

SUPPORTING AWARENESS IN INSTANT MESSAGING: AN EMPIRICAL STUDY AND MECHANISM DESIGN

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ABSTRACT

Supporting awareness plays a prominent role in facilitating natural and effective communication in Instant Messaging (IM). This paper reports our empirical study of awareness in IM, using an online survey and face-to-face interviews to identify user needs for awareness support. The study has identified three themes, including awareness of multiple concurrent conversations, presence awareness of a group conversation, and visibility of moment-to-moment listeners and viewers. The study showed that these three types of awareness are necessary but have been either ineffectively supported or ignored by current IM systems. Drawing on these findings, we have designed three awareness features to support these three categories of awareness. Conversation Dock provides awareness of multiple conversations; Group List provides presence awareness in a group chat by showing who are no longer in the group chat and who are going to join the chat; and Track View provides awareness of in-progress listeners in voice conversations and in-progress viewers in video conversations.

KEYWORDS: Awareness, Instant Messaging, Chat Tools, Design, Empirical Study.

1. INTRODUCTION

Instant Messaging (IM) is an application that supports quasi-synchronous¹ communication between people over wired and wireless networks. In recent years, IM has increasingly become a popular communication tool, used by millions of worldwide users at home and at work. IM was once mostly used by teenagers for chitchat over the Internet, but the service has quickly moved to the mainstream as many home users and business users find IM as an easy, fast and convenient way of communication with family members, friends and colleagues (Isaacs et al., 2002; Nardi et al., 2000). The population of IM home users increased 28% from 42 million in September 2000 to 53.8 million in September 2001 (Perera, 2001), and enterprise IM is growing at approximately 20% annually (Shukla, 2003). As reported in February 2003, MSN Messenger alone has more than 75 million registered users (Yudkowsky, 2003). Research showed that 77% of IBM employees responded that IM had enhanced their communication by reducing the time they often spent on e-mail, telephone and face-to-face communications. And, more than 75% of IBM's clients, who have IM, acknowledged that IM enhanced their productivity (Shukla, 2003).

Whilst email is more like exchanges of digital letters, IM closely resembles face-to-face spoken conversations in which exchanges are often short, quick and even incomplete sentences (Dix et al., 2004; Smith et al., 2000). Due to the conversational style of IM, there is a strong need for maintaining awareness between conversants. For example, awareness of the availability of other people assists users in deciding if they should move into conversations; and awareness of other people's activities helps to coordinate IM conversations naturally and effectively.

¹ The term, 'quasi-synchronous', was coined by Garcia and Jacobs (1999) to refer to a type of synchronous transmission in which messages are composed before being sent, unlike synchronous transmission that transmits each character as soon as it is typed.

Research on awareness in IM has gained much attention within the CSCW and HCI communities. Many studies, such as (Isaacs et al., 2002; Tang et al., 2001; Viegas and Donath, 1999; Cech and Condon, 2004; Segerstad and Ljungstrand, 2002), have researched various techniques to support different aspects of awareness including users' presence awareness, awareness visualisation, turn-taking convention, and so on. Although different awareness features have been included in IM systems, there are still many aspects of awareness need to be supported, as discussed in the next section.

This paper reports our empirical study of awareness in current IM. The study helps us to gain real-world users' experience with current awareness support. The study has identified three issues of awareness support that are currently lacking in IM: *multiple conversation awareness*, *group conversation awareness*, and *in-progress viewing and listing awareness*. Based on the study, we have designed several awareness widgets to support these three types of awareness. For example, Conversation Dock improves users' awareness of multiple concurrent conversations; and Track View provides awareness of in-progress listeners in voice conversations and in-progress viewers in video conversations.

The remainder of the paper is organised as follows. The next section reviews related research on awareness in IM. Section 3 describes our online survey and face-to-face interviews, and reports findings emerging from the study. Section 4 describes three awareness widgets that are designed in light of the user study. Finally, we conclude the paper by recapitulating the findings of our study and presenting a view of future research.

2. IMPORTANCE OF AWARENESS IN INSTANT MESSAGING

This section reviews different techniques developed by other research to maintain awareness in IM. We classify those techniques into four categories based on the types of awareness that they support: presence awareness, turn-taking awareness, contextual awareness, and emotional awareness.

