IM = Interruption Management? Instant Messaging and Disruption in the Workplace

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Some scholars worry that Instant Messaging (IM), by virtue of the ease with which users can initiate and participate in online conversations, contributes to an increase in task interruption. Others argue that workers use IM strategically, employing it in ways that reduce interruption. This article examines the relationship between IM and interruption, using data collected via a (U.S.) national telephone survey of full-time workers who regularly use computers (N = 912). Analysis of these data indicates that IM use has no influence on overall levels of work communication. However, people who utilize IM at work report being interrupted less *frequently than non-users, and they engage in* more *frequent computer-mediated communication than non-users, including both work-related and personal communication. These results are consistent with claims that employees use IM in ways that help them to manage interruption, such as quickly obtaining task-relevant information and negotiating conversational availability.*

Introduction

To make real progress in creative thinking, problem solving, or other knowledge work, we need to keep out interruptions and set our own agenda. IM, in contrast, lets your agenda be controlled by anybody who has your screen name. - Nielsen (2003)

Instead of conversations taking place at the convenience of the initiator, IM allows genuine social negotiation about whether and when to talk. - Nardi et al. (2000)

Interruption is a major workplace concern today, especially for people engaged in information work, and computer technologies are widely viewed as exacerbating the problem. One reason for concern is the high incidence of interruptions. For example, a recent ethnographic study in an IT support organization revealed that workers

spent an average of just 11 minutes on a task before being interrupted or moving on to a new task, and more than half the interruptions (57%) were unrelated to the task at hand (Mark, González, & Harris, 2005).

Such a high rate of interruption is obviously a serious issue, but even in work environments where interruption is less prevalent, it can significantly hinder productivity by disrupting thought processes and work flows, causing individuals to take longer to complete tasks (Gillie & Broadbent, 1989). Interpersonal communication is one of the most common sources of work interruption, with phone calls and face-to-face conversations topping the list (González & Mark, 2004; Mark et al., 2005). A computer-supported work environment can exacerbate the problem (McFarlane & Latorella, 2002). For example, the adoption of email was associated in one study with an increase in the volume and diversity of organizational communication (Sproull & Kiesler, 1998).

Instant messaging (IM) is the latest form of computer-mediated communication to gain popularity in and outside the workplace. While there are several different IM platforms (e.g., AOL's Instant Messenger and Microsoft's Windows Messenger, as well as various enterprise IM applications), they generally share a few key attributes:

- IM affords near-synchronous communication that can be initiated by either party in an exchange;
- IM offers some form of presence awareness, indicating whether other users are connected to the network and/or are available;
- IM provides high-profile notifications of incoming communication, often in the form of pop-up windows and audio alerts.

IM and Interruption

Given the growth in popularity of IM, scholars have begun to examine its influence on the workplace (e.g., de Vos, Hofte, & de Poot, 2004; Handel & Herbsleb, 2002; Herbsleb, Atkins, Boyer, Handel, & Finholt, 2002; Isaacs, Walendowski, Whittaker, Schiano, & Kamm, 2002; Muller, Raven, Kogan, Millen, & Carey, 2003; O'Neill & Martin, 2003). A core theme in this body of work is the effects of IM on interruption levels, since IM might be an important new source of such interruptions (Czerwinski, Cutrell, & Horvitz, 2000a, 2000b; Nardi, Whittaker, & Bradner, 2000; Renneker & Godwin, 2003). This view is grounded in the idea that IM supplements existing communication technologies, resulting in an increase in overall communications during work. However, at least some evidence exists that IM is used as a substitute for other media, rather than as an addition, both in work environments (Muller et al., 2003) and social settings (Flanagin, 2005).

A more central way in which IM and work interruptions are related is that IM is interruptive by definition. Interruption has been defined as "a synchronous interaction which is not initiated by the recipient, is unscheduled, and results in the recipient discontinuing their current activity" (O'Conaill & Frohlich, 1995, as

cited in Renneker & Godwin, 2003, p. 155). Several characteristics of IM seem directly related to this conception of interruption as a disruption (Renneker & Godwin, 2003). First, the mechanism of message notification is uniquely disruptive. While email clients generally offer users peripheral notification of incoming messages, many commonly-used IM clients default to a high-profile announcement in the form of an immediate on-screen display that appears on top of currently running applications. Second, although IM clients generally provide some form of presence awareness, this tends to be a rather blunt measure of availability. Even when users are able to specify their level of availability ("available," "do not disturb," etc.), most users do not assign or frequently update these status indicators, leaving themselves open to uncontrolled interruption. Third, IM might encourage polychronic communication—that is, it might contribute to an environment in which people frequently engage in multiple simultaneous conversations. Such practices could greatly reduce workers' opportunities to focus on the task at hand. Thus IM's popularity and its unique technical characteristics would contribute to an increase in the level of interruption in the workplace.

