Chapter 5
Social Motivation Consequences of Activity Awareness Practices in Virtual Teams: A Case Study and Experimental Confirmation

Russell Haines, Nadine Vehring and Malte Kramer

Introduction

Thanks to advanced information and communication technology (ICT), groups of geographically and/or temporally disbursed individuals can be brought together virtually to work on collaborative tasks. Such teams come with the promise that members with the best talent available can be brought in and taken away as needed, without incurring the expense and trouble of relocating members. However, the reality of virtual teams often does not meet this promise of seamless collaboration—virtual team members are frequently observed to be distrustful and unmotivated (e.g., Jarvenpaa & Leidner, 1999; Sarker & Sahay, 2003; Watson-Manheim & Bélanger, 2007; Piccoli & Ives, 2003). These *social motivation losses* (e.g., social loafing) in virtual teams can have dramatic effects, such as the incident when two U.S. Army black hawk helicopters were misidentified as enemy helicopters and destroyed (Snook, 2000, p. 135).

Social psychology research suggests that if one's effort can be identified and evaluated, motivation losses are reduced (Parks & Sanna, 1999, p. 86). When one is face-to-face with others, the notion of "mere presence" carries with it the connotation that others can observe and evaluate one's activities, which thereby increases motivation and performance (Zajonc 1965). However, awareness of the activities of others is not as easily achieved in virtual teams. When the members of a virtual team

R. Haines (✉)
Old Dominion University, Norfolk, VA, USA
e-mail: rhaines@odu.edu

N. Vehring · M. Kramer
WWU - University of Muenster, Münster, Germany
e-mail: Nadine_vehring@web.de

M. Kramer
e-mail: malte.kramer@uni-muenster.de

K. Riemer et al. (eds.), *Collaboration in the Digital Age*, Progress in IS,
https://doi.org/10.1007/978-3-319-94487-6_5

are geographically dispersed,, the lack of physical presence denies them access to important identification and comparison information (Greenberg, Ashton-James, & Ashkanasy, 2007), which increases the likelihood of motivation losses. Indeed, one might think of a virtual team setting where members use mediated communication (e.g., email, instant messaging) as similar to a face-to-face setting in which another is observable bodily, but whose back is turned such that his/her activities cannot be directly observed. In such a setting, one might observe the presence of the other and the outcomes of the other's work but not the extent to which the other is making an effort. This notion is prominent in virtual teams research, which suggests that dispersal affects the development of trust to the extent that many teams are unable to effectively perform their assigned task (Jarvenpaa & Leidner, 1999; Sarker & Sahay, 2003).

An inability to compare oneself with others via computer mediated communication (CMC) is thought to lead virtual team members to choose "less than ideal" sources of social comparison information, causing problems when perceiving fairness and experiencing negative affect about other team members (Greenberg et al., 2007). Based on the preceding, it is no surprise that social motivation losses have been shown to occur in a wide variety of experimental CMC studies, including electronic brainstorming (Shepherd, Briggs, Reinig, Yen, & Nunamaker, 1996, Pinsonneault, Barki, Gallupe, & Hoppen, 1999) and group decision making (Chidambaram & Tung, 2005).

The purpose of this paper is to examine how awareness of the activities of others via CMC affects the motivation of geographically distributed virtual team members. We present a case study of a financial services firm in which members of geographically dispersed teams developed and refined practices for maintaining awareness of the availability of other team members. These practices in turn affected their attitudes toward their team and their work. Using the results of the case study, we developed hypotheses about the effect of activity awareness on social motivation. These were tested a laboratory experiment, the results of which are presented in the second part of this paper. The paper begins with a theoretical foundation, which discusses the role of awareness practices in coordinating behavior in teams and includes a brief review of the theories and empirical CMC studies of social motivation losses. We conclude the paper with a general discussion of the results of both studies, along with implications for researchers and software designers.

Theoretical Foundation

When individuals are assigned to a team and given a task that must be accomplished by their collective efforts, the total amount of effort exerted is often less than what the individual members would be capable of if they were working alone. The difference between a team's performance and the sum of their individual capabilities is called *process losses* (Steiner, 1972). Process losses can further be divided into *coordination losses*, which are the result of team members' efforts not being used fully or not

contributed at the best time, and *motivation losses*, which are the result of individual team members not exerting their full effort on behalf of the team.

Coordination Losses

Team coordination can be defined as "managing dependencies between activities" (Malone & Crowston, 1994, p. 90)—a team might have a shared resource and have to schedule its use, or there might be a task-subtask relationship in which certain subtasks have to be performed before others. Coordination encompasses the management of task/subtask dependencies in a team context where various team members need to perform different activities in order to achieve an overall team task or goal. For a given subtask, a team and its members need to know: what to do, who should do it, and when it should be done. If a team and its members do not understand how their work will be coordinated, it results in tasks not being completed, duplicated efforts, and/or team members interfering with each other.

Awareness

In order to coordinate his/her efforts with others, a team member needs to obtain information about the other members of the team, what they are working on, and how those activities will be coordinated (Gross, Stary, & Totter, 2005). This "understanding of the activities of others, which provides a context for your own activity" (Dourish & Bellotti, 1992, p. 107) has been broadly termed *awareness*. Maintaining awareness has been identified as a critical factor in ensuring that team members are able to coordinate their efforts in a variety of face-to-face contexts, including air traffic control (Harper, Hughes, & Shapiro, 1989) and subway control rooms (Heath & Luff, 1992). Awareness here is somewhat broader than "situational awareness," which is typically limited to task-oriented information that helps to coordinate activities in the present. We choose a more broad conception of awareness because information about others' past activities and background is used to infer the reasons behind their present behavior (Cooper & Haines, 2008) and therefore affects social motivation.

In face-to-face settings, awareness is maintained by observing others directly, meaning that one can gather awareness information without it being explicitly communicated by others. For example, when working on an assembly line, one may be able to directly observe that the person from whom one receives raw materials is engaged in a heated conversation with a supervisor. Thus, one is aware that the arrival of raw materials will be delayed at least until the conversation is finished. Awareness information places one's own activities in the context of other activities (e.g., you will not be able to begin your assembly work until after the conversation

is over), and also provides context about the others with whom one works (e.g., the other is being disciplined for being late to work for the last five days).

When interacting via CMC, awareness information must either be provided explicitly by other team members or communicated by the mediating technology. Extending our example, if one is not able to directly observe the person from whom one receives raw materials, one can only speculate about the reasons why raw materials have been delayed (cf., Cooper & Haines, 2008). One will not be able to form a realistic expectation about when raw materials will arrive, nor will one have an explanation for why the other is unable to complete his/her work in a timely manner unless and until the other communicates what is happening or has happened.

Mitigation of Coordination Losses via CMC

To deal with this lack of easily obtainable awareness information, members of distributed virtual teams can employ awareness practices using communication technology. For example, features of an instant messaging (IM) application can be employed to create and maintain awareness of team members' presence or activities (Riemer, Klein, & Frößler, 2007). Based on this information, a distributed team may be able to better coordinate their individual activities in order to ensure the achievement of an overall team goal (Gutwin & Greenberg, 2002, Gross et al., 2005). For example, providing activity awareness information via CMC has been shown to help reduce the harm caused by interruptions by enabling team members to more carefully time when they interrupt another team member (Dabbish & Kraut, 2008).

Motivation Losses

In contrast with coordination losses, which occur when one is not sure *when* to apply one's efforts on behalf of the team, motivation losses occur when one questions *whether* to apply one's best efforts. For example, members of a tug-of-war team win based on the efforts of the entire team, but a given member might not necessarily pull as hard as he/she could. The primary individual drivers of motivation losses are dispensability and low involvement (Parks & Sanna, 1999). A perception of dispensability occurs when a team member feels that his/her efforts are not necessary for achieving the team's goal, such as a tug-of-war team member that feels that there are enough strong members to defeat the other team. Low involvement is evidenced when a team member contributes little to the team's effort because he/she has little interest in accomplishing the task and/or does not feel motivated to achieve the team reward, such as a tug-of-war team member who does not care whether their team wins the contest or not. When either of these occurs, a team member may not exert their full effort.

In a team context, motivation losses typically only occur when team members feel their individual efforts cannot be observed and evaluated separately from the effort of the team as a whole. Thus, the principal way to reduce motivation losses is to make individual efforts more visible. For example, if the members of a tug-of-war team can see how hard an individual member is pulling, the other members of the team would know and could sanction when one was shirking, and one could also see when the team would benefit from a little more effort (Kerr & Hertel, 2011). The implications of awareness information on motivation have received relatively little attention in the information systems literature (e.g., Shepherd et al., 1996).