2.1. Presence Awareness

Providing presence awareness information about the availability of other users is one of the primary and most important features of IM. Presence awareness helps users to decide if and when to move into conversations (Nardi et al., 2000). At a rudimentary level, presence awareness informs users if their buddies² are online or offline. This feature has been implemented in all popular IM clients such as messengers of AOL, ICQ, MSN, Yahoo and Jabber (e.g., Yahoo Messenger shows yellow icons to indicate online users and grey for offline users). At a higher level, IM systems incorporate many other features such as sound alerts and live video to inform when buddies come online and go offline. Hubbub (Isaacs et al., 2002) uses auditory cues to support presence awareness—whenever users' buddies go online, their 'sound IDs' are played at the user site.

Furthermore, IM users can even set presence messages (e.g., 'On the Phone' and 'Stepped Out') so that other users trying to contact them know that they are on the phone or not in the office. Some IM systems not only show if users are available, but also provide the level of their activities. For example, Activity Meter (Isaacs et al., 2002) shows users' level of activities within the last 15 seconds. Chat Circles (Viegas and Donath, 1999) changes colours of users' circles to indicate how active they are.

When IM becomes part of an integrated communication platform, more sophisticated support for presence awareness is required. For example, as the mobility factor is added to IM, a new degree of presence awareness is introduced. Hubbub shows if users are online, and also indicates whether they logged into IM networks from their PCs or their PDAs. MOST (Cheverst et al., 1999) and WebWho (Ljungstrand and Segerstad, 2000) provides awareness of both virtual and physical presence. They display notifications if users are present in an IM network (i.e., virtual presence), and their geographical location (i.e., physical presence). A study of WebWho shows that both virtual and physical presence awareness affect content of IM messages.

² The term, 'buddy', refers to a person on a user's IM contact list.

IMVis (Neustaedter et al., 2002) and Chat Circles explore alternative metaphors to represent presence awareness. IMVis develops a 3D tunnel to show available buddies around the outside edge of the tunnel, and less available buddies closer to the vanishing point of the tunnel. Chat Circles represents users as coloured circles. The circles expand as a new message arrives, and become blurry after a period of idleness.

2.2. *Turn-taking Awareness*

Turn-taking has been well-known as a fundamental process in human conversations (Dix et al., 2004). In face-to-face communication, turn-taking is supported by a suite of fine-grained back channels such as body language, eye-contact, voice intonation, facial expression, and so on. But those fine-grained back channels are almost missing in IM. Moreover, IM inherits many generic problems of text-based communication tools with respect to turn-taking such as visibility of listening-in-progress, control over turn positioning and visibility of turns-in-progress as discussed comprehensively in (Smith et al., 2000; Herring, 1999).

Several solutions for maintaining turn-taking in IM have been developed. Yet, effective support for organising turn-taking rules and resolving floor control conflicts is still very limited (Cech and Condon, 2004; Voids et al., 2002; Woodruff and Aoki, 2003). The simplest solution for turn-taking is that a conversant explicitly offers the floor to other conversants by asking direct questions such as “What do you think, Bob?”. However, this solution is limited as it does not suit the conversational style of IM in which exchanged messages are short and instant (Dix et al., 2004). Other alternative solutions for turn-taking have been studied. For example, IM systems provide awareness cues such as the textual ‘Who is typing’ indicator in MSN Messenger and Yahoo Messenger, the visual ‘focusing’ and ‘not-focusing’ cues used in Hubbub, and the auditory typing cues used in Babble (Erickson et al., 1999). Threaded Chat (Smith et al., 2000) adopts the threaded conversational style, which has been widely implemented in discussion boards to support turns and replies in IM conversations.

When voice chat is added to IM, supporting turn-taking in auditory conversations is even more challenging compared to text-based conversations. IM systems have introduced a visual indicator that signals when a person is talking in IM conversations. For example, Woodruff and Aoki (2003) examine how the push-to-talk mechanism affects IM users’ turn-taking convention.

2.3. *Contextual Awareness*

Contextual awareness refers to information that provides users with context of IM conversations. Commonly, IM systems support contextual awareness by displaying a *quasi-shared window*—a window containing messages sent by all participants in a conversation. We define the term, ‘quasi-shared’, to refer to that window because currently local messages appear on that window instantly, but remote messages are displayed in the order of their arrivals at a central server. Consequently, the order of messages shown on conversants’ screens can be different from one to another. Despite being un-identical, the quasi-shared window still provides IM users with some degree of a common understanding of the flow of messages.

