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Towards a Practice Understanding of the Creation of Awareness in Distributed Work

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TOWARDS A PRACTICE UNDERSTANDING OF THE CREATION OF AWARENESS IN DISTRIBUTED WORK

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Abstract

Distributed, ICT-based work is becoming increasingly popular in and between organizations. However, such modes of working typically yield problems of creating and maintaining a mutual sense of awareness. Whereas in co-located teams awareness of others and their activities happens naturally and almost inevitably as part of daily routines, in virtual contexts awareness needs to be raised and facilitated. Existing literature treats awareness as determined by technology, hence technological design and the development of suitable IT artifacts and 'awareness features' are seen as crucial. We challenge this view after studying five cases, in which one real-time tool, Skype™, is used in quite diverse ways to create and maintain a sense of awareness. Our case analysis leads us to argue that awareness is part of shared social practices that are embedded in organizational contexts. Within these practices technology has been appropriated and embedded quite differently. We will spell out a practice theoretical understanding of awareness creation and suggest a re-conceptualization of awareness and its sister concepts presence and co-presence. We conclude with some implications for further research.

Keywords: Awareness, presence, practice theory, distributed work, Instant Messaging, Skype™

Introduction

In the past decade we have observed a profound transformation of the organization and practices of work: most obvious is the increase of distributed and networked forms of work within and across organizations (Ciborra and Suetens, 1996; Malhotra, et al., 2001; Orlikowski, 2002). The distribution of work has extended degrees of freedom in terms of place and time of work – virtual work has significantly increased over the past years (Kakihara and Sørensen, 2003). However, virtual work creates problems of maintaining awareness in the distributed context - awareness for people, their activities, shared objects and workspaces. For example, in distributed work one has significantly fewer opportunities to see one's collaborators (Scupelli, et al., 2005). A lack of awareness is believed to be at the heart of typical coordination problems in distributed work (Rennecker, 2005).

Most studies on awareness are found in the CSCW and CHI domains. In such research, the production of awareness in distributed environments is treated as a design problem that is addressed by the development of suitable technology. IT artifacts are developed in order to evoke, or even produce, certain types of awareness by means of specific awareness features (e.g. Gutwin, et al., 1996; Koch, 2005). We will challenge this technology-oriented view and argue for a broader, organizationally embedded understanding of the creation of awareness. Specifically we are suggesting a practice theoretical lens (Giddens, 1984). Such a view is much less prevalent in the literature (Orlikowski, 2000); it represents a new stream of research, in which the Information Systems discipline, due to its focus and objects of research, can make a substantial contribution.

We present Skype™ as a typical communication technology that aims at improving awareness in distributed work by means of providing what is termed presence awareness - an understanding for the availability and context of others. Our discussion of five cases of Skype™ usage will illustrate that affordance provided by Skype™ are ambiguous and are subject to (re-)interpretation by the users in their specific contexts. The resulting modes of awareness created in situ go way beyond what can be expected from the tool and its 'built in' awareness capabilities.

We find heterogeneous forms of Skype™ usage and modes of awareness creation, which leads us to propose a practice understanding of the creation of awareness in distributed work. We argue that awareness is created through social practices. The technology becomes embedded in these practices as the result of ongoing appropriation processes. To view awareness creation as social practice has also implications for the way we interpret the role of the IT artifact itself – rather than a bundle of features we emphasize technology-in-use. Moreover, we will argue for a conceptual distinction between the concepts awareness and presence. While in Instant Messaging research the status feature of such tools is claimed to create what is called 'presence awareness', we argue that presence is best understood as a distinct concept. We will discuss the idea of 'extending one's presence' beyond the physical world. In clarifying our understanding of presence and awareness we will draw on the work of Giddens (1984).

We begin by introducing the technology view of awareness production. Then, we will introduce Skype™ as an example of real-time communication technology. This is followed by the presentation of five cases of Skype™ usage. Subsequently, we analyze the cases and elicit a diverse set of shared practices of awareness creation. This discussion leads us to propose a more nuanced re-conceptualization, distinguishing among the main concepts - presence, presence availability, co-presence and awareness. We conclude with implications for further research.

Awareness

The role of awareness in distributed work

In face-to-face situations, awareness is generally taken for granted and therefore seldom discussed at all (Rennecker, 2005). Awareness of the activities of colleagues is relatively easy to maintain in traditional workplaces (Gutwin and Greenberg, 2002). However, through the distanciation of time and space brought about by ICT (Giddens, 1984), interaction nowadays involves more and more communication among dispersed parties, where people do not share a common physical environment (Leinonen, et al., 2005; Mark, 2002). And it is argued that when "collaborators are remotely located, however, there are fewer opportunities to see them, and less awareness." (Scupelli, et al., 2005, 1773) Consequently, the question if and how computer-mediated forms of interaction enable awareness or presence within the virtual work environment is one of increasing interest. A lack of awareness is believed to create typical coordination problems in distributed work, such as inter-group conflicts (Rennecker, 2005).