Motivation Losses via CMC

In geographically distributed contexts where team members interact via computer-mediated communication (CMC), the influence of others is believed to be reduced because of the lack of physical presence of others (Greenberg et al., 2007; Short, Williams, & Christie, 1976), and reduced even more when team members communicate anonymously (McLeod, Baron, Marti, & Yoon, 1997; Haines, Hough, Cao, & Haines, 2014). Furthermore, motivation losses have been shown to occur during CMC brainstorming sessions (Shepherd et al., 1996; Kahai, Sosik, & Avolio, 2003), and have been observed in distributed teams when team members must post status reports (Watson-Manheim & Bélanger, 2007; Piccoli & Ives, 2003).

This suggests a rather bleak view of distributed work—researchers should expect to see situations where the members of a large proportion of distributed teams are reluctant to put forth their best effort toward their team's goal, are likely to focus on the failings of other team members and not to trust each other, and ultimately be ineffective at accomplishing their assigned task (e.g., Jarvenpaa, Knoll, & Leidner, 1998; Sarker & Sahay, 2003; Piccoli & Ives, 2003). One study goes as far as to suggest that mandatory reporting of activities via weekly status reports, rather than motivating members to work harder, actually *reduces* social motivation in distributed teams because it only serves to make the failings of team members evident (Piccoli & Ives, 2003). However, in spite of these results, the same researchers also note that virtual teams have become an integral part of real world organizations.

Thus, the question of whether and how communicating via CMC affects social motivation in distributed teams remains unanswered. Our case study, which is presented next, revealed that adopting and appropriating a communication system could have positive motivational effects on members of geographically distributed virtual teams. Our case study results suggest a more nuanced model of how using CMC affects motivation in teams, which was tested in a laboratory experiment. Following our analysis of the experimental results, we present overall conclusions and implications for researchers and practitioners.

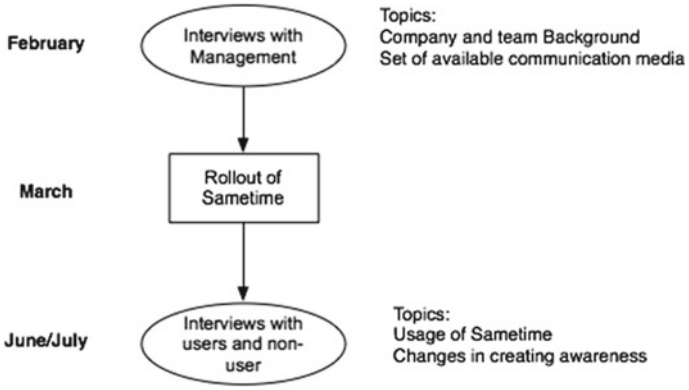


Fig. 5.1 Overview of data collection

Case Study

The case study involved the members of back office teams in a medium-sized financial services company in Germany, which hereafter is identified by the pseudonym MUFIN. We conducted interviews at different organizational levels of the company (e.g., managers and employees) during the period immediately surrounding the roll out of Lotus Sametime (see Fig. 5.1). Our goal for the case study was to investigate the adoption and development of usage practices for Sametime at the individual and team level. The interview topics centered how Sametime was used at MUFIN, and whether Sametime changed the ways that employees routinely communicated, coordinated, and collaborated.

Data Collection and Analysis

One month before the Sametime rollout, we conducted interviews with managers of the IT department to get a good overview of the company and team background as well as the existing set of available communication technology. Several months after the rollout of Sametime, we conducted semi-structured interviews with 13 members belonging to ten different teams in the finance division. The demographics of the participants are summarized in Table 5.1. We tape-recorded the interviews with the team members and the head of department and transcribed them.

A grounded theory approach was used, meaning that the interviewers did not formulate hypotheses in advance to guide their questioning. Instead, a preliminary analysis of the earlier interviews focused the questions in the later interviews. The overall objective of understanding the adoption and development of CMC usage practices was the central phenomenon of interest in the interviews. Our finding that these practices had an impact on motivation in the teams was revealed in a post hoc

Table 5.1 Demographics of study respondents

Total in operating department		182
Total selected for interviews		13
Gender	Females	6
	Males	7
Job type	Team leader	1
	Deputy team leader	4
	Case worker	8
Sametime user type	User	12
	Non-user	1

analysis of the case study data, but was consistently noted by the study participants. Because the potential for communication practices to improve motivation has not been observed in the distributed teams literature, we thought it deserved a separate examination and experimental testing.

One key question of the interviews was: Why and how are different technologies used to create awareness of other team members' presence and availability? The interviews were transcribed and first analyzed by looking for points in time where the interviewees described changes in team awareness practices. Next, we identified the factors that led to the changes in the practices. Finally, we re-read the interviews to identify outcomes of the new practices. The outcomes of the practices are the focus of the analysis. In the text below, the quotes presented are highlights from the interviews and are translated from the original German.

Case Setting

The headquarters of MUFIN houses the IT department and several operating departments. The operating departments are subdivided into several divisions, each of which consists of approximately 15 teams with about 8–12 team members. These teams provide day-to-day support for the decentralized sales organization, whose members are spread over the entire country. Besides processing standard files for the sales agents, the daily work of the employees in these teams also involves communicating with sales agents, customers and colleagues inside or outside their teams. Normally, a single team member is responsible for processing his/her own set of standard files in a timely fashion, meaning efforts within a team only need to be coordinated to the extent that someone must be present when a sales agent or customer calls.

The physical structure of the workplace for the teams consisted of small offices, each with two work stations, which meant that team members were not physically co-present, even when all members were working in the headquarters building. Furthermore, most of the investigated teams included team members that practiced alternating telework, meaning that team members alternated between one workday at

home (home office) and a workday in the headquarters office. Two team members with complementary rhythms normally shared a desk and thus only met face-to-face at team meetings.

Over the time period covered by the case study, employees could draw on a variety of communication technology: telephone, email, and instant messaging (IM). Telephone was the dominant communication medium for team members, especially when communicating with people outside their team. Every team member had his/her own telephone number that could be used at the headquarters office or forwarded to their home office. In addition, every team had a team telephone number. If someone called the team number, the call rang the phone of all team members who had connected to the team number at that moment. Team members normally had to answer both types of calls—their own phone number and any team calls. Furthermore, if a team member would not be able to answer his/her own telephone (e.g. they were going to be in a meeting), he/she could forward their telephone number to the team number.

Basis for Awareness Practices: Team Goal

Because the employees in the headquarters function as the back office for the sales organization, it is important that incoming calls from the sales organization are answered immediately to ensure prompt, personal service. All interviewees stated that it was important to know the availability of their colleagues in order to provide the right information when a sales agent called. As the manager of the IT department put it:

> Sales agents often are at the customer's house and can't strike the deal, because they don't know a particular legal detail or contract feature. If they leave the customer and need to make a new appointment … deals are lost because of that.

Thus, being informed about the absence of other colleagues was essential when deciding whether one could leave the office, as it was crucial that there always be at least one team member to answer the telephone. In the late nineties, MUFIN's management decided to improve telephone response rates at the team level by including it as one of the performance measures in the calculation of the annual team bonus. The head of the department explains:

> In the late 1990s we did some intensive optimizing of the telephone response rate. It is like a kind of registration authority. When you leave, when you arrive, when you shift your phone, all these things had been a little loose. We had always monitored these things, but in 1999 we added them to the variable salary. […] We monitored it for every team, the telephone response rate, and then we compared all teams.

At this point, achieving a 100% telephone response rate became one of the teams' top goals to assure the highest bonus. Now, teams had to coordinate telephone availability. In order to do this, team members depended on receiving awareness information about the comings and goings of their other colleagues to decide on their own availability.

Awareness Practices Using Instant Messaging

Coordinating 100% availability at the team level was difficult during the time period immediately following the new requirement, as the head of the department remembered:

> … they really obsessed about this and started to scream at each other: 'Why haven't you shifted your telephone? Man! You have to shift it to the team number when you leave your office.

At this point, it became obvious to the team members that the physically distributed nature of their workplace made it difficult for them to be aware of their colleagues' presence or absence from their workstation. Because being aware of others was essential when deciding on one's own presence or absence, teams started to use their instant messaging system to inform each other about an absence by sending a message to all group members. The head of the department continued:

> This is why there is an incredible huge sensitization about telephone: 'I will be gone for a few minutes or I won't be available'. And we don't have open-plan offices. Thus people might have said: 'I don't know about the others. It seems that I am the last one doing business and answering the telephone.' … and to avoid this: 'Before others might think that I am intentionally not answering the phone, I prefer to give notice of my departure'. This is why this practice evolved.