Although increasing levels of interruption are a source of concern for obvious reasons, it is important to note that not all forms of interruption are detrimental, and certain interruptions are a valuable component of work for many. For example, managers often prefer the timely if disruptive delivery of critical information over delayed delivery, because it allows them to make more informed decisions and to intervene before an issue in the work domain becomes unmanageable (e.g., Hudson, Christensen, Kellogg, & Erickson, 2002). Furthermore, not every "interruption" is disruptive. When interruptions pertain to the current work tasks, they may be viewed as valuable opportunities for interaction, information sharing, and coordination. And while interruption during higher-order activities is problematic (e.g., switching from one project to another), routine or familiar work can often be interrupted without much harm to performance (González & Mark, 2004; Mark et al., 2005).

IM as Interruption Management

As suggested by the opening quote from Nardi et al. (2000), there is some evidence that IM might allow people to manage disruptive interruptions more effectively. As noted above, telephone calls and in-person conversations are among the most common sources of interruption. People who initiate such interactions might try to avoid disrupting their coworkers. For example, when working in close proximity, people will listen to their colleagues in order to determine their availability, only interrupting when they think that it will be convenient (Mark et al., 2005, p. 325). However, such strategies are imprecise and prone to error, and they are not effective when people are physically distant, as is the case in most telephone calls.

Nardi and her colleagues (2000) suggest that IM actually provides increased opportunities for negotiating the timing of interactions. From the sender's point

of view, IM provides a relatively unobtrusive way to test availability. The sender does not need to be as concerned about when to initiate communication, because he or she knows that the recipient can ignore or dismiss the IM notification easily or can provide an explicit indication of status quickly (e.g., "I'm busy right now. Can we talk in 15 minutes?"). Although an IM pop-up is disruptive, it is not as distracting as an inopportune telephone call or an unexpected office visit.

From the recipient's point of view, IM provides two key techniques for managing availability. First, unlike a telephone, IM allows users to flag their availability. Research shows that people can effectively use such information to time interruptions so as to minimize adverse influence on performance (Dabbish & Kraut, 2003). Even if users do not utilize the flags provided by IM software, they can indicate availability in other ways. As noted above, they might request to postpone the conversation. Also, because the presence awareness functionality provided by IM clients is generally quite limited, ignoring an incoming IM is often socially acceptable. Thus IM offers the recipient "plausible deniability" (Nardi et al., 2000, p. 84), because a non-response might simply mean that the person is away from the computer.

New patterns of communication afforded by IM can also be used to manage interruption. IM provides a means of obtaining task relevant information rapidly and with minimal disruption, allowing a worker to ask clarifying questions without the expectation of engaging in a longer conversation. Alternatively, it can be used to participate in a sustained form of low-intensity collaboration (Nardi et al., 2000). Setting up a line of communication via IM is as easy as making a phone call, and the line can be kept open indefinitely, allowing participants to query one another infrequently on an as-needed basis and with the expectation that a response will be forthcoming at the next convenient opportunity. Of course, such communication patterns also depend on the supporting social skills and norms of the users, but the technology does afford a novel opportunity. Finally, IM could enable workers to manage their work/life balance less disruptively. Using IM, non-work communications can be integrated seamlessly into the work environment, affording quick, conveniently timed check-ins with family and friends without requiring relatively longer periods of off-task time (e.g., Handel & Herbsleb, 2002; Nardi et al., 2000).

In this article, we analyze empirically the experiences of contemporary U.S. workers with IM. Based on the evidence, we argue that, contrary to prevailing concerns, IM generally does not contribute to higher levels of workplace interruption. While the technology makes certain types of interruption easier, it can also allow users greater control over when to communicate, with minimal disruption to their on-going work, and can afford them the opportunity to create new patterns of communication that sustain necessary linkages while reducing off-task distractions. We suggest that such strategic uses currently dominate. From this perspective, IM might actually serve to reduce overall interruption levels. Although people using IM during work will engage in more frequent communication, we do not anticipate

that use of IM will be associated with more communication overall or with more interruption.

Our analysis empirically assesses four hypotheses associated with instant messaging in work environments:

H1: IM users will report lower levels of disruptive interruption than will non-users.

H2: IM users will have the same overall level of work communication as will non-users.

H3a: IM users will engage in more frequent computer-mediated work communication than will non-users.

H3b: IM users will engage in more frequent computer-mediated personal communication than will non-users.

In the following sections, we describe the data used to test these hypotheses, and we report our results. We then conclude that IM use is associated with changing communication patterns and discuss what these results mean for scholars' and professionals' understanding of instant messaging in the workplace, as well as how this might change as IM clients evolve to include other communication modalities, such as voice or video.