Providing information about other conversants’ activities, such as if they are typing, talking, focusing or not focusing on a chat window (discussed in the previous section), also helps to maintain contextual awareness in IM. Chat Circles uses the cadence of size of coloured circles on a user’s screen to show the flow of conversations. Babble (Erickson et al., 1999) uses a graphical representation called ‘social proxies’ to show the activity that people carry out with the application. This also helps to provide users with an intuitive sense of context in conversations. Some other IM clients such as Gaim³ and Trillian⁴ even notify users when their buddies close chat windows, and display a timeout flag if a conversation is inactive for too long.

One aspect of maintaining contextual awareness in IM is to support identity awareness. Awareness of people’s identities is crucial for managing oneself in a public space. In the case of IM, although each user is not publicly seen by everyone in the networks, they are a part of a big group in which each individual

³ <http://gaim.sourceforge.net>

⁴ <http://www.ceruleanstudios.com>

presents their own sense of identity. Providing identity awareness enhances context of conversations as it shows people with whom they are communicating. Commonly, IM systems support identity awareness by associating IM users with different nicknames, colours, avatars, coloured circles (Viegas and Donath, 1999) and even ‘sound IDs’ (Isaacs et al., 2002). These attributes are indicators of identity in the IM virtual community. The study in (Tran et al., 2004) reported that users of the IM community even reach out for multiple identities that allow them to project themselves differently to different IM users.

2.4. Emotional Awareness

Emotions are a social need and play an important factor in human communication. Both our own affective state and our perception of that of others influence the process and outcome of our conversations (Damasio, 1994). There has been a growing interest in providing expressive representation of emotions in IM (Garcia et al., 1999). At the most basic (but very popular and effective) level, IM users convey their emotional state like happiness, anger or sadness by using punctuations and acronyms e.g., :-) stands for a smiling face, and ;-) is for a winking face (Dix et al., 2004). Advancing from that, IM systems have integrated those punctuations with animated graphical emoticons (Rivera et al., 1996). Recently, Yahoo Messenger has developed animated utterance called *audibles*. Audibles include animated images and auditory track, used to deliver messages (e.g., hello, goodbye and flirt) and also to reflect the affective state of a sender and the illocutionary force of the messages.

In addition to emoticons, the avatar is another graphical representation that is also commonly used by users to portray their emotional state (e.g., “*I use a funny avatar when I am happy*” (Tran et al., 2004)). IM users also express their emotions through their online status⁵. As reported in (Tran et al., 2004), “*I often use status to tell my friends if I am sad or happy and also edit my status to tell them what I am doing like studying, cooking, and stuff*”. Furthermore, Conductive Chat (DiMicco et al., 2002) explores a new metaphor to convey IM users’ emotion by incorporating users’ skin conductivity levels into IM.

3. THE STUDY AND RESULTS

In this section, we describe our empirical study of IM that helps us to gain users’ feedback on their real-world experience with awareness support in IM, and report the results of the study.

3.1. Methods

The study was composed of an online survey and face-to-face interviews. The survey was used to gain a broad understanding of how awareness features are used by real-world users. The interviews were conducted to gain a deeper understanding of support for awareness in IM.

The online survey consisted of demographic multiple choice questions, 7-point Likert scale questions and open-ended questions⁶. 173 participants⁷ took part in the survey. The participants comprised of 56 females and 117 males. In this study, we did not aim to study the different uses of IM between females and males, thus we set no gender balance target. Also given the nature of anonymous online surveys where we are unable to interact with respondents, we accepted responses as they came. The participants were students from several universities in Australia and most of them (75%) were in their early twenties. All of them had used IM for more than 3 months, and nearly 90% of them had used IM for more than one year.

After finishing the survey, we were interested in knowing more about the participants’ use of IM, so we conducted further informal face-to-face interviews with 6 participants including 2 females and 4 males, who were selected from the 173 participants of the online survey. Similar to the online survey, we did not set a gender balance target for our interviews. The six participants were chosen based on a first-responded, first-selected fashion. Open-ended questions were used in the interviews. The questions were chosen based on the results of the online survey. The interviews were informally structured. In the interviews, apart from the pre-chosen open-ended questions, we also asked follow-up questions based on the

⁵ An online status is a text-based description composed by a user and can be seen by the user’s buddies.

⁶ Due to space limits, a full list of questions used in the survey is not included in the paper.