With instant messaging, employees sent short messages to individuals by addressing the ID number of this person. This ID number contained the number of the person's team (e.g. 45), meaning it was possible to send a message to an entire team by addressing it to the team ID followed by a wildcard (e.g. 45*). Thus, team members developed a practice of using instant messaging to send messages to their team whenever they needed to leave their workplace, informing their team members about their absence and its duration. MUFIN later implemented email, which was used in a similar way to maintain awareness, with the disadvantage that emails did not always arrive at a person's in box instantly, sometimes taking as long as 2 h.

Awareness Practices Based on Sametime

Although the employees had been familiar with practices for communicating awareness information via instant messaging that could simply evolve to fit the Sametime chat feature, Sametime's presence feature was new to them and led to the creation of new practices.

Awareness Practices using Chat Feature: As the employees had perceived some downsides of using email for signaling their comings and goings, most of them welcomed Sametime as an alternative that was similar to instant messaging. Thus, there were some teams where members simply changed from using email to using Sametime for signaling availability via text messages.

Awareness Practices using Presence Feature: Sametime's presence feature, although ostensibly quite simple, enabled new methods of signaling. Prior to the

introduction of Sametime, availability could only be signaled by composing and sending an instant message. Afterward, it became possible to signal availability using the presence feature: for example, by actively changing one's presence status from "available" to "away" or "in a meeting" when one left the workplace. Furthermore, members of some teams added additional text to their status information. One employee reported:

> Right now, the additional label for my status information says: 'I am available @MUFIN.' I was the one that wrote this … and if I was working from home, it would say: 'I am available @home'.

Besides the active forms of signaling (changing the status and/or entering an additional text label), automatic forms of signaling were also reported, like when the computer was inactive for a certain time or when someone has logged off by pulling out his/her identification card from his/her computer. One employee explained, "[…] when I pull out my card, the status automatically changes to 'not available' and that's it."

Monitoring changed the most dramatically as a result of Sametime's presence feature. Prior to the introduction of Sametime, awareness about someone's availability had always depended on the active signaling of that person via text messages. After the introduction of the presence information feature of Sametime, employees could monitor the availability of their colleagues at any time under the assumption that they were available to answer the phone when their status showed available on Sametime, whether they were at home or in the office. The presence feature was perceived by some employees as a possible instrument for surveillance:

> I don't like the idea of big brother watching me. I don't know. I mean if they can see when I am online, it makes you wonder what else they can see.

However, many of the interviewees emphasized the advantages of using Sametime to better create an awareness of other's availability. This allowed them to better coordinate team availability and to manage their telephone response rate. Some of them stated:

> I always have a look at my buddy list to see who is online when I arrive in the morning. Starting at 8 a.m., we have to answer the telephone. If I arrive at 8.15 a.m. and no one is online, I know that I am the only one and that I have to connect to our team number.

> We use the presence information of our team members to coordinate availability. It is not okay to leave the work place for lunch or a cigarette break if half of the team is already absent.

Motivational Effects of Sametime Practices: Because the Sametime status changed automatically when a team member's identification card was inserted or removed, it began to be viewed as a proxy for availability. However, beyond simply coordinating availability, this feature affected the teams in ways that led to a new level of visibility and connectedness. As one employee put it:

> You always notice. When I have pulled my card out of my computer, people rarely call. In other words, if it says "I am not available" or "I am in a meeting" … no one calls. When I

> put in my card and people can see that I am suddenly there, my telephone suddenly rings and then 'I have seen that you have just logged into Sametime' …

The ability to monitor comings and goings via the presence feature also motivated members to make themselves more available. One employee reported:

> …I don't know, after 5 p.m. when it is normal that one called it a day and then someone sees…'Hey! You are still working. That's why I have thought that I could call you to clarify some things'. Thus, one knows who is there and one can get through to someone quickly …

> … it is really interesting in the evening at about half past 5, who is still there. I think I have never seen all 27 people - belonging to my buddy list - being online at the same time. Right now, 18 out of 27 are online and at about half past five it will be about four, then three, then two. One day I just said; 'Today, I work till such time as I am the last one being online.' I really did this and then… I found it really funny and I really managed it.

The employees increasingly assumed that just being connected and available on the Sametime system indicated that the other team members were working. The team members reported that this assumption was made because team members were under individual pressure to process case files over the course of the day, and assumed that others were under similar pressure.

Case Study Discussion

Drawing a line through the changes in practices occurring from the time before the first messaging system was adopted to the current state shows how team awareness practices evolved as team members adapted to altering circumstances, additions to the available technology, or changes in team structure. Initially, team members developed a practice for communicating their availability so that their teams could deal with management's monitoring of the team telephone response rate and the inclusion of the response rate into the calculation of the annual bonus. Before this time, no practices were in place because coordination was not explicitly considered. With the change in the incentive structure, employees experienced the need to coordinate their availabilities and, by extension, their activities. Thus, they started to use the instant messaging system for sending short chat messages to their team members in a "push"-oriented fashion to inform them about their availability. Sametime initially enabled team members to reproduce their practice of using instant messages to signal their team members. Over time, however, the presence features in Sametime enabled them for the first time to *monitor* the presence status of other team members using a "pull"-orientation.

Coordination Gains

The driving force behind these changes was a desire to reach 100% availability. The earliest driver of change was the implementation of the team bonus for telephone

availability, which gave the team members a financial reason to be coordinated. To a great extent, the later changes in communication practices were made in order to maintain or improve their efficiency at maintaining 100% availability. For example, less effort had to be exerted using Sametime than instant messages because team members could rely on others knowing they were away after simply removing their badge from the card reader.

Motivation Gains

At the time that management first incorporated the teams' availability into the calculation of their annual bonus, the team members realized that their distributed context meant that they needed to coordinate availability using mediated communication practices. In the beginning there were no awareness practices about availability; however, there was a demand to answer the team line, so some team members became rather upset with how other team members behaved about being available. With virtually no visibility about whether other team members' had switched their own numbers to the team line, members indicated they had the feeling of being the only one answering the team line, and reported that some team members had been yelling at each other. At this point, the lack of awareness information was demotivating for the teams.

Motivation gains came with the introduction of practices that enabled more visibility into the comings and goings of team members, first with instant messaging and ultimately with the presence feature of Sametime. This contrasts with prior research, in which members of distributed teams were observed to manipulate awareness information to the extent that it had demotivating effects (Watson-Manheim & Bélanger, 2007; Piccoli & Ives, 2003). The practices at MUFIN led to reported decreases in frustration within the teams, and the synchronous nature of the Sametime presence feature seems to have had the added effect of increasing feelings of what we term *connectedness*, and thereby the biggest positive impact on motivation within the teams.

Case Study Limitations

There are limitations to the case study that present opportunities for future research. The bulk of the interviews were conducted after the Sametime roll out, meaning that new practices had been developed and evaluated by the participants. In addition, we relied primarily on interview data, which might be affected by recall bias. Finally, team members in MUFIN had the motivation to maintain awareness about the availability of others because availability formed the team goal. However, in a context where the team goal was the completion of a collaborative document or project, availability awareness practices might be considered an unwelcome distraction and not fit with the task. We emphasize that this could be as much or more a task-practice fit than task-technology fit because team members might be able to choose whether

or not to be prompted by such messages and/or use that information for purposes not intended by the designers of the technology. For example, being aware of the comings and goings of other team members might be viewed as a proxy for how much effort was being made and increase social motivation—members of a software development team might view the checking in and checking out of code from a repository as a means for gauging the effort of other team members and adjust their social motivation accordingly. Thus, we recommend further research into how awareness practices affect motivation in other contexts.

Case Study Conclusions

The emerging practices for coordinating availability could be described as merely an evolution in team communication practices. However, these changes influenced the performance of the teams, the efficiency of the teams' coordination, the motivations of the team members, the team members' attitude toward their team, and their relationship with each other. For example, using Sametime, team members only send instant messages when urgent, there is a "pull" observation of colleagues' status, and the presence status has been enriched with taken for granted information about availability and activity that gives team members a sense of how much effort that others are exerting (cf., Carroll, Rosson, Convertino, & Ganoe, 2006). Instead of feeling solely responsible for their team's success and phone availability, team members felt more connected as they could now see at a glance who was online and able to cover the phone. Based on the positive experience of being connected to a team and not alone, a motivational side effect emerged: employees made themselves more available and started to work more.