Research Methods and Data

The data for this study were generated in a national random-digit-dial (RDD) telephone survey conducted between May and September of 2006. Survey respondents were limited to "computer-using workers"—people who hold a full-time job (which we define as working at least 30 hours per week) and who use a computer for at least five of those hours. The response rate was 41.4%, yielding a sample of 1,200 respondents.[1] Given the analytic focus of this study on IM in the workplace, we further limited the subjects in this article to only those individuals who worked for an employer and who spent at least some of their work time in an office; this created a subsample of 912 respondents.[2]

Some relevant demographic characteristics of the respondents are reported in Table 1. In terms of standard occupational classifications (from the U.S. Census Bureau), a plurality of respondents worked in professional fields, followed closely by employees in management or finance. Respondents were generally well-educated, with almost three in five (58.6%) holding a college degree or higher. The mean age of respondents was 43.7 years (SD = 11.5), the modal group was the 46-to-55 bracket, and almost three-quarters (74.3%) were between the ages of 26 and 55. There were slightly more women (53.2%) in the sample than men. It is also notable that most of the respondents used computers extensively in their work. The mean hours per week of work-related computer use in the office was 22.4 hours (SD = 14.8) for the employees analyzed in this article.

At the time of this analysis, about one in three respondents (29.8%) used instant messaging at work to keep connected with coworkers and clients. It is perhaps

Table 1 Demographic characteristics of sample and IM users

	All Respondents	IM users
Total	912	272
IM users	29.8%	–
Standard Occupational Classification		
Management, business, & financial	28.3%	29.0%
Professional & related	37.1	32.7
Sales & related	7.0	6.3
Office & administrative support	14.5	19.1
Other	10.0	8.5
Educational attainment		
Less than college	15.6%	15.2%
Some college	25.2	26.7
College	34.9	35.7
Graduate degree	23.6	22.1
Age		
18–25	6.8%	5.9%
26–35	20.2	20.2
36–45	23.1	20.2
46–55	31.0	32.4
56–65	14.9	17.3
Over 65 years old	1.4	1.5
Gender		
Male	46.8%	48.5%
Female	53.2	51.5

surprising that the demographic characteristics of these 272 IM-using workers are generally comparable to those of the sample as a whole. That is, the distributions of IM users' occupational classifications, education levels, gender, and age are statistically indistinguishable from respondents who do not use IM during work (based on Chi-square statistics).

Variables and Measures

The overarching subject of the survey was the use and influence of new information and communication technologies (ICTs) in the workplace. The survey instrument was composed of several sections, covering a range of related topics. There were sections dedicated to mapping the technology environment (e.g., what kinds of hardware and software were used in which locations and with what frequency) and to capturing job characteristics (e.g., types of work, levels of autonomy, communication patterns), individual characteristics (e.g., satisfaction, stress, commitment, computer skills, demographics), and organizational characteristics (e.g., organizational size, computer use policies).

It should be noted that these are self-reported data, which are prone to error due to misperception and memory failure. One strategy we used to minimize such errors was to focus on concrete, easily recalled behaviors or events. We did not ask respondents to explain the motivations for their actions or to reflect on their consequences; instead, we assessed the relationships among our measures to test our causal claims. In this section, we provide detailed information about the specific variables used in our analyses.

IM Usage

The survey asked, "When working in the workplace, do you keep connected with your coworkers and clients through instant messaging?" Affirmative responses, making up about one-third (29.8%) of the sample, were coded as one. This item serves as the dependent variable in analyses that follow. The survey also asked if respondents communicated with their colleagues "using an Internet-based video or voice system such as Skype of iChat." About one in 12 (8.1%) respondents reported doing so.

Interruption

In order to assess interruption levels, respondents were asked to indicate their agreement with the statement, "I rarely complete a work task without being interrupted." This Likert-scaled item was anchored by strongly disagree (1) and strongly agree (5). Although less robust than multiple-item scales, a single-item measure such as this can provide a sound assessment of a homogenous concept (Loo, 2002).[3] Note that the interruptions referred to here are reasonably interpreted as being disruptive, because they draw attention and effort away from the work task at hand.

Figure 1 displays the pattern of responses to this statement. In one interpretation, half (49%) of all workers indicate a high level of interruption in their work, since they agree that they *rarely* complete a task without interruption, and the modal response to this statement is the strongest level of agreement. Alternatively, one might conclude that fully half of the workers do not experience substantial interruption, and that more than one in four workers (27%) disagrees with the statement about work interruption. Overall, the mean score was 3.4 (SD = 1.4). While the distribution of responses does not indicate that constant workplace interruptions are universal, the extent of such interruptions does seem significant for at least half of the employees.