⁷ Some participants did not answer all questions, thus the number of valid respondents vary amongst questions.

participants responses. We found this technique really useful for the study. As an example, one of our findings (i.e., awareness of multiple conversations) was not anticipated by us in the survey, but it emerged strongly from the interviews.

3.2. Results

The study overall yielded much data and some results have been published elsewhere (Tran et al., 2004). This paper only reports results related to support for awareness in IM. In particular, we look at trends of the respondents' beliefs and usage by reporting three themes that emerged from the study.

3.2.1. Awareness of Multiple Concurrent Conversations

The online survey showed that it is common behaviour for IM users to interact with many people simultaneously. The majority of the respondents (92%) had used IM to chat with two people or more at the same time. Over 50% of them had chatted with more than 3 people simultaneously (mean = 3.2, std. dev. = 0.09, n = 173). The issue of awareness support for multiple concurrent conversations (referred to as multiple conversations henceforth) was not covered in the online survey, but arose from the interviews.

Five out of the six interviewed participants responded that at one time or another they had typed into a window that was not the one intended, especially when they had multiple conversations with many buddies at the same time. Such a mistake may happen because support for managing multiple conversations in current IM is weak. One respondent commented that *"my biggest problem when chatting with more than one person is maintaining a presence in each conversation, so conversations should be arranged easily. For example, I would really appreciate if it [conversation] could lock into a corner and then perhaps another chat window could be stacked beneath it or beside it so that I can understand what's going on"*.

3.2.2. Presence Awareness in a Group Chat

At the moment, IM systems provide awareness mainly for one-to-one conversations. When a conversation involves a group of more than two people, there is a lack of support for awareness. Many awareness cues, which are provided in a one-to-one conversation, are either missing or become significantly less effective in a group conversation. For example, a visual 'Who is typing' cue is missing in a group chat especially when more than one person is typing at the same time. This leads to many problems in maintaining turn-taking and resolving floor control conflicts. *"I rarely use group conference but I once chat with four friends and it was very difficult... because they were talking about many things at the same time. It is hard to follow."*, commented one respondent.

Furthermore, IM systems only show presence awareness about people who are currently participating in a group chat. These systems do not provide any presence awareness about those who were in the group chat and had already left, or those who are going to join the group chat. Around 65% of the respondents believed that it is important to know who were in a group chat before (mean = 4.5; std. dev. = 1.71; n = 149), and nearly 55% of the respondents thought that it is useful to know who will join a group chat (mean = 4.6; std. dev. = 1.63; n = 149).

3.2.3. Visibility of Moment-to-moment Listeners and Viewers

The study showed that IM systems should provide some level of visualisation to support awareness about the visibility of listening- and viewing-in-progress. Current IM systems do not provide users with moment-by-moment information about people who are listening to other auditory messages. That is, when users are talking in IM voice chat, they do not know who can and cannot hear them. Nearly 80% of the respondents said that they wanted to know who can hear them speaking (mean = 5.7; std. dev. = 1.72; n = 149). In the case of video chat, IM systems like Yahoo Messenger let users know how many people are viewing their webcam, but they do not know exactly who those people are. Around 80% of the respondents wanted to know which users are currently viewing their webcam video (mean = 5.9; std. dev. = 1.74; n = 149).

In addition, our respondents also suggested that IM systems should provide information about if other users can have an audio or video chat. *"It is quite useful to know if my friends are capable of audio and*

video conversations. For example, do they have microphone, speakers or webcam installed?”, said one participant.

4. AWARENESS WIDGETS FOR INSTANT MESSENGER

Reflecting on the findings of the empirical study, we have designed three awareness widgets to address the issues of supporting awareness that have been discussed in the previous section. These awareness widgets include:

- *Conversation Dock* (ConDoc) supports awareness of multiple concurrent conversations by integrating a miniature view and magnification lenses;
- *Group List* provides presence awareness in a group chat by showing a list of users who were in the group chat and had already left the chat, and a list of users who are going to join the group chat;
- *Track View* shows awareness information about moment-to-moment listeners and viewers in audio and video chats by showing a list of users who are currently listening to a user’s auditory track and who are currently viewing a user’s webcam.

Out of these three mechanisms, ConDoc have been implemented and evaluated. The screenshots of ConDoc are shown in Section 4.1 (Figure 1). Group List has been partially implemented, and Track View has not yet been implemented, thus only mock-ups are shown in this paper to illustrate the design and general functions. Certainly, further implementation, improvement and evaluation are required to improve the usability of these mechanisms.