As noted earlier, social motivation *losses* seem to be the rule for virtual teams (Watson-Manheim & Bélanger, 2007), so finding that awareness practices increased social motivation at MUFIN was an unexpected result. Social motivation gains are ignored in the predominant workspace awareness frameworks (Teruel, 2014; Gutwin & Greenberg, 2002; Gross, 2013; Gross et al., 2005), beyond saying that "it might not only enhance the mutual understanding of group members, but also direct individuals or the group to follow certain goals or procedures" (Gross et al., 2005, p. 341). The prior studies that found only social motivation losses in CMC contexts also offer nothing to explain why users would alter their IM screen names (Smale & Greenberg, 2005) or maintain a long term Skype connection (Riemer et al., 2007). The results of the case study therefore mark an important first step toward examining the potential for awareness practices to lead to social motivation gains in distributed contexts. We suggest that motivational factors should be considered when studying the use of mediated communication for awareness creation.

We further suggest that there are certain organizational contexts where social motivation losses are reduced by increasing activity awareness. The organizational context of our case study seems to differ from contexts where losses were observed in the following key ways: (1) team members had clearly defined roles and objectives,

(2) team members understood how their portion of the team task would lead to team level rewards, (3) all team members were skilled at performing their portion of the team task, and (4) teams were allowed to create their own communication and coordination practices. In such a context, we suggest that individuals gauge the extent to which the efforts of team members are comparable based on the amount and kind of effort they observe them to make instead of on other factors like physical appearance. Members of distributed virtual teams interacting via CMC would therefore be able to experience social motivation gains when using a technology tool that simply shows if someone is online or not. Our experimental study, presented next, simulates such an organizational context and tests whether social motivation gains occur when activity awareness technology and practices are employed. By examining this experimentally, we hope to provide additional evidence and insights into how social motivation gains can be encouraged by managers of distributed teams and designers of awareness technology.

Experimental Study

The notion that activity awareness practices can lead to social motivation gains has intuitive appeal. However, we have already noted prior research that observed negative effects of activity awareness practices on social motivation (Watson-Manheim & Bélanger, 2007; Piccoli & Ives, 2003). In order to confirm that our observed increase in motivation was not idiosyncratic to a particular set of individuals at MUFIN using only Sametime, we developed and conducted an experimental study. In the experimental study, we examined the extent to which a user interface element that presents activities of other team members increased feelings that one is aware of the activities of others, how this in turn affects feelings of being connected to one's team, and the extent to which this in turn increases team performance. In the following subsections, we discuss how specific findings of the case study informed hypotheses that were then tested via the experiment.

Awareness Technology as a Facilitator of Awareness Practices

When working in a co-located (face-to-face) environment, where open offices or cubicles make spaces relatively open and accessible, one may be able to directly experience co-workers' presence and observe their activities. In a distributed work context like the case study, one may be unable to observe one's colleagues in their physical work environment and only indirectly be able to observe colleagues' presence and activities. Thus, information about the activities of others must be obtained by other means than direct observation.

In the case study, virtual team members compensated for others being unable to directly observe them by providing awareness information by CMC channels, such as

status indicators or messages via IM, or through other, more general channels, such as including information about one's activities in an email. System designers can add user interface elements that automatically show information about the activities of others (Gutwin & Greenberg, 2002), which would make such practices easier to implement (Haines & Riemer, 2011). However, we emphasize that user practices are necessary in order for the technology's intended purpose to be realized (Orlikowski 2000), meaning that a direct link between a technology and other group factors like connectedness and performance is mediated by perceived awareness of the activities of others. Thus, we suggest:

> H1: A user interface element that automatically provides information about the activities of other team members will be more likely to lead to practices that heighten perceived awareness of the activities of others.

Awareness as a Facilitator of Feelings of Connectedness

In a face-to-face context, team members may take for granted that they can observe the activities of others and be relatively unreflective about the importance of such information in facilitating attachment. However, in a distributed work context, one can only indirectly observe colleagues' presence and activities, and when practices that provide this information are not employed, the information may not be available at all and decrease understanding of the behavior of others (Cooper & Haines, 2008). Because of this, one is likely to feel less connected to one's colleagues (Greenberg et al., 2007).

Increasing the amount of information that is passed when interacting via mediated communication can compensate for a lack of awareness, enabling one to experience colleagues' presence and activities virtually (Walther, 1992; Haines & Riemer, 2011). Rationally knowing that one belongs to the same team, being aware of colleagues' presence and activities, and knowing that others are working on the same or similar tasks and potentially able to communicate all work together to reinforce a feeling of being "in touch" or being connected with the team. Thus, we hypothesize:

> H2: Higher perceived awareness of the activities of other team members will lead to higher feelings of connectedness.

Connectedness as a Faclitator of Motivation

Simply being more aware of the activities of other team members should increase one's own effort because of increased social comparison. However, we noted earlier a case where mandatory reporting of activities via weekly status reports, rather than motivating members to work harder, actually reduced social motivation in distributed teams because it made the failings of other team members more evident (Piccoli &

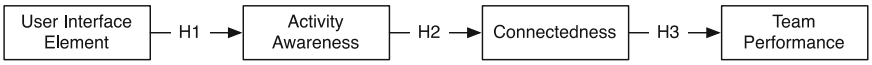


Fig. 5.2 Experimental study research model

Ives, 2003). In a case study of another organization with a lower trust environment (Watson-Manheim & Bélanger, 2007), employees reported that that "using email is not sufficient for relationship development," and instead must be combined with other, more personal media (p. 12), and reported instances of employees "copying email to colleagues and management to show 'how busy I am'" (p. 14).

In our case study, team members indicated that motivation increased when team members received activity information from others, reporting increased feelings of being connected with their team. Based on the case study results, we expect that social motivation will be increased the more one feels connected to the other members of one's team via the mediating technology. This occurs because the virtual presence of the others is heightened (Sarker & Sahay, 2003), meaning that the other team members more strongly become referent others (Greenberg et al., 2007). Thus, we hypothesize that simply having the additional information about the activities of others is not enough—feelings of connectedness mediate the link between awareness of the activities of others and increased social motivation:

H3: Higher feelings of connectedness are associated with higher team performance.

The research model for the experimental study is summarized in Fig. 5.2.

Experimental Design

Similar to our case study context, management research suggests that social motivation losses are the exception rather than the rule under certain organizational conditions: (1) when teams have a specific goal rather than just "do your best," (2) team members are aware of the presence of other members (3) team members are free to communicate, and (4) team members know each other and might work together in the future (Erez & Somech, 1996). Under such conditions, regularly monitoring others inspires higher levels of performance from team members (i.e., "the Kohler Effect" Kerr & Hertel, 2011). We emphasize that condition #2 emerges as a result of awareness practices in a distributed environment, and awareness of others' activities cannot be taken for granted via CMC like it can in a face-to-face context. Our experimental setting was therefore designed such that teams needed to develop activity awareness practices and connectedness in order to experience social motivation gains.

In contrast with a context where motivation losses are expected in team members, these organizational conditions imply the converse of the normal hypothesis about why motivation losses occur. In many ad hoc experimental contexts, motivation losses are mitigated by enabling others to observe one's individual effort (Parks,

1999), meaning that individuals are expected to increase their efforts in the team situation because they worry about sanctions when their efforts are judged by others to be too low (a.k.a., evaluation apprehension). In situations such as those, a researcher should expect individuals to only perform to a *minimum* standard (i.e., social loafing). In an environment where all four of the above conditions are present, our analysis of the case study suggests an alternative explanation for a reduction in motivation losses: individuals increase their efforts because they see how much others are contributing; in essence, they evaluate their *own* efforts in comparison with the work of others when judging how much to contribute (cf., Erez & Somech, 1996). In a context where team members can trust each other, or at minimum wish to maintain their reputations, awareness should lead to performances that are measured against a *maximum* standard.

Participants in the experimental study were recruited from information systems courses offered by the business school at a public U.S. university. All communication within the teams took place via mediated communication.

Experimental Task

The experimental task simulated the process of making a medical diagnosis. This context proved to be meaningful to the participants, in contrast with contexts they might feel were artificial (e.g., the prisoner's dilemma), or that they did not understand (e.g., processing cases for a financial services company). In health care contexts, patient diagnosis and treatment is a process that involves communication among many health care providers, including paramedics, triage nurses, general practitioners, surgeons, and specialists (Anantharaman & Han, 2001; Bal, Mastboom, Spiers, & Rutten, 2007; Ng, Wang, & Ng, 2007). In general, the process of diagnosis and treatment begins with a first responder, usually a triage nurse or a paramedic, who collects and passes information to other, more specialized health care providers. The more specialized health care providers use this information as a basis for their own examinations and/or request that other health care providers do further examinations (e.g., a laboratory test of fluids, a radiological exam).