Level of Work Communication

Three Likert-scaled items measured how much time workers spent in work-related communication. The first was an overall measure of communication based on agreement with the statement, "I spend a substantial amount of my time communicating or sharing information with others." Again, higher values correspond to stronger agreement with the statement. Most respondents did agree, yielding a mean of 4.0 (SD = 1.1). The other two measures took into account the direction of the information flow: "I have shared work knowledge and experience with co-workers,"
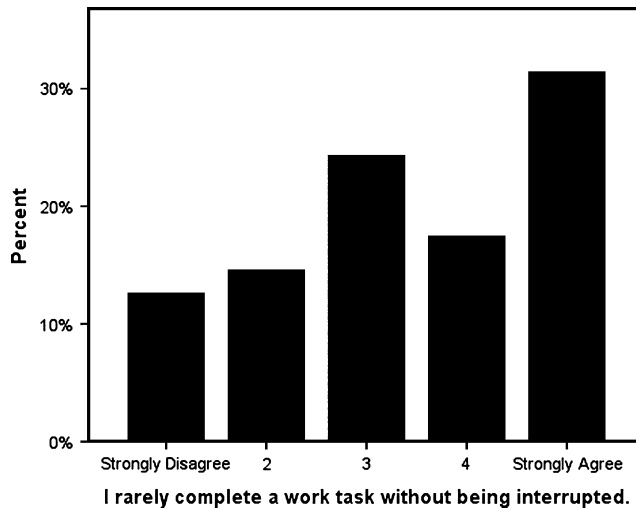
Figure 1 Distribution of work task interruption

and "I have learned new things about my work from my colleagues." Workers strongly agreed with both statements (M = 4.0, SD = 1.1 and M = 4.5, SD = 0.8 respectively). In sum, most of these computer-using workers engaged in a very high level of communication in their work.

Frequency of Computer-Mediated Work Communication
To assess the frequency of computer-mediated work communication, respondents were asked, "In general, how often do you use a computer during work to contact other employees within your organization to get information or transact business?" Responses were given on a five-point scale that ranged from never (scored as 1) to several times a day (scored as 5). The relatively high level of such communications is reflected by the mean response score of 3.8 (SD = 1.4) (closest to "every day") and a modal score of 5 ("several times per day"). Another item with parallel construction asked respondents, "In general, how often do you use a computer during work to contact other businesses or clients outside your organization to get information or transact business?" The mean score of 2.9 (SD = 1.5) is closest to "a couple of times per week," and the modal response was again 5, "several times per day." These data reveal that a substantial proportion of the employees frequently engaged in computer-mediated work communication, especially for internal communication with coworkers; however, there was notable variation in this frequency across employees.

Frequency of Computer-Mediated Personal Communication
Personal communication while working was assessed with a question similar to those used to measure work communication: "In general, how often do you use a computer during work for personal email and text messaging?" Response categories were the same as for work communication (1 = "never" to 5 = "several times a day"). More

than one-third (34%) of respondents acknowledged that they use their computer at work for personal communication at least once per day, while slightly fewer than one-third (29%) indicated that they never engage in this practice. The average level of these personal communications is substantially lower (M = 2.7, SD = 1.4) than for communication with coworkers.

Results

The interruption levels of IM users and non-users are compared in Figure 2. This comparison reveals that fewer IM users were frequently interrupted during work tasks than were non-users. A *t* test confirms that the means of the two groups are significantly different, with IM users' interruption score being three-tenths lower on average (t = 2.5, df = 902, p < .05). The negative correlation between greater interruption and more IM use is modest (Spearman's rho = −.08), but it is statistically significant (p < .05). The biggest differences between IM users and non-users are in the substantially larger proportion of non-users who strongly *agree* that they are regularly interrupted on work tasks and the larger proportion of IM users who strongly *disagree* that they are interrupted regularly.

What accounts for the finding that IM users report *lower* levels of interruption? It is possible that antecedent variables explain both IM adoption and lower levels of interruption. For example, it might be that workers who experience the most interruption have job characteristics that are associated with a lower likelihood of using IM (e.g., managers, more senior employees, those with the longest work hours, or those with less work autonomy). A regression analysis of interruption on IM use while controlling for these factors allows us to examine the distinct contribution of
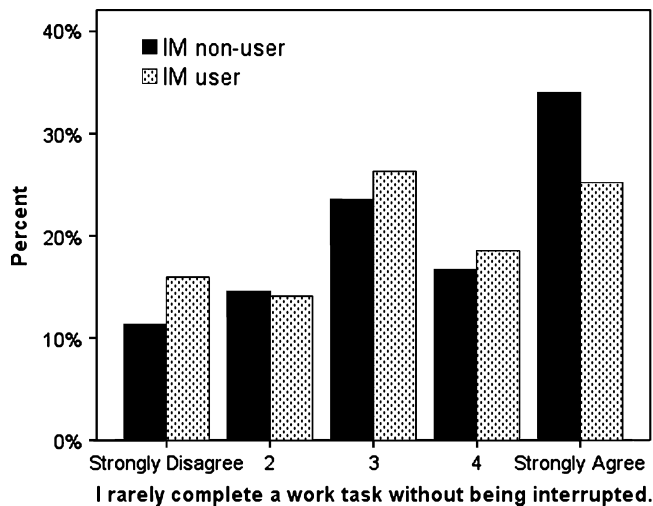