4.1. Conversation Dock to Support Multiple Conversation Awareness

As discussed in Section 3.2.1, the participants reported that current support for awareness of multiple conversations in IM is limited and insufficient. *Conversation Dock* (ConDoc) was designed to assist users in managing their multiple conversations. ConDoc helps users to manage their conversations by placing all currently active conversations in a miniature window form (Figure 1a). Users can quickly *read* a conversation in ConDoc by moving a mouse over it. As a user moves the mouse over a particular conversation, the window of that conversation is enlarged while windows of other conversations in ConDoc remain unchanged (Figure 1b). This creates a visual effect of magnification lenses described in (Greenberg et al., 1996; Bier et al., 1994). If users want to *type* further in a particular conversation, they can drag the conversation out of ConDoc and interact with the window as normal. When users minimise a chat window, the window is then put back into ConDoc instead of being placed on the task bar.



Figure 1. Conversation Dock (ConDoc)

In addition, ConDoc also includes visual cues to provide awareness information about the arrival of new messages. When a new message arrives at a particular conversation in ConDoc, the window containing that conversation is flashing, and a new message is highlighted in another colour. The window stops flashing and the colour changes to the default colour when a user attends to the conversation by moving a mouse over the window.

We are not suggesting that the visualisation technique that has been implemented in ConDoc is necessary the best way to resolve the problems of managing multiple conversations in IM, but rather explains an alternative metaphor for visualisation of conversational awareness.

4.2. Group List to Support Awareness in Group Conversation

To enhance awareness support for a group chat, Group List is designed to support presence awareness of people who are no longer in a group chat and who are going to join the group chat. As shown in Figure 2, in addition to the list of users who are currently in a group chat (i.e., ‘Active Buddies’), Group List keeps track of who were in the chat before and already logged out (i.e., ‘Left Buddies’), and who are invited to join the group chat but have not yet arrived (i.e., ‘Coming Buddies’). Also, Group List provides temporal information about how long a contact has logged into a group chat, and how long a contact had logged out the chat.

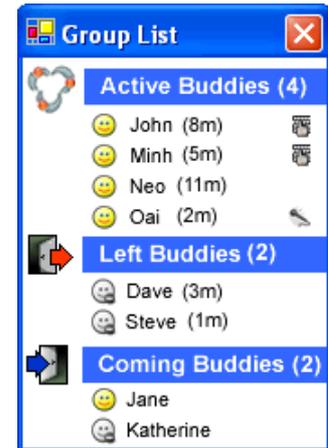


Figure 2. Group List

Group List also conveys contextual awareness of *multiple* users’ activities (e.g., who are typing and who are talking) by providing visual ‘someone is typing’, ‘someone is talking’ indicators. Whenever a user is typing, an animated keyboard icon appears next to the user’s name on the contact list. By using such a visual indicator, we can resolve the problem of a textual ‘Who is typing’ as our method can handle the case when more than one user is typing currently. Similarly, whenever a user is talking, an animated microphone indicator appears next to the user’s name. Vronay et al. (1999) developed an intermediate text indicator to show a character-by-character typing mode, but this mechanism was found uncomfortable by many participants in their study. Hence, Group List was designed to provide an indicator showing that a message is currently being composed rather displaying an actual message.

In the current design, Group List does not support the case when a user rejoins the chat. We find this can be a challenging task especially when users join, then leave, and rejoin the group conversation many times. In addition, although Group List provides temporal awareness of how long active users have logged into the group chat and how long inactive users had left the chat, it does not provide information of how long users will join the group chat. We believe that providing temporal awareness of when users will join the chat can be difficult to anticipate, and can create extra work for the users as they need to tell the IM system when they are able to join, and moreover it can only be estimated information.

4.3. Track View of Listeners and Viewers

As shown in Section 3.2.3, current IM systems provide limited moment-to-moment awareness information about listeners and viewers in audio and video conversations. Track View is designed to inform users of who are currently listening to their auditory conversation and who are currently viewing their webcam. Figure 3 illustrates Track View by showing 3 users who are currently viewing a local user’s webcam and 2 users who are currently listening to the local user’s auditory track. In addition, Track View also allows the local user to stop any current viewer from listening to their voice or seeing them through webcam, for example, by unselecting a check box in Figure 3.