The medical conditions and symptoms for this experiment were simplified so that a team of college students could complete the medical diagnoses of a hypothetical patient with the assistance of a job-specific expert system. Three different jobs were filled by team members in this study: (1) nurse, (2) doctor, and (3) specialist. The nurse completed his/her job by "interviewing" a patient and received a patient's primary symptom and vital signs as output. The doctor completed his/her job by entering a patient's primary symptom and vital signs as received from the nurse, then "examining" the patient to receive more specific symptoms. The specialist entered the patient's primary symptom, vital signs, and specific symptoms, and received a "final diagnosis" as output, which was the final step in the process. Each interview, examination, or diagnosis appeared after a 15 s wait. This delay was chosen because

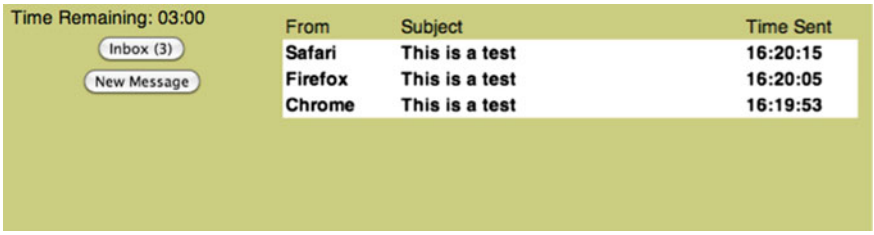


Fig. 5.3 Email screen for non-treatment team

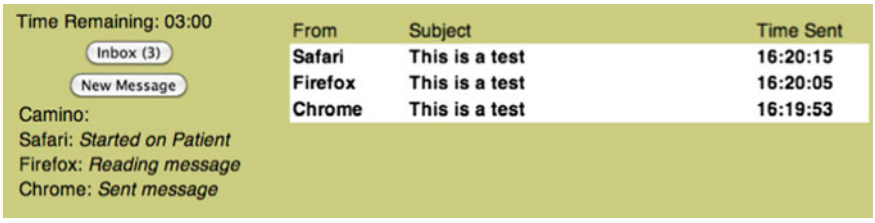


Fig. 5.4 Email screen for treatment team

it allowed team members a few seconds of idle time beyond the time that was required to exchange messages with other team members in pilot studies.

During the diagnosing period, participants used an email system to communicate that was integrated into the experimental application. The email screen was modeled after recent web-based email systems. It displayed an inbox that listed all of the messages that the participant had received during that period, the text of which was displayed below the list when that row was clicked (Figs. 5.3 and 5.4). The participants addressed messages using a drop down list that contained the names of their team members. The expert system that was used to interview, examine, or diagnose a patient was located below the status display on the left side of the screen.

The participants were rewarded at the conclusion of an experimental session based on the number of patients that were correctly diagnosed by the teams in which they worked. The participants whose teams diagnosed the most patients overall won a nominal cash prize.

Experimental Procedures

The experiment was completed during normal classroom hours as a class exercise illustrating online collaboration. First, the participants indicated their informed consent and filled out a demographic questionnaire. Next, the computer totaled the number of participants in the session and randomly assigned the participants to a job. When the class size was not an even multiple of three, the remaining participants

were given the role of lab technician, meaning some teams had four members. The specialist on four member teams had to enter the results of a lab test before a patient diagnosis could be completed. The data for this study includes only teams that had three members.

The participants were given verbal instructions about the different jobs on the team, the task the teams needed to complete, and how to use the messaging system. Finally, each participant read instructions specific to their particular job: how to use the expert system, from whom they needed to receive information, and to whom they needed to send information. After all of the participants had read these instructions and any questions were answered, they were told that they would be meeting in a chat room for 5 min, and instructed to use the time to decide on a process for completing a patient diagnosis. All of the participants in the session were then randomly assigned to teams and met in the chat room. When the 5 min had elapsed, the participants completed a post chat questionnaire and then began the diagnosing period.

During the diagnosing period, the team members communicated via email. Typically, information flowed from the nurse to the doctor, then from the doctor to the specialist for final diagnosis. After 4 min, the diagnosing period ended, and the participants completed another questionnaire, which included the items used in this study.

Over the course of the session, each participant was part of three different teams. After the end of the first diagnosing period and post-diagnosis questionnaire, the participants were randomly assigned to a second team. The new teams returned to the chat room to decide on their process for diagnosing patients, then diagnosed patients again. After the second diagnosing period the participants completed the questionnaire again and were assigned to a third team. During the second and third chat periods, teams were given 3 min to chat because they were more familiar with their jobs and the diagnosing process. The shorter time period did not seem to affect the teams in any way, and a longer time period likely would have meant 2 min of idle time and/or off topic chatting.

Throughout the exercise, chat and email messages were identified by first names, which were entered by the participants at the time they indicated informed consent. This enabled team members to potentially recognize people they had worked with before. On the second and third teams, each participant performed the same job, but potentially worked with new people. This meant that a person could be on a team that was the same size but with one or more different team members, or be on a team with a different number of members. In that way, the second and third rounds simulated an environment where an individual is expert at their own task, but is working with new members and/or with new steps in the process. The data used in this study were collected after the participants worked with their third team.

Experiment Study Variables

The email interfaces were identical with the exception of an on-screen indicator that showed the activities of team members for teams with the experimental treatment (Fig. 5.4). Members of control group teams did not see the indicator (Fig. 5.3), making this a between-groups design. The status on this indicator automatically changed each time a team member clicked on an item on their screen (e.g., clicked the Interview Patient button, clicked on a message in their inbox, clicked on the New Message button, etc.).

Unless otherwise noted, the scales used were developed specifically for this study. The scales for each construct were reduced and/or modified from a larger set of items based on data collected from two pilot test sessions. All of the items are seven point Likert-type scales anchored Not At All—To A Great Extent. *Activity awareness* is defined as one's feeling that one knows when the other people on the team are working. Five items were used to measure activity awareness, which are based on the scale developed by George (1992):

(1) I could tell when the other people on this team were occupied with work.
(2) I knew when the other people on this team were busy.
(3) I knew whether or not I should wait before sending a request or information to another person on this team.
(4) I was aware of when the other people on this team were doing something.
(5) I recognized when the other people on this team were working versus not working.

Connectedness is defined as one's feeling that others in the team are virtually present. Four items were used to measure connectedness:

(1) I felt like the messaging system connected me to the other people on this team.
(2) I felt like the people on this team were connected through the message system.
(3) The message system linked me with the other members of this team.
(4) It seemed like we were linked together as a team.

Performance is the number of patients correctly diagnosed by the team during the third round. As noted earlier, participants were rewarded based on the total number of patients that all of their teams diagnosed.

Experiment Results

The data used for this study comes from questionnaire responses gathered after participants completed the experimental task with their third team. The data were analyzed using Partial Least Squares (PLS Graph build 1130). Significance of paths was determined using the bootstrap resampling technique (500 subsamples). The tests shown use data at the group level (n = 76), but we note here that the statistical significance of the tests is the same using individual level data (n = 228). Of the

Table 5.2 Means (standard deviations) of study variables by treatment

	n	Activity awareness	Connectedness	Performance
No indicator	41	4.70 (1.29)	5.03 (1.17)	1.88 (1.63)
Indicator	35	5.21 (0.98)	5.31 (1.05)	1.69 (1.83)

Table 5.3 Composite reliability and correlations of latent variables (square root of AVE on diagonals)

	Composite reliability	Activity awareness	Connectedness	Performance
Activity awareness	0.966	0.921		
Connectedness	0.968	0.873	0.939	
Performance	N/A	0.391	0.482	N/A

participants that were included in the analysis, most were business majors. Just over half were male (55%). The average age was 22 years old, and the average participant was between his/her second and third year of college. The means and standard deviations of the study variables by treatment are shown in Table 5.2. The values shown are the average of the responses to the items that comprise each seven point scale. Higher values represent a higher feeling of the underlying construct. For example, a higher value for Activity Awareness indicates that participants felt like they were more aware of the activities of others. Cell sizes for the treatments are not equal because of the design of the overall study.