Figure 2 Distribution of interruption, by IM use

the technology (see Table 2). The explanatory power of the model is quite low (R^2 = .03), indicating that the occupational characteristics identified here do not have much influence on the level of interruption. While this regression also indicates that the direct effect of IM use on interruption is of low magnitude, the influence of IM use is negative, and IM use is the most significant variable in the analysis, compared to the potential confounding variables of occupation and work conditions.

IM Does Not Increase Overall Communication Time

The data reported above support our hypothesis (H1) that IM use contributes to a modest reduction in interruptions, leaving us to examine the dynamics underlying this relationship. A first step is to assess whether IM is associated with an increase in overall communication (H2). One of the standard claims about IM is that it supplements existing communication media, contributing to a net increase in workplace communication (Renneker & Godwin, 2003). We suggest, however, that there is persuasive evidence of a media substitution effect (Muller et al., 2003; Nardi et al., 2000). Thus Hypothesis 2 presumes that workers shift email, telephone, or face-to-face conversations to IM; hence, IM does not produce a substantial increase in overall communication.

The data support this hypothesis. There is no significant difference in the overall levels of work communication between IM users and non-users in terms of either the time spent in communication (see Figure 3) or in the amount of information exchanged with colleagues (see Figure 4 for knowledge sharing; the results for learning from colleagues, not shown, are similar). In other words, workers' communication levels are unrelated to their use of IM, and there is certainly no evidence that IM use increases the overall amount of communication time. This might provide a partial explanation for why IM is not associated with an increase in interruption.

Table 2 Linear regression of interruption on IM use, with multivariate controls

	B	SE
Use IM	−.29**	(.10)
Work hours last week	.01	(.00)
Years in the job	.01	(.01)
Autonomy	.01	(.01)
Education	−.04	(.04)
Management, business & financial occupation[a]	.43*	(.19)
Professional occupation[a]	.36 *	(.18)
Sales occupation[a]	.32	(.23)
Office/admin support occupation[a]	.50*	(.20)
(Constant)	2.67***	(.29)
N	852	
R^2	.03	

Notes: [a]Reference category: service or production occupations. *p < .05, **p < .01
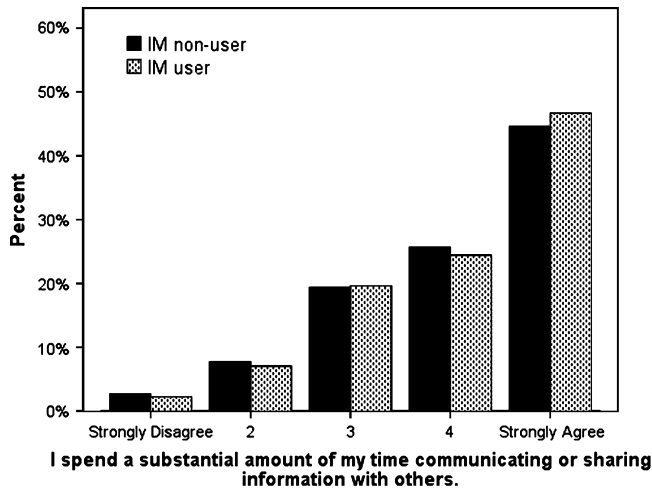
Figure 3 Time spent on communication, by IM use

IM Communication Patterns

While we have demonstrated that IM does not increase overall communication levels, this does not explain why IM use is associated with a reduction in interruption. We suggest that *how* people communicate over IM is the second piece of this puzzle. As noted above, workers can use IM to negotiate when to communicate, to ask quick clarifying questions, and to engage in low-intensity collaboration. If these practices are prevalent, then IM use will tend to be more frequent and briefer
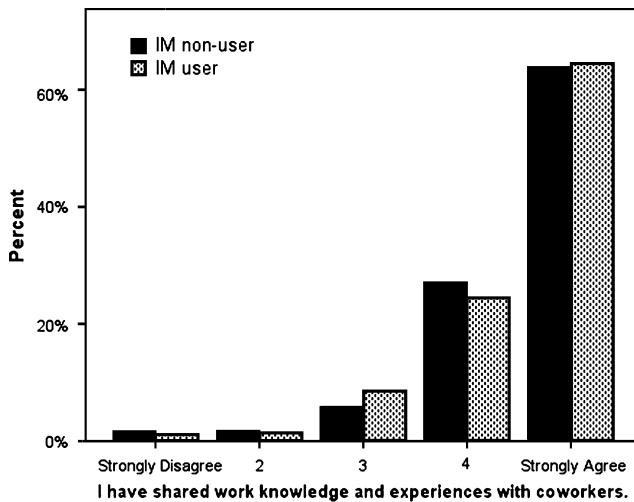

Figure 4 Amount of information exchanged with coworkers, by IM use

than comparable use of such media as email, telephone, and face-to-face interactions. Given the evidence that overall communication levels are not influenced by IM, we next examine communication frequency.

Comparing IM users to those who do not use this technology, we find that IM users contact coworkers and clients using their computer more often than do non-users (see Tables 3 and 4). For example, 72% of IM users report that they communicate with coworkers online every day or several times a day versus only 62% of non-users. Similarly, 44% of IM users communicate this frequently via the computer with clients, compared to only 34% of non-users. These statistically significant differences confirm our hypothesis (H3a) that IM use is associated with an increase in the frequency of computer-mediated work communication.

In addition to changes in patterns of work-related communication, we also hypothesized (H3b) that the frequency of computer-mediated personal communication while working will be higher for IM users. Just as employees are able to negotiate when to communicate about work-related issues, they might also use IM to better manage their personal communications during work. As a consequence, it might be that interactions with friends and family via IM are less disruptive to work than those conducted over the phone. As Nardi et al. (2000) observed, personal communications do not have to be time consuming: For example, sometimes family members just want to say "hi" (p. 83). Such behavior could allow workers to maintain personal ties through brief, relatively non-disruptive IM exchanges that also can be easily postponed if the timing is inopportune. Telephone conversations, in contrast, tend to demand immediate attention (the phone rings until answered), can be difficult to reschedule (as anyone who has played phone tag can attest), and might tend to be longer in duration (relative to IM communications). Perhaps the decrease in disruptions associated with IM use can be attributed in part to these personal communication uses at work.

Again, the results are supportive. As posited in H3b, IM users engage in significantly more frequent personal communication via the computer during work than do non-users (see Table 5). For example, about one in five IM users report using a computer to communicate with friends and family several times a day, compared to about one in six non-users. A chi-square test confirms that IM use is significantly

Table 3 Frequency of computer-mediated communication with coworkers for work, by IM use

	n	Never	Less often	Couple times a week	Every day	Several times a day
IM non-user	634	15.6%	10.1%	12.8%	18.8%	42.7%
IM user	271	6.3%	7.4%	14.0%	19.9%	52.4%
Difference		− 9.3%	− 2.7%	1.2%	1.1%	9.7%
Chi-square	18.7, df = 4, p < .01					

Table 4 Frequency of computer-mediated communication with clients/businesses for work, by IM use

	n	Never	Less often	Couple times a week	Every day	Several times a day
IM non-user	634	26.3%	16.4%	22.9%	13.9%	20.5%
IM user	271	18.8%	20.3%	17.3%	14.4%	29.2%
Difference		− 7.5%	3.9%	− 5.6%	0.5%	8.7%
Chi-square	15.0, df = 4, p < .01					

linked to more frequent personal communications while at work (chi-square = 9.7, df = 4, p < .05). Like the results concerning work-related communication, these findings do not necessarily mean that IM is producing a dramatic increase in the time spent on personal communication. Rather, we believe that, coupled with the IM-associated drop in overall interruption levels, this increase points toward a change in the timing, frequency, and duration of personal communication, reflecting the new opportunities for managing non-work activity afforded by IM.

Discussion

Contrary to some popular characterizations of instant messaging, the use of IM in the workplace is associated with *reduced* interruption. This might seem counterintuitive at first. IM is yet another medium for communication in an environment already saturated with information and interactions, and the modalities of IM technology certainly seem to lend themselves to disruptive communication, by virtue of IM's ease of use, its high-profile new message announcements, and its near-synchronous interaction style. Nevertheless, understanding the implications of a new technology requires more than simply mapping out its capabilities (Bijker & Law, 1992; Bijker, Hughes, & Pinch, 1987; Jasanoff, Markle, Peterson, & Pinch, 1995). People who use IM bring to the technology their own communication goals, styles of interaction, and modes of technology use, all of which influence how the technology is put into practice and, thus, its impacts (Eason, 1997; Orlikowski, 2000).

The same attributes of IM that create new opportunities for workplace interruption can also enable users to manage interruption more effectively, and our empirical

Table 5 Frequency of computer-mediated personal communications, by IM use

	n	Never	Less often	Couple times a week	Every day	Several times a day
IM non-user	633	31.0%	18.0%	19.9%	17.9%	13.3%
IM user	272	23.9%	18.8%	17.6%	19.9%	19.9%
Difference		− 7.1%	0.8%	− 2.3%	2.0%	6.6%
Chi-square	9.7, df = 4, p < .05					

analysis suggests that employees are more likely to do this than experience IM as disruptive. From this perspective, IM use reduces interruption by allowing users to create communication practices that minimize some types of interruption and negotiate the timing of others. Employees can engage in briefer, more frequent interactions in order to get quick answers to work-related questions with minimal disruption, to participate in loose, flexible collaboration, and to coordinate more intense interactions to protect time on task for higher-order activities. Personal communication while at work is also more frequent among IM users.

Another factor that might contribute to the IM-interruption relationship is that instant messages that are relevant to the task at hand might not be perceived as disruptions. Having to seek out a colleague physically in order to get work information or having to wait an extended period of time for an email response might be perceived as more disruptive of work flow than a quick query and response via IM.

One open question concerns distinctions among IM users. Some research suggests that frequent IM users exhibit communication patterns that differ significantly from those who use IM less frequently. For example, frequent IM users tend to exchange shorter messages over a longer period of time, and they are more likely to engage in multitasking (Isaacs et al., 2002). In light of such differences, it seems possible that the interruption implications of IM would also differ. For example, it might be that people who more fully integrate IM into work practices use the technology in ways that are less likely to be viewed as disruptive. Alternately, it may be that those who are more sensitive to the disruptions created by IM are less inclined to use it.

In this article, we have identified several possible mechanisms underlying the lower levels of work interruption reported by IM users. One avenue for future research would be to examine in more detail the relative contribution of these mechanisms. For example, to what extent is reduction in interruption attributable to a drop in the number of externally-initiated communications during high-level work activity? How often and how effectively is IM used to streamline information acquisition? Under what conditions (especially regarding content and timing) are incoming IM messages viewed as something other than an interruption? How do individual and organizational characteristics shape the adoption and use of IM? These kinds of research questions have important implications for understanding the relationship between IM and interruption in the workplace. Research in this area could also be useful to software designers whose goal is to enhance the interface between workers and IM capabilities. IM is continuing to evolve, and understanding how it is used to manage interruption could suggest new design attributes supporting such use.

The Evolution of IM

In its present form, instant messaging seems to be a useful tool for dealing with workplace interruption, but the technology is evolving rapidly. This article has focused on text-based IM; however a number of software clients now allow users

to engage in text, voice-over-IP (VoIP), and video-conference communication. Use of these hybrid IM clients in the workplace is still quite limited, with only one in 12 workers (8%) in our sample reporting such use. But the utilization of these capabilities appears to be growing rapidly. For example, Skype, which was acquired by eBay for approximately $2.5 billion in October 2005, produces one of the most widely-used voice/video IM clients. The client was first released in 2003, and as of this writing, it has more than 171 million registered users (*Skype Launches Skype Pro in Europe*, 2007). If text-based IM is any indication, voice/video-enabled IM could move very quickly from being a popular consumer communication technology to one that is also widely-used in the workplace (for both work-related and personal communications).

What will happen to interruption levels if voice/video-enabled IM clients replace text-based IM in the workplace over the next few years? On one hand, the newer technology could detract from the interruption management qualities afforded by text-only IM. That is, it is possible that communicative engagements using voice/video-enabled IM could have some of the interruptive qualities associated with telephone and face-to-face interactions. For example, to the extent that employees use voice/video-enabled IM the way they use telephones, making calls without first checking availability of the recipient, then the technology could counteract the benefits associated with IM reported here. Furthermore, voice and video engagements, even if employing IM technology, might share certain key features with more traditional communications: more lengthy interactions, less focused content, and more extensive affective (as opposed to task-oriented) communication.

On the other hand, these new forms of IM could further enhance work-related communications. In contrast to IM, people's use of telephones is shaped by the fact that the only way to check a receiver's availability is to call: Telephones do not afford the presence awareness or subtle status checks embedded in IM. Presented with information about the availability of the intended communication partner and the ability to check a colleague's status quickly and easily, people are likely to account for this in their efforts to communicate using voice/video modes of IM. In fact, Nardi et al. (2000) have already observed that text-based IM is regularly used to coordinate communication over richer channels, although others have noted that this is a relatively rare occurrence (Isaacs et al., 2002). Moreover, relative to text-based media— even emoticon-enriched versions of text-based IM[4]—voice- and video-enabled IM technologies offer additional advantages associated with the richer and more subtle aural and visual modalities for conveying meaning and affect.

With only 74 computer-mediated voice/video-enabled IM users in our sample, we are limited in our ability to evaluate these possibilities. Among IM users, we found that those who use voice/video-enabled IM report significantly *higher* levels of interruption on average than those who do not (chi square = 11.0, p < .05). Fully 60% of voice- and video-enabled IM users report that they are regularly interrupted, compared to 48% of non-users. At this early stage, it is also perhaps notable that almost three-quarters (69%) of the users are male. However, this technology is so

new, especially in the workplace, that fuller analysis must wait until there is greater adoption and routinization of its use.