In addition, we have designed Buddy List that enhances the current buddy list by providing visual cues to inform users if their buddies are capable of joining audio and video conversations (e.g., if they have microphone and webcam installed). Those visual cues are icons displayed next to contacts on the buddy list. If a buddy can join audio and video conferences, a headphone icon and a camera icon are shown accordingly (e.g., in Figure 4, John, Neo and Jane are capable of joining audio chat; Neo and Jane are

capable of video chat). If a buddy is currently participating in audio and video conversations then the corresponding icons become bright (e.g., Neo is involved in both audio and video chats).

At the moment, information about listeners and viewers shown in Track View is based on the request-and-accept protocol in IM. That is, for example, whenever a request to view webcam is granted, Track View adds a user making the request into a viewer list. But, Track View is not able to track if that user actually sees the webcam (e.g., the webcam window might be covered by another window on the user's PC). Similarly, Track View is not able to detect if listeners' speakers are muted.

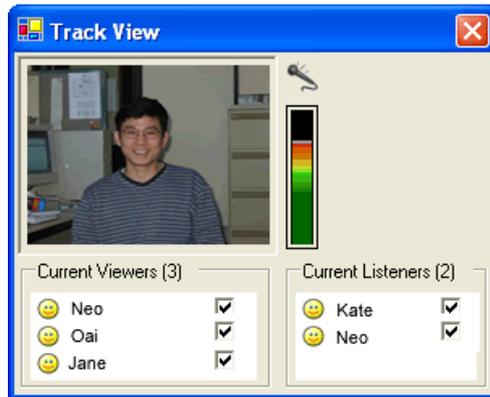


Figure 3. Track View



Figure 4. Buddy List

5. CONCLUSIONS

We have presented our empirical study of awareness support in Instant Messaging (IM). The study involved an online survey and face-to-face interviews that aimed to understand user needs for supporting awareness in IM. The study has identified three issues related to awareness that need to be better supported. In short, the results showed that it is important to: (1) provide more awareness information about multiple concurrent conversations; (2) provide more awareness support for a group chat; and (3) display awareness of moment-to-moment listeners in audio conversations and viewers in video conversations.

Based on the results of the study, we have designed three awareness widgets to support various aspects of awareness emerging from the study. Conversation Dock (ConDoc) utilises the concept of magnification lenses to support awareness of multiple concurrent conversations. Group List provides presence awareness in a group chat by showing people who already left the group chat and people who will join the chat. Track View supports awareness of in-progress listeners in voice conversations and in-progress viewers in video conversations.

So far, we have implemented and evaluated ConDoc. The field trial of ConDoc shows positive results and feedback on the design. As future work, we will continue working on the implementation of the other awareness features, and once the awareness features are implemented we will conduct user studies to evaluate the usefulness of those features.

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7. REFERENCES

Bier, E. A., Stone, M. C., Pier, K., Fishkin, K., Baudel, T., Conway, M., Buxton, W., and DeRose, T. (1994). Toolglass and Magic Lenses: the See-Through Interface. In *Proceedings of the CHI '94*, Massachusetts, ACM Press, pp. 445-446.