All of the scales exhibited adequate reliability, with composite scale reliabilities equaling or exceeding 0.966. Convergent validity for the scales was supported because the correlations of the latent variables were lower than the square root of the average variance extracted for a given variable (shown in Table 5.3). The constructs of activity awareness and connectedness are strongly linked in the participants' minds, as proposed by hypothesis 2. However, discriminant validity was supported because individual scale items loaded higher on their own latent variable than their correlation with other latent variables (shown in Table 5.4) (Chin 1998). Furthermore, a model with a link from the user interface element to connectedness was not significant, indicating that feelings of connectedness arise more from communication practices than from user interface elements.

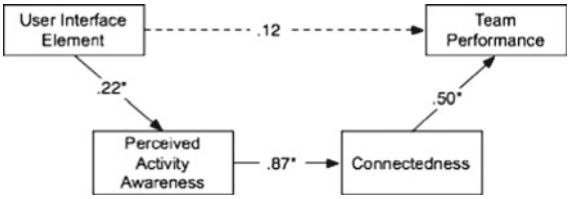
An alternative ordering of the research model with reversed causation of activity awareness and connectedness in predicting performance was also not supported. The correlation between activity awareness and performance is lower than the connectedness and performance (0.391 vs. 0.482). In addition, when performance is predicted only by activity awareness, its path coefficient is lower than when performance is predicted by connectedness (0.42 vs. 0.50), and the amount of variation in performance explained is lower (r-squared 0.174 vs. 0.247).

The results show that members of teams with the on-screen indicator had a significantly higher level of perceived activity awareness (Hypothesis 1: $b = 0.215$, $t = 2.10$,

Table 5.4 Loadings and cross loadings of items on latent variables

	Activity awareness	Connectedness
Act1	**0.918**	0.789
Act2	**0.927**	0.782
Act3	**0.890**	0.794
Act4	**0.951**	0.841
Act5	**0.920**	0.811
Conn1	0.799	**0.944**
Conn2	0.845	**0.960**
Conn3	0.794	**0.927**
Conn4	0.837	**0.925**

Fig. 5.5 PLS results



*p<.05, **p<.01

$p = 0.0359$), confirming that the user interface element heightened activity awareness for participants. In turn, higher levels of perceived activity awareness were associated with a higher level of connectedness (Hypothesis 2: $b = 0.873$, $t = 28.59$, $p < 0.0001$). Finally, higher values of connectedness were associated with higher levels of group performance (Hypothesis 3: $b = 0.498$, $t = 6.8446$, $p < 0.0001$). Figure 5.4 graphically summarizes the results (Fig. 5.5).

Experiment Discussion

The experimental results confirm our hypotheses: a user interface element that provides activity awareness information about other team members led to increased feelings of awareness of the activities of others. This in turn led to higher feelings of connectedness; and higher connectedness was associated with higher team performance. This occurred in a team context where distributed members were expert at their own task and were working with a new team of people that were similarly experts. Thus, we suggest that the effects on coordination and motivation that were reported in the case study were indeed caused by increased feelings of connectedness that arose because of the practices developed to increase activity awareness.

Experiment Limitations

The experimental task was relatively clearly defined and took place over a short period of time. In more general organizational conditions, team tasks may be accomplished over the course of several hours or days and development of connectedness might take several months. In addition, our user interface element was relatively unsophisticated in its reporting of activities; however, the user interface element in the case study showed that conveying something as simple as "I am connected to the organization's Sametime system" was enough to convince other team members that one is working and thereby increase feelings of connectedness. Similar information about the activities of employees have formed the basis for staffing decisions (Carlson 2013).

General Discussion and Conclusions

As we noted in the Theoretical Foundation section, effective teams need information about the activities of team members in order to reduce coordination losses. In the case study, team members shared information about when they would be in meetings, taking breaks, etc. and needed others to cover the team phone. In their context, practices for communicating availability of team members had the additional effect of increasing social motivation as evidenced by the declining levels of frustration with other team members when awareness practices were introduced. With the introduction of Sametime, team members developed additional awareness practices that relied on automatic status changes resulting from removing the identification card from one's computer. Although these practices weren't directly aimed at increasing motivation, they had an impact on team performance because team members used this information to gauge the extent to which they and others were working (cf., Carlson 2013). The experimental results confirmed a causal relationship between activity awareness, connectedness, and performance.

Taken together, the results of the case study and experiment suggest that relatively simple technologies can be used to develop practices for increasing awareness of the presence and activities of others. Such practices might be developed with a goal of improving the coordination of team availability and thus team effectiveness (i.e., reduction of coordination losses). However, such practices might additionally lead to feelings of being connected to other members of the team in certain organizational contexts. We further suggest that team members that are more aware of the activities of others are better able to compare themselves with others. This can motivate them to work harder and longer for their teams because they feel other team members are doing the same (i.e., social motivation gains). The practical implications of these results are summarized in Table 5.5, and explained in detail in the following sections.

Table 5.5 Practical implications

	Managerial implications	Tool designer implications
1. A shared team goal is a critical antecedent to creation of awareness practices	A shared team goal motivates the development of awareness practices	A shared team goal motivates incorporation of available tools into awareness practices
2. Awareness practices that emerged from team interactions increased connectedness	Management-dictated awareness practices might not increase connectedness and lead to distrust	Sophisticated awareness technology may not have beneficial side effects
3. Awareness practices become more sophisticated over time	As team members internalize activity awareness practices, point of comparison shifts from others to self	Given sufficient time and message exchanges, simple-seeming awareness tools may be enough
4. Awareness practices leverage high trust environment	In a high trust environment, positive outcomes occur with activity awareness practices. In a low trust environment, activity awareness practices seem to make things worse	Context is important: users combine technology signals with taken-for-granted awareness information to determine meaning of signals
5. Awareness technology signals should be focused on the team	When users trust that their signals are private to their team, team-level social motivation increases. When signals are reported to and used by management, system gaming and demotivating effects are likely to occur	If the array of signals is too broad, it may overcome the information processing abilities of the users. Users should be able to limit the scope and narrow the frequency and amount of signals they receive

Managerial Implications

A shared/team goal is likely a critical antecedent to whether a team member will wish to be aware of the activities of others. In the case study, practices for monitoring availability did not emerge until after a goal was given. Once the goal was introduced, team members showed frustration with the lack of availability information, which motivated the development of awareness practices using the available technology. Team members likewise had a shared goal in the experimental study. In this case, the information shown in the on-screen indicator would not necessarily improve coordination, but an effect of activity awareness on connectedness and performance was shown.

We note that the practices for providing awareness of availability observed in the case study emerged from team interactions. Management clearly had the option to simply develop a system for ensuring that enough team members would be available to answer the phone. For example, management could have developed a schedule that ensured hour-by-hour coverage and dictated when each employee could take breaks for lunch, etc. We speculate that a management-dictated system would not have increased connectedness, and would not have had the motivating effects that the

team developed availability awareness practices had. Thus, if management dictates practices rather than simply goals, employees will simply follow the practice and fewer beneficial side effects may occur.

A "between the lines" interpretation of the attitudes of the team members also emerged in the case study: as time passed and awareness practices became more sophisticated, team members seemed to use positive rather than negative language about efforts. Moreover, the point of evaluation seemed to shift from judging the efforts of others, to judging the efforts of oneself—descriptions of the later awareness practices were accompanied by statements about feeling more motivated to work harder, while the earlier practices were associated with statements about ensuring that others were working hard enough. Thus, we suggest that activity awareness might be necessary in order for social motivation gains to occur under organizational conditions where team members are expert at their tasks and may be working with their current team members again in the future (cf., Kerr & Hertel, 2011).

Finally, we note that, although our case involved members of ten different teams within MUFIN, teams in other organizations with different cultures might react differently. We noted earlier that Watson-Manheim & Bélanger (2007) suggested in their case study that "using email is not sufficient for relationship development," and instead must be combined with other, more personal media (p. 12), and reported instances of employees "copying email to colleagues and management to show 'how busy I am'" (p. 14) in a relatively low trust environment. We contrast this with our user above that eagerly worked after the end of business hours in order to give the signal to his/her group members that they were the last one online. Thus, we suggest that activity awareness should be treated as private, team-level information, and caution that when managers use activity awareness as a means for social comparison in low trust environments, members are likely to attempt to "game the system" instead of actually increasing their performance.

Tool Designer Implications

When designing interfaces for supporting communication and collaboration in a team context, designers should be aware of the importance of information about the activities of the different users. The presence indicator and status messages in Sametime as well as the on-screen indicator used in the experiment were relatively simple tools for providing awareness of the activities of others. However, in both environments, team members developed practices for increasing awareness to meet their shared goal, and reported higher connectedness with other team members. This higher connectedness seems to be durable over longer time periods—participants in our experiment still reported higher levels of activity awareness with the tool after working with their third group. This suggests that some, ostensibly simple, tools might not be taken for granted over time and still be used to provide awareness to team members (cf., Oemig & Gross, 2007), and reaffirms that subtle differences indeed count in the design of collaboration systems (cf., Huber 1990). Furthermore,

sophisticated workspace awareness systems may provide unnecessary or unwanted information and might simply be ignored.

The status indicator provided with many messaging systems automatically provides information about whether the application on the users computer is connected with the messaging service, and many also indicate whether the user has recently moved the mouse or pressed a key on the keyboard. Simply saying that a person is online, however, does not necessarily provide a feeling of connectedness to others; rather, users need more information about the context in which the person resides (cf., Majchrzak, Malhotra, & John, 2005). One might wish to know where the other is—at a restaurant, in the office, and at home, meaning that whether they are available and/or when they will be available has some relevance when determining how much effort the other is making. In some contexts, then, a status indicator may be enough to indicate that a user is engaged in team-related work and thereby heighten willingness to work in others. However, this would require one to combine the status indication with other taken-for-granted information, such as assuming that another would only use that particular mediating application when performing team-related tasks.

We do not necessarily suggest that designers of mediating technologies need to add detailed information about team members' activities—a la the Facebook "news feed." Indeed, such information might unnecessarily overload the information processing abilities of the team members (cf., Dabbish & Kraut, 2008). Rather, technology designers should recognize that users wish to obtain activity information about others, and provide the flexible means for users to add context and implement practices that communicate such information. Practices that involve changing IM screen names (Smale & Greenberg, 2005) or status messages (Riemer et al., 2007) to indicate activity provide evidence that flexibility is desired.

Furthermore, it may be undesirable in some cases to provide others with what might be considered private information by an individual. The experiment's results show a positive relationship between our user interface element and team productivity and member satisfaction. In the case study, Sametime was only used in the work context. A user interface element that reported private information might be considered intrusive. We also speculate that such a user interface might be associated with indifference or perhaps user dissatisfaction in a context in which individual performance is rewarded.

Finally, we note that the team members in our experiment could only see the activity information about their own team members, and the team members in the case study could limit their viewing to only their team members. Thus, in both cases, team members knew at least part of the context in which the other users resided—they were members of their team. In this way, the information presented by an activity information tool could be combined with information about the known border of the group (cf., Gross et al., 2005) and information that the user might be able to recall from memory (e.g., that a particular person was the Nurse, or that a particular person was a smoker). Thus, we speculate that systems should allow for work unit differences—members of a particular team might feel more connectedness when they can see information about their *own* team members' activity, but activity information

about *outsiders* (i.e., persons outside the team) would probably be deemed irrelevant and might only distract one from being able to understand whether and how hard their team members are working. For members of an organization that are outside of a particular individual's work area, it may only be necessary to provide what is typically considered presence information, and perhaps desirable to restrict the number of others about which one would observe more detailed information.

Implications for Future Research

Researchers in the area of computer mediated communication (CMC) have embraced the notion of process losses, and much attention has been given to the need for awareness to reduce coordination losses (Gutwin & Greenberg, 1996; Carroll et al., 2006). However, there has been little attention paid to the role of awareness in mitigating social motivation losses. Based on what we observed in the case study and experiment, we propose that social motivation gains can occur when IT artifacts are introduced, and might occur spontaneously when awareness practices are adopted that enable users to reliably track comings and goings (e.g., the Sametime presence feature, the experiment's on-screen indicator). Normally, the presence feature of IM applications is considered by technologists to indicate simply whether or not the person is able to communicate. Our case study shows that such a tool can mean much more than that to team members. In the case study, we found that team members observed when others' status changed and used this information not only to determine when others were available for work, but also as a means for determining how much they were working. In addition, we found some evidence that team members are motivated to be sure that their efforts measure up when compared with others. Thus, we suggest that the adoption of social software such as life streaming, microblogging, wikis and online communities will likely have implications for social motivation among the participants.

Prior researchers have noted the importance of presence awareness via CMC as a means to monitor others (Cameron & Webster, 2005). Here, we show that being aware of what other people are doing has implications for feelings about one's team and team performance, meaning the lack of bodily presence in a mediated context has additional implications beyond simply "Is anyone there?" For teams working in distributed contexts, members are unable to directly observe others, and must rely on what is they receive via CMC in order to compare efforts (Greenberg et al., 2007). In addition to our results, knowing who is there and being able to differentiate among them has been shown to improve decision-making and increases a team's ability to reach consensus (Cooper & Haines, 2008).

Thus, what normally is termed *presence* awareness in mediated communication (cf., Shaw, Scheufele, & Catalano, 2007; Kekwaletswe & Ngambi, 2006; Bønes, Hasvold, Henriksen, & Strandenæs, 2007) has an additional subcomponent of *activity* awareness (cf., Carroll et al., 2006). Researchers have observed that users wish to communicate information about their presence—when they will be able/unable to

communicate (Shaw et al., 2007; Smale & Greenberg, 2005). However, when users indicate their presence, they are, in many cases, implicitly including information about their activities. Depending on the context, the Skype status message "in a meeting" could also be an indication of another's effort exerted, while observing that another's icon changed in the company's Sametime application, meaning he/she has just connected to the system, could indicate that the other has begun his/her workday. The observed benefit of online status in instant messaging (IM) as indicating whether one is "idle or away" (Shaw et al., 2007) implicitly acknowledges the potential usefulness of knowing whether another is engaged with work. Similarly, some of the screen name changes observed in IM contexts show activity information rather than just one's presence (e.g., "House hunting!", "reading at my desk/disregard (Away) status", "60% done my portfolio" Smale & Greenberg, 2005). Our results suggest that such user practices would improve feelings of connectedness and in turn increase effort.

Finally, we suggest activity information is often *imputed* from what is ostensibly presence information. Our examples above about meeting attendance or beginning of a workday involved a user interpreting the status update and/or status change as indicating another's activity. This happened because the user combined that new information with taken for granted assumptions about the other's context to impute awareness about their activities (cf., Garfinkel 1967; Carroll et al., 2006). Future research could examine the extent to which users feel that information presented by a mediating technology can be relied on, the degree to which users combine such information with additional information to create other aspects of awareness, and the extent to which users alter their practices to provide or impute activity information from tools ostensibly designed to provide presence or other awareness information.

In online communities research, the notion of social motivation losses has been used to explain the extent to which individual users contribute material and/or knowledge to a community (McLure-Wasko & Faraj, 2005; Butler 2001; Ling et al., 2005; Ludford, Cosley, Frankowski, & Terveen, 2004; Michinov & Primois, 2005, Yuqing, Kraut, & Kiesler, 2007). This study is unique in that it finds that social motivation can both drive contributions to a community (i.e., sharing one's status) and have social motivation effects on work that is not directly related to the community. For example, one might be following a company microblog on human resource practices, and find the tweets very useful and be impressed by the number and quality of contributions. However, one might not be an expert on human resources and thus feel like one has nothing to contribute. Instead, one might be motivated to contribute to the company wiki on a topic where one is able to provide some expertise.

References

Anantharaman, V., & Han, L. S. (2001). Hospital and emergency ambulance link: Using IT to enhance emergency pre-hospital care. *International Journal of Medical Informatics, 61,* 147–161.

Bal, R., Mastboom, F., Spiers, H. P., & Rutten, H. (2007). The product and process of referral optimizing general practitioner-medical specialist interaction through information technology. *International Journal of Medical Informatics, 765,* 528–534.

Bønes, E., Hasvold, P., Henriksen, E., & Strandenæs, T. (2007). Risk analysis of information security in a mobile instant messaging and presence system for healthcare. *International Journal of Medical Informatics, 76*(9), 677–687.

Butler, B. S. (2001). Membership size, communication activity, and sustainability: A resource-based model of online social structures. *Information Systems Research, 12*(4), 346–362. https://doi.org/10.1287/isre.12.4.346.9703.

Cameron, A. F., & Webster, J. (2005). Unintended consequences of emerging communication technologies: Instant messaging in the workplace. *Computers in Human Behavior, 21*(1), 85–103.

Carlson, N. (2013). How marissa mayer figured out work-at-home yahoos were slacking off. *Business Insider*. Retrieved September 15, 2015, from http://www.businessinsider.com/how-marissa-mayer-figured-out-work-at-home-yahoos-were-slacking-off-2013–3.

Carroll, J. M., Rosson, M. B., Convertino, G., & Ganoe, C. H. (2006). Awareness and teamwork in computer-supported collaboration. *Interacting with Computers, 18*(1), 21–46.

Chidambaram, L., & Tung, L. L. (2005). Is out of sight, out of mind? An empirical study of social loafing in technology-supported groups. *Information Systems Research, 16*(2), 149–168.

Chin, W. W. (1998). The partial least squares approach to structural equation modeling. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 295–336). Mahwah, NJ: Lawrence Erlbaum Assoicates.

Cooper, R. B., & Haines, R. (2008). The influence of workspace awareness on group intellective decision effectiveness. *European Journal of Information Systems, 17*(6), 631–648.

Dabbish, L., & Kraut, R. (2008). Research note—awareness displays and social motivation for coordinating communication. *Information Systems Research, 19*(2), 221–238.

Dourish, P., & Bellotti, V. (1992). Awareness and coordination in shared workspaces. In *CSCW '92: Proceedings of the 1992 ACM Conference on Computer-Supported Cooperative Work* (pp. 107–114). ACM Press. http://doi.acm.org/10.1145/143457.143468.

Erez, M., & Somech, A. (1996). Is group productivity loss the rule or the exception? Effects of culture and group-based motivation. *Academy of Management Journal, 39,* 1513–1537.

Garfinkel, H. (1967). *Studies in ethnomethodology*. Englewood Cliffs, NJ: Prentice-Hall Inc.

George, J. M. (1992). Extrinsic and intrinsic origins of perceived social loafing in organizations. *Academy of Management Journal, 35*(1), 191–202.

Goffman, E. (1961). Fun in games. *Encounters* (pp. 15–81). Indianapolis, IN: Bobbs-Merrill.

Greenberg, J., Ashton-James, C. E., & Ashkanasy, N. M. (2007). Social comparison processes in organizations. *Organizational Behavior and Human Decision Processes, 102*(1), 22–41. https://doi.org/10.1016/j.obhdp.2006.09.006.

Gross, T., Stary, C., & Totter, A. (2005). User-Centered awareness in computer-supported cooperative work-systems: Structured embedding of findings from social sciences. *International Journal of Human-Computer Interaction, 18*(3), 323–360.

Gutwin, C., & Greenberg, S. (1996). Workspace awareness for groupware. In *Proceedings of the Conference on Human Factors in Computing Systems* (pp. 208–209). Vancouver.

Gutwin, C., & Greenberg, S. (2002). A descriptive framework of workspace awareness for real time groupware. *Computer Supported Cooperative Work, 11,* 411–446.

Haines, R., & Riemer, K. (2011). The user-centered nature of awareness creation in computer-mediated communication. In *Proceedings of the Thirty Second International Conference on Information Systems* (p. 8).

Haines, R., Hough, J., Cao, L., & Haines, D. (2014). Anonymity in computer-mediated communication: More contrarian ideas with less influence. *Group Decision and Negotiation, 23*(4), 765.

Harper, R. R., Hughes, J. A., & Shapiro, D. Z. (1989). The functionality of flight strips in ATC work. The report for the civil aviation authority. In *Lancaster sociotechnics group, department of sociology, lancaster university january.*

Heath, C., & Luff, P. (1992). Collaboration and control: Crisis management and multimedia technology in London underground line control rooms. *Computer Supported Cooperative Work, 1*(1–2), 69–94.

Huber, G. P. (1990). A theory of the effects of advanced information technologies on organizational design, intelligence, and decision making. *Academy of Management Review, 15*(1), 47–71.

Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization Science, 10*(6), 791–815.

Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is anybody out there? Antecedents of trust in global virtual teams. *Journal of Management Information Systems, 14*(4), 9–64.

Kahai, S. S., Sosik, J. J., & Avolio, B. J. (2003). Effects of leadership style, anonymity, and rewards on creativity-relevant processes and outcomes in an electronic meeting system context. *The Leadership Quarterly, 14*(4–5), 499–524.

Kekwaletswe, R. M., & Ngambi, D. (2006). Ubiquitous social presence: Context-Awareness in a mobile learning environment. In *IEEE International Conference on Sensor Networks, Ubiquitous, and Trustworthy Computing, 2006* (p. 2).

Kerr, N. L., & Hertel, G. (2011). The köhler group motivation gain: How to motivate the 'weak links' in a group. *Social and Personality Psychology Compass, 5*(1), 43–55. https://doi.org/10.1111/j.1751-9004.2010.00333.x.

Ling, K., Beenen, G., Ludford, P., Wang, X., Chang, K., Li, X., et al. (2005). Using social psychology to motivate contributions to online communities. *Journal of Computer-Mediated Communication, 10*(4), 00–00. https://doi.org/10.1111/j.1083-6101.2005.tb00273.x.

Ludford, P. J., Cosley, D., Frankowski, D., & Terveen, L. (2004). Think different: Increasing online community participation using uniqueness and group dissimilarity. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (pp. 631–638). ACM. https://doi.org/10.1145/985692.985772.

Majchrzak, A., Malhotra, A., & John, R. (2005). Perceived individual collaboration know-how development through information technology-enabled contextualization: Evidence from distributed teams. *Information Systems Research, 16*(1), 9–27. https://doi.org/10.1287/isre.1050.0044.

Malone, T. W., & Crowston, K. (1994). The interdisciplinary study of coordination. *ACM Computing Surveys, 26,* 87–119. https://doi.org/10.1145/174666.174668.

McLeod, P. L., Baron, R. S., Marti, M. W., & Yoon, K. (1997). The eyes have it: Minority influence in face-to-face and computer-mediated group discussion. *Journal of Applied Psychology, 82*(5), 706–718.

McLure-Wasko, M., & Faraj, S. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly, 29*(1), 35–57.

Michinov, N., & Primois, C. (2005). Improving productivity and creativity in online groups through social comparison process: New evidence for asynchronous electronic brainstorming. *Computers in Human Behavior, 21*(1), 11–28. https://doi.org/10.1016/j.chb.2004.02.004.

Ng, W. H., Wang, E., & Ng, I. (2007). Multimedia messaging service teleradiology in the provision of emergency neurosurgery services. *Surgical Neurology, 67,* 338–341.

Oemig, C., & Gross, T. (2007). Shifts in significance: How group dynamics improves group awareness. In *Mensch & computer 2007: 7. Fachübergreifende konferenz fuer interaktive und kooperative menien.*

Orlikowski, W.J. (2000). Using technology and constituting structures: A practice lens for studying technology in organizations. *Organization Science*, *11,*(4), 404–428.

Parks, C. D., & Sanna, L. J. (1999). *Group performance and interaction*. Boulder, CO: Westview Press.

Piccoli, G., & Ives, B. (2003). Trust and the unintended effects of behavior control in virtual teams. *MIS Quarterly, 27*(3), 365–395.

Pinsonneault, A., Barki, H., Gallupe, R. B., & Hoppen, N. (1999). Electronic brainstorming: The illusion of productivity. *Information Systems Research, 10*(2), 110–133.

Riemer, K., Klein, S., & Frößler, F. (2007). Towards a practice understanding of the creation of awareness in distributed work. In *Proceedings of the Twenty-Eighth International Conference on Information Systems.*

Sarker, S., & Sahay, S. (2003). Understanding virtual team development: An interpretive study. *Journal of the Association for Information Systems, 4,* 1–38.

Shaw, B., Scheufele, D. A., & Catalano, S. (2007). The role of presence awareness in organizational communication: An exploratory field experiment. *Behaviour and Information Technology, 26*(5), 377–384.

Shepherd, M. M., Briggs, R. O., Reinig, B. A., Yen, J., & Nunamaker, J. F. (1996). Invoking social comparison to improve electronic brainstorming: Beyond anonymity. *Journal of Management Information Systems, 12*(3), 155–170.

Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. New York, NY: Wiley.

Smale, S., & Greenberg, S. (2005). Broadcasting information via display names in instant messaging. In *Proceedings of the 2005 International ACM SIGGROUP Conference on Supporting Group Work* (pp. 89–98).

Steiner, I. D. (1972). *Group processes and productivity*. New York: Academic Press.

Watson-Manheim, M. B., & Bélanger, F. (2007). Communication media repertoires: Dealing with the multiplicity of media choices. *MIS quarterly, 31*(2), 267–293.

Yuqing, R., Kraut, R., & Kiesler, S. (2007). Applying common identity and bond theory to design of online communities. *Organization Studies, 28*(3), 377–408. https://doi.org/10.1177/0170840607076007.

Zajonc, R. B. (1965). Social facilitation. *Science, 149*(3681), 269–274.