Organizations undoubtedly will be intensely interested in how employees utilize the emerging package of IM technologies. Organizations will attempt to establish policies and technological practices in ways that both reduce interruptions and enhance information flows and communications patterns that increase productivity. At the same time, workers will attempt to adapt IM technologies to serve their interests and goals, related to both their work-related and personal roles.

Conclusion

This article has addressed the possible linkages between two important issues in the contemporary workplace: the frequency of significant interruptions of work and the role and impacts of instant messaging. We posited four hypotheses regarding the influence of IM on contemporary computer-using workers. Our conclusions, based on our empirical analyses of a U.S. national sample of more than 900 such workers, are summarized in Table 6:

In sum, our study of computer-using workers indicates that *instant messaging in the workplace simultaneously promotes more frequent communications and reduces interruptions*. We have argued that this occurs because workers are using IM technology to manage interruptions, postponing work-related communications until they are more relevant or less disruptive, and integrating communication with friends and family into the ebbs and flows of work. In some instances, work-related instant messaging also enhances employees' interactions with colleagues by offering an efficient mode of rapid communication and information exchange.

Managing interruption and controlling workflow are clearly a challenge for many information workers. If IM is used to manage these obstacles to efficient work, it could benefit both organizations and their employees. However, as IM evolves to support richer communication modalities, becoming a medium over which voice and video dominate text, some of the benefits noted here might be reduced. There is some evidence in our data that changes in IM technology, particularly the shift from

Table 6 Summary of conclusions

Hypothesis	Result
H1: IM users will report lower levels of disruptive interruption than non-users	Confirmed (t test and regression)
H2: IM users will have the same overall level of work communication as non-users	Confirmed (chi-square)
H3a: IM users will engage in more frequent computer-mediated work communication than non-users	Confirmed (chi-square)
H3b: IM users will engage in more frequent computer-mediated personal communication than non-users	Confirmed (chi-square)

text-based IM to voice- or video-enabled IM, could ultimately be problematic for both the individual worker and the employer. However, these results are very preliminary, based on a small number of early adopters who may still be learning how to use the technology most effectively.

More importantly, the major findings in this article, grounded in the actual uses of instant messaging in the work environment, suggest that *workers are developing effective strategies for using IM technologies in positive ways,* even when more negative workplace impacts seem equally possible. Further research on IM in the workplace is merited. Such analyses will contribute to a fuller empirical description of how IM is being utilized in work, can shed more light on the nature of workplace interruption, and might help software designers to refine IM technologies so that they more fully support the goals of both employers and employees.

Acknowledgments

Notes

1   Based on AAPOR Response Rate 1, the minimum response rate. This rate is computed by dividing the number of completed interviews by the total number of calls placed to eligible respondents or to respondents whose eligibility could not be determined, e.g., phone lines that were always busy. The RDD technique relies on a sample of randomly generated telephone numbers to contact respondents. As a result, many of the numbers do not correspond to an eligible individual. Ineligible numbers include those that connect to fax machines or businesses and those that are temporarily out of service. These calls are omitted from the response rate calculation (The American Association for Public Opinion Research, 2006).

2   This sample reasonably represents the population of interest. It includes respondents from all 48 contiguous states plus the District of Columbia, and respondents are fairly evenly dispersed among the various regions of the country. We also compared the demographic characteristics of the sample to those found in the Census Bureau's September 2001 Current Population Survey (CPS). That edition of the CPS included a module focusing on computer and Internet use, allowing us to construct an appropriate comparison group. After selecting from the CPS data all adults who worked for an employer at least 30 hours per week and who used a computer to do so, we computed a variety of characteristics. We found that the gender, age, and racial

composition of our sample are comparable to that of the census data, but that there are differences in terms of education and occupation. Individuals with more education and those in higher-status occupations (e.g., professionals and managers) were more likely to respond. For example, the Census data indicate that about 15% of the selected group hold graduate degrees, compared to 24% in our sample. Although the apparent non-response bias of our telephone survey reduces the sample's representativeness, we do not believe that these characteristics fundamentally alter the relationship between interruption and IM usage, which is the focus of this article. Furthermore, we control for these characteristics in later analyses.

3 The survey also included an additional measure of interruption. Respondents were asked about their agreement with the statement, "I am frequently interrupted when I work in the office." Analyses based on a combined measure yielded comparable results to those reported here. These results are not reported because the two items had a slightly different emphasis—the item used in this article focuses on disruption of work tasks, while the other item is grounded in a single work location. The inter-item reliability was just below the commonly accepted threshold (Cronbach's alpha = .6).

4 Emoticons are textual representations of facial expressions that are intended to convey affect; e.g.,:-) signifies a smile.

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