- Cech, C. G. and Condon, S. L. (2004). Temporal Properties of Turn-Taking and Turn-Packaging in Synchronous Computer-Mediated Communication. In *Proceedings of the 37th HICSS*, Hawaii, IEEE Press.
- Cheverst, K., Davies, N., Mitchell, K. and Blair, G.S. (1999). The Support of Mobile-awareness in Collaborative Groupware, *Personal Technologies Journal*, 3(1), pp. 33-42.
- Damasio, A. R. (1994). *Descartes's Error: Emotion, Reason, and the Human Brain*, Gosset Putnam Press, New York.
- DiMicco, J. M., Lakshmipathy, V., and Fiore, A. T. (2002). Conductive Chat: Instant Messaging With a Skin Conductivity Channel. *Poster Presentation, CSCW '02*, New Orleans, ACM Press.
- Dix, A. J., Finlay, J., Abowd, G. D., and Beale, R. (2004). *Human-Computer Interaction*, 3rd ed., Pearson, Prentice Hall, Harlow, England.
- Erickson, T., Smith, D. N., Kellogg, W. A., Laff, M., Richards, J. T., and Bradner, E. (1999). Socially Translucent Systems: Social Proxies, Persistent Conversation, and the Design of "Babble". In *Proceedings of CHI'99*, Pennsylvania, ACM Press, pp. 72-79.
- Garcia, A. and Jacobs, J. (1999). The Eyes of the Beholder: Understanding the Turn-Taking System in Quasi-Synchronous Computer-Mediated Communication. *Research on Language and Social Interaction*, 32(4), pp. 337-367.
- Garcia, O., Favela, J., and Machorro, R. (1999). Emotional Awareness in Collaborative Systems. *Proceedings of CRIWG'99*, Mexico, IEEE Press, pp. 296-303.
- Greenberg, S., Gutwin, C., and Cockburn, A. (1996). Using Distortion-Oriented Displays to Support Workspace Awareness. In *Proceedings of the HCI'96*, London, Springer-Verlag, pp. 229-314.
- Herring, S. C. (1999). Interactional Coherence in CMC. In *Proceedings of the 32nd HICSS*, Maui, IEEE Press.
- Isaacs, E., Walendowski, A., and Ranganathan, D. (2002). Hubbub: a Sound-Enhanced Mobile Instant Messenger That Supports Awareness and Opportunistic Interactions. In *Proceedings of CHI'02*, Minnesota, ACM Press, pp. 179-186.
- Isaacs, E., Walendowski, A., Whittaker, S., Schiano, D. J., and Kamm, C. (2002). The Character, Functions, and Styles of Instant Messaging in the Workplace. In *Proceedings of CSCW'02*, Louisiana, ACM Press, pp. 11-20.
- Ljungstrand, P. and Segerstad, Y. H. (2000). Awareness of Presence, Instant Messaging and WebWho. *ACM SIGGROUP Bulletin*, 21(3), pp. 21-27.
- Nardi, B. A., Whittaker, S., and Bradner, E. (2000). Interaction and Outeraction: Instant Messaging in Action. In *Proceedings of CSCW'00*, Pennsylvania, ACM Press, pp. 79-88.
- Neustaedter, C., Greenberg, S., and Carpendale, S. (2002). IMVis: Instant Messenger Visualization. *Video Proceedings of the CSCW'02*, ACM Press.
- Perera, R. (2001). *Study: Instant Messaging at Work up 110 percent*. <http://www.cnn.com/2001/TECH/internet/11/16/workplace.IM.idg/>, Accessed 2005, September 9.
- Rivera, K., Cooke, N. J., and Bauhs, J. A. (1996). The Effects of Emotional Icons on Remote Communication. In *Proceedings of CHI'96*, Vancouver, ACM Press, pp. 99-100.
- Segerstad, Y. H. A. and Ljungstrand, P. (2002). Instant Messaging With WebWho. *International Journal of Human-Computer Studies*, 56(1), pp. 147-171.
- Shukla, U. (2003). *The Future of Enterprise Instant Messaging*. <http://www.expresscomputeronline.com/20030505/tech1.shtml>, Accessed 2005, September 9.
- Smith, M., Cadiz, J. J., and Burkhalter, B. (2000). Conversation Trees and Threaded Chats. In *Proceedings of CSCW'00*, Pennsylvania, ACM Press, pp. 97-105.
- Tang, J. C., Yankelovich, N., Begole, J. B., Kleek, M. V., Li, F., and Bhalodia, J. (2001). ConNexus to Awarenex: Extending Awareness to Mobile Users. In *Proceedings of CHI'01*, Seattle, ACM Press, pp. 221-228.

- Tran, M. H., Yang, Y, and Raikundalia, G. K. (2004). Supporting Multiple Identities in the Instant Messaging Virtual Community. In *Proceedings of OzCHI'04*, Wollongong, CD ISBN: 174128079.
- Viegas, F. B. and Donath, J. (1999). Chat Circles. In *Proceedings of CHI'99*, Pennsylvania, ACM Press, pp. 9-16.
- Voida, A., Newstetter, W. C., and Mynatt, E. D. (2002). When Conventions Collide: the Tensions of Instant Messaging Attributed. In *Proceedings of CHI'02*, Minnesota, ACM Press, pp. 187-194.
- Vronay, D., Smith, M., and Drucker, S. (1999). Alternative Interfaces for Chat. In *Proceedings of UIST'99*, North Carolina, ACM Press, pp. 19-26.
- Woodruff, A. and Aoki, P. M. (2003). How Push-to-Talk Makes Talk Less Pushy. In *Proceedings of GROUP'03*, Florida, ACM Press, pp. 170-179.
- Yudkowsky, C. (2003). *IM in a Corporate Environment: Is instant messaging a nuisance or an untapped tool?* <http://accounting.smartpros.com/x37078.xml>, Accessed 2005, September 9.