Researchers have been particularly interested in the role of technology for facilitating awareness and presence in dispersed settings. In fact, the awareness concept has been extensively discussed within the CHI and CSCW communities. According to frequently cited definitions, awareness is "an understanding of the activities of others, which provides a context for your own activity" (Dourish and Bellotti, 1992, 107); it thus is the "knowledge of other people's activities that is required for an individual to coordinate and complete their part of a group task" (Gutwin and Greenberg, 1995, 88), and it "involves knowing who is 'around', what activities are occurring, who is talking with whom; it provides a view of one another in the daily work environments" (Dourish and Bly, 1992, 541). As is reflected in the last definition, different types of awareness are typically distinguished according to the reference object to which awareness is directed - e.g. task-related awareness, social awareness in relation to emotional states of others, location awareness etc. For a comprehensive overview see (Gross, et al., 2005; Robertson, 2002).

In the following, we will introduce the technology view of awareness creation, which is most prevalent in the literature. We will later challenge this view and subsequently introduce a practice understanding. We will argue that the technology-based view uses a quite limited notion of awareness. While focusing the question how awareness can be technologically enabled or facilitated, it largely ignores the fact that awareness is part of the human way to engage with its environment. It thus falls short of explaining how awareness is created in social contexts.

Technology-based view of enabling awareness

A technology-based understanding of awareness creation represents the predominant view found in the CHI and CSCW domains. In such a view, enabling awareness in distributed, ICT-based environments is treated as a design problem mastered through the development of suitable technology. Hence, technology artifacts, which are the typical outcomes of design-oriented research in CSCW, aim to enable certain types of awareness by means of specific technological features (e.g. Gutwin, et al., 1996; Koch, 2005). Gross et al. provide a comprehensive overview of CSCW research in this tradition; they cluster CSCW systems according to awareness features and the types of awareness they are intended to produce (Gross, et al., 2005); also see (Gutwin and Greenberg, 2002).

A technology view of enabling awareness is also reflected in the language that is used (see table 1 for selected statements indicative of this tradition): CSCW systems provide certain awareness functions (Scupelli, et al., 2005) or features (Borning and Travers, 1991); they gather and provide awareness data (Gross, et al., 2005) in order to promote (Rennecker, 2005) or support awareness in collaborative work (Gutwin and Greenberg, 1996). Specialized awareness applications or systems (Boyer, et al., 1998; Ljungstrand and Segerstad, 2000) are developed to address awareness problems in distributed work. It becomes obvious that awareness is determined by the technology itself.

Research in this tradition takes the role of supporting the creation of awareness by designing the right artifacts. In doing so, a recurring theme is the distinction between the real world and the virtual environment. This is grounded in the observation that people experience certain problems in distributed work that typically do not exist in traditional work settings (Leinonen, et al., 2005; Mark, 2002). Enabling awareness is treated as a matter of designing into the virtual space objects that represent real world entities or features that simulate traditional ways of creating awareness (Robertson, 2002). Consequently, research projects in this tradition typically aim at creating virtual environments by developing IT artifacts that simulate the real world and its ways of creating awareness (e.g. Borning and Travers, 1991; Boyer, et al., 1998; Gutwin and Greenberg, 1996). Hence, the quality of virtual collaboration is affected by the fidelity with which ICT represents the physical world and makes relevant aspects explicit as to facilitate collaboration (Flach and Holden, 1998; Leinonen, et al., 2005; Lombard and Ditton, 1997).

This is also reflected in dominant theories in this domain such as media richness theory (Daft and Lengel, 1984; Daft and Lengel, 1986). According to media richness theory there is a fundamental difference between real and virtual presence insofar as real presence, i.e. face-to-face meetings, shows the greatest capacity for transferring rich information whereas technologically mediated environments are always less rich. Richness in the virtual environment consequently has to be re-created by ways of design, in order to resemble the real-world experience as closely as possible. However, such an approach takes an instrumental and deterministic view of the role of technology: Technologies and their characteristics determine (to a large extent) social processes in the virtual environment. As we will argue, such an understanding fails to appreciate the diverse ways in which people use and enact technologies (Orlikowski and Iacono, 2000) in order to create awareness in distributed work.

Given the central role of technology, the next sections will first introduce one specific technology, Skype™, and its characteristics. We will then explore ways in which this technology has been used in various organizational settings in order to see if and how Skype™ enables awareness.

Table 1. Selected quotes indicative of a technology view of awareness production	
Quotes	*References*
"Awareness is a design concept that holds promise for significantly improving the usability of real-time distributed groupware."	(Gutwin and Greenberg, 2002)
"In this paper we discuss the specific tools we are developing to address the Presence Awareness (PA) problems (…) of the distributed work group."	(Boyer, et al., 1998, 11)
"There have been other systems designed to support awareness of presence in real time…"	(Ljungstrand and Segerstad, 2000, 22)
"Providing presence awareness information about the availability of other users is one of the primary and most important features of IM."	(Tran, et al., 2005, 2)
"The ultimate aim of our project is to create the same atmosphere of casual awareness and informal interaction between people at sites that might be physically separate."	(Borning and Travers, 1991, 13)
"We developed PVIM as a plug in to standard IM that provides (…) an awareness function that allows users to know which of their collaborators are working on a joint project and what they are doing."	(Scupelli, et al., 2005, 1776)
"Groupware designers face two problems in designing awareness support. First, what information should a groupware system capture…? Second, how should this information be presented…?"	(Gutwin and Greenberg, 1996, 208)

Real-Time Communication (RTC)

The communication landscape is changing: Instant Messaging and IP telephony are spreading quickly and have made fast inroads into the corporate domain (Lazar, 2006). Technology to support distributed teams draws a lot of attention from developers and users likewise (Bradbury, 2005; Lazar, 2006). Instant Messaging is reported to be among the fastest growing communications media of all times (Meall, 2006). It is seen as an alternative to e-mail that allows for immediate and more controlled communication (Conlin, 2005). Instant Messaging tools have quickly spread throughout many organizations (Bradbury, 2005). In the same way, telephony over IP networks (VoIP) has entered many organizations either propagated as low-cost telephony solution or – in absence of a clear policy – through the back door with tools such as Skype™ which employees simply download and install on their computers (Cheung, et al., 2005; Mitchell, 2006). While Skype™ has been around since 2003 and is very successful in terms of user numbers, not only for private use but also in terms of corporate usage, it was rarely mentioned in articles concerning Instant Messaging (Bradbury, 2005; Gawlicki, 2005). While there is controversy as to whether Skype™ is ready for business use (Gaskin and Thayer, 2005), Skype™ Group claims that one third of their over 100 million customers have used Skype™ for work-related purposes. As a basis for both a better understanding of the cases presented below and the subsequent analysis of the ways in which Skype™ is used in shared work practices, it is necessary to first give an overview of the characteristics of the technology (Markus, 2005).

Skype™ - technology and feature set

The core element of Skype™ is the buddy list, which is well-known from other Instant Messaging clients. Users generate this list by sharing their user ID with other users. Access to a user is typically limited to the (authorized) members of the contact list, which de facto creates a closed community (Mitchell, 2006). The buddy list shows an availability status icon for every contact.

Skype™ offers person-to-person text chat functionality as well as group chats, i.e. text based multi person conferences. It also archives text conversations, which is important for many companies from a compliance point of view (Gaskin and Thayer, 2005). The message history is available to all conference participants even after ending a chat session, which helps keeping track of conversations (Economist, 2006). Furthermore, text conversations can be bookmarked in order to facilitate ongoing group conversations, i.e. persistent chat channels.

The VoIP calling functionality is typically promoted as Skype™'s primary value proposition. Users can place free voice or video calls to other Skype™ users who are currently online. Users can also setup conference calls with up to four people (conference calls are limited to voice calls; video is only supported for bilateral conversations in

Version 2.5, September 2006). Moreover, Skype™ also allows its customers to place calls to (SkypeOut) and to be called from (SkypeIn) traditional landline and mobile telephones. These features are not free of charge and require the customer to setup an account with Skype™. In most countries Skype™ is reportedly the cheapest VoIP provider in the marketplace (Fitchard, 2004). Further VoIP features are voice box functionality, the ability to send short messages to mobile phones (SMS), and a call forwarding feature that allows users to forward unanswered calls to a designated landline or mobile phone. Although Skype™ cannot fully replace traditional phones since features such as emergency calls are not supported, it acts almost like a full VoIP provider.

Skype™ offers basic capabilities for customization. A personal profile can be set-up with information visible to other people in the personal buddy list. A photo, postal address, E-Mail address, