. This encompasses not only full time workers, but also mutual support in seminar courses, on-line office hours for educators, distance education groups, and research groups. No particular agenda was presumed for the group, except some decision to "be" a group for a period of time. That is, the system is not task-oriented. It is oriented to improving communication and cohesion within the group.

We had prior academic experience with distributed work groups using a variety of both real-time and asynchronous tools (Kolarevic, Schmidt, *et al.*, 1998) (Donath, Kruijff, *et al.*, 1999). That experience indicated that support for both asynchronous and synchronous communications was important, as was simplification of the communication options.

2.1 Web-based

The idea of passively linking distant locales is not new. In addition to pre-web projects like *Portholes* (Dourish and Bly, 1992) and *Beyond Being There* (Hollan and Stornetta, 1992), the web-based *Phase-(x)* system (Wenz and Hirschberg, 1997) demonstrates varying support for the idea.

Compadres combines an extremely light-weight client presence, a focus on communication, and a visual presence monitor.

The system uses a web browser as the client software, with several web server Common Gateway Interface (CGI) applications and databases to store system data. As in the Portholes system, existing CMC tools (email and chat) are used for focused communication.

2.2 Lightweight Client Interface

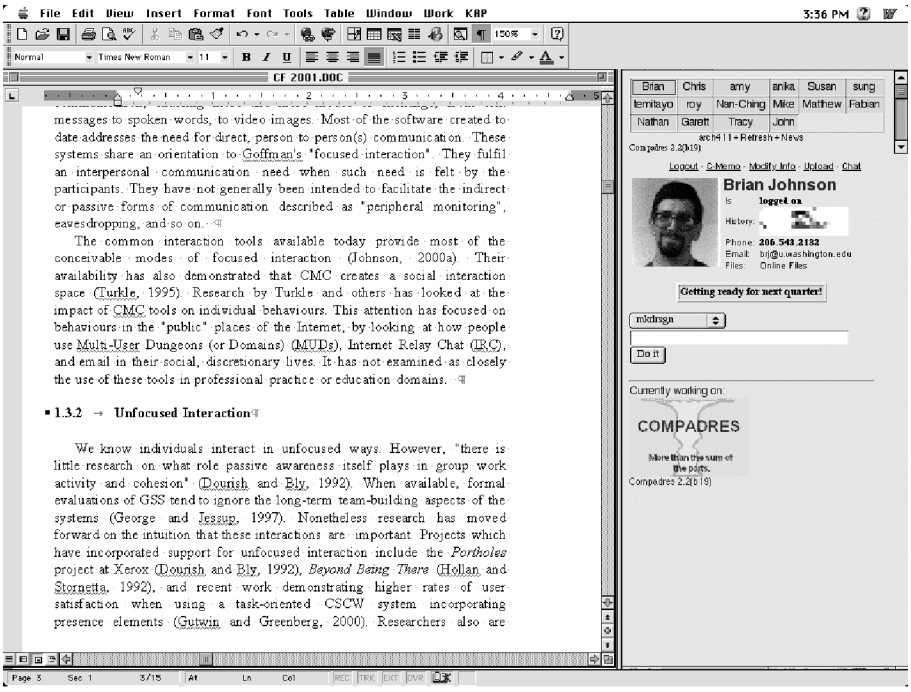

Figure 1. Compadres in use along-side primary-task application window

The current client interface (shown to the right in Figure 1) uses a web browser as the host environment. This choice supports itinerant users (such as students) because web browsers are practically ubiquitous and users' personal data and preferences are stored in the central Compadres database. They can sit down at any networked workstation with a web browser and

access Compadres by simply directing the browser to the correct URL. Browser features are generally familiar to users, reducing cognitive load associated with using the system.

The Compadres browser window is purposely 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 user data pages and transient interaction pages are presented.

2.2.1 The Presence Monitor

While it is web-based, Compadres is a private system, limiting access to known users. The use of usernames and passwords may make users feel more comfortable with personal information and pictures being on the web, but it also means they know who the other users are. This has been shown to encourage use (Nunamaker, 1997). It also allows the system to actively tracks users. One product of this tracking is the real-time presence monitor.

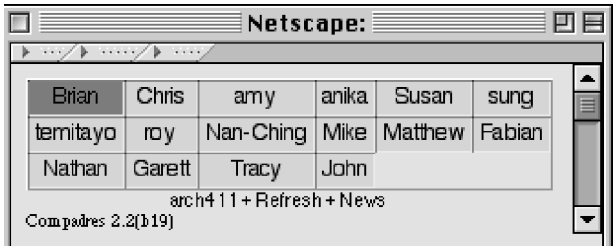

Figure 2. The Compadres presence monitor, showing connected users in green (dark grey) and absent ones in pink (light gray)

The presence monitor consists of a text-based area of the screen which simultaneously shows current workgroup ("cadre") membership and individual connection status (through varied background colors–green for connected users, pink for absent ones. This page automatically refreshes two or three times a minute.

Each time the presence monitor is refreshed the CGI queries the user database for new messages. If present, it delivers them in a JavaScript fragment that issues an alert upon loading, assuring that they will be seen even if the Compadres window is covered.

Links at the bottom of the presence monitor (see Figure 3) allow the user to see the name of the current cadre, select an alternative group, and manually refresh the presence monitor, and view system-wide news

Figure 3. Cadré selection pop-up displayed when changing workgroups

2.2.2 The Command Console

Figure 4. Command console, showing the user's perpetual options

The thin central frame of the interface (Figure 4) provides the user with certain options that are always available, as described in Table 1.

Table 1. Command console options

Command	Action
Logout	Terminate Compadres services.
C-Memo	Compose and send a message to multiple users selected by checklist from the Cadre's membership.
Modify Info	Display your own user data for modification.
Upload	Link to URL for manipulation of group files.
Chat	Link to URL for group chat-room.

2.2.3 The Personal Data Page

Each user of Compadres has a personal data page. This page, as shown in Figure 5, displays the individual's "public" face, the information that they wish to share with other workgroup members.

Another product of the system's awareness of users is maintenance of a "radar view" of presence over time (see "History" field in Figure 5). A grey-scale density map showing the relative amount of time the user was connected over the previous seven days is presented as part of their personal data page. The green (dark) squares along the edges indicate the current hour and day of the week.

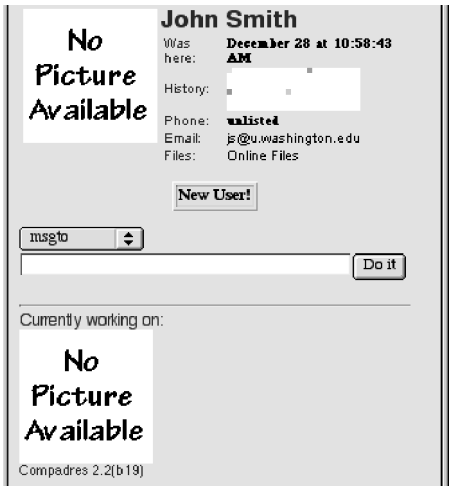

Figure 5. Personal Data Page, showing default values for a new user

User data pages present the following personalizable options:

Table 2. Individual user-alterable preference fields

Compadres User Preferences
Head-shot (IMG) URL
Head-shot destination (link) URL
Name (permitting use of nick-names, etc.)
Phone number
E-mail address
Personal files URL
"Door Sign" text (shown against a yellow background)
Personal HTML (arbitrary)
Current work (IMG) URL
Current work destination (link) URL
Cadre subscription list (listing cadres to which the user belongs—not displayed in Figure 5)
Default cadre (establishes initial presence monitor—not displayed in Figure 5)

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

When viewing the data page of another user, you may use the Message-to form to write them a quick note. When viewing your own data page, this same input field is used to quickly update the Door-sign message. Messages are queued for the recipient in the user database and delivered the next time they log on or their presence monitor refreshes. Uncollected messages are forwarded via e-mail each night, when possible.

2.3 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 CGI provides users with a private environment. Each request on the CGI must be authorized. Since it would be impractical to include a username and password with each hit, Compadres uses a trust model. When a user logs-on to the server using their Compadres username and password, the CGI records their IP-address. Subsequent requests from that IP-address are trusted until the user logs-out or times-out. Timing-out covers contingencies such as users who close the browser window without logging out. Further, since each interaction with the CGI, including updating the presence monitor, resets the time-out clock, "timing out" and "logging out" are virtually synonymous.

The Compadres application processes all requests on the database, displaying and updating user data as needed. It also logs connectivity data to the individual history fields. Once a day it launches a utility to convert the history data into the history graphics displayed as part of the user's personal data page, forward uncollected e-mail, etc.

2.4 Alternative Client Implementations

In the real-world, unfocused interaction takes on many forms, including acoustic, visual, and even olfactory ("Jan's brewing coffee again"). We do not need to "log on" to take advantage of these cues. In our ideal system, users would not need to explicitly "connect" or "disconnect". Nor would screen space be required for the presence monitor, cues might be embedded in the surrounding physical environment.

One configuration of the Compadres system involves running two special programs on the client's machine in addition to a browser. One provides an alternative to a static "current work" desktop graphic by broadcasting live images of the user's screen buffer (suitably downsized to remove detail). The other replaces the "head shot" graphic with a live webcam image.

Other configurations eliminate the browser window. In one we developed a "Butler" client for Compadres. When launched, this client-side script retrieves the presence-monitor data, scans it for newly-connected or disconnected users, and then speaks an announcement to the effect that the individual has arrived or departed.

In a related "soft media" project, the Butler was made to activate "Crickets", generating unique user-specific tone sequences at intervals whenever monitored individuals were on-line. A variation of this, using X-10 technology and lamps, is also under development.

2.5 Initial Results

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.

Compadres has been used experimentally as part of three courses. In each case, students were encouraged to use the system, but were not required to, and had ready access to face-to-face communications. After using the system for a few days, they were asked to provide feedback. Table 3 shows some of the comments received. Initial student response was also reported in (Johnson, 2000b).

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."

These responses reflect the challenge of constructing suitable "distributed workgroup" 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 recognisable 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.

2.5.1 Personalization

The personal data page, including a photograph, was appreciated by users for it's group-building, though some users replaced the photo with a different graphic. Very few students provided a phone number (though cell-phone use is quite wide-spread in this group).

2.5.2 Messaging

The messaging feature drew significant use and comment. Though the "message to" input field is only 40 characters wide, it was common to find substantial messages being transmitted with this mechanism. Several responses indicated desire for more options in message management. This has been partially addressed through addition of the "Compadre Memo" command-console option, and the nightly forwarding of unread messages via e-mail.

2.5.3 Privacy

Management of personal privacy is certainly an issue, not unique to Compadres. The Portholes Public client, for example, which was presumably available to users outside the primary user group, didn't show office spaces (Dourish and Bly, 1992, p544). Others have identified privacy concerns as critical to the acceptance of CMC (Tu, 2000). Many objections expressed relative to web-cam software involve the anonymity of possible viewers. Careful integration of such technology into an overall privacy management scheme seems essential.

3. FUTURE DEVELOPMENT

While more than two years old, Compadres is still early in its development. There are a number of areas undergoing active development, and one or two in which we hope to undertake projects.

3.1 Increased Passivity

One of the motivations for creating Compadres was the observation that the available tools require considerable user knowledge and commitment to use. Increasing ease of use of the tools is one of the important CMC agenda items (Nunamaker, 1997). We felt that one source of difficulty was the number of different interfaces and attempted to mitigate this complexity through use of a single "switchboard". Currently Compadres brings together email and chat within a single umbrella.

The motivation behind Compadres is to link people, not places. Thus, it is necessary to identify individual participants. Unfortunately, biometric and similar technology is of little use unless widely deployed. However, several scenarios exist in which a single machine is consistently used by a single user. We are examining opportunities to provide such users with automatic log-on and log-off, by monitoring system mouse and keyboard events for example.

Increased passivity through alternative presence monitors using audio or alternative visual cues (as described above) is also an area for investigation. Alternative mechanisms for displaying and managing availability cues (perhaps tied to physical objects in the office) offer additional avenues.

3.2 Increased Interaction

Another area of investigation is that of mechanisms for making available the kind of information available in physical environments. In the real world, we can see someone looking in our office door. We can see who is visiting whom in our lab. Not only can we see, we are able to eavesdrop if their conversation is loud enough (and receive tacit permission to do so by the speaking volume used by the participants). Replicating such interactions, especially asynchronously, presents a number of visualization, presentation, and privacy-management challenges.

3.3 Measuring Benefits

As indicated above, assessing the impact of CMC systems such as this is difficult. We are approaching this from two sides: we are working with small

groups to asses responses to the system, and we have instrumented the system to log user actions, providing objective background data. We are also seeking appropriate deployment settings in which to conduct more extensive testing.

3.4 Integration into other tools

Unfocused interaction in the physical world is a side-effect of our bodily embedding in that world. The natural domain for embedding unfocused interaction tools in the CMC universe is the operating system, where keyboard and mouse events provide information regarding the user's presence, and might be indicative of more subtle mental states (e.g., concentration).

At the same time, inclusion of "unfocused interaction" features in "primary task" CSCW applications (such as multi-user CAD software for architects and engineers) might significantly enhance collaboration even within co-located workgroups.

This is a direction we are beginning to explore.

4. CONCLUSIONS

Face-to-face communication between people clearly remains the vastly preferred communication option when such interaction is available (Hollan and Stornetta, 1992). However, as CMC matures, focused interaction tools such as video conferencing and email will be joined by tools which support unfocused communication. These tools will help maintain workgroup identity and group awareness for those who work at a distance.

It is important to continue the investigation of feature-sets, interaction modes, and user behaviors that accompany these tools. The Compadres framework provides several opportunities to advance this research.

5. AVAILABILITY

We believe that one of the best ways to understand collaborative work systems is through collaboration. Individuals or groups wishing to try Compadres to support a workgroup, or wishing to collaborate on development of the system, should contact the author at brj@u.washington.edu, or visit the Compadres web site at <http://www.caup.washington.edu/software/compadres>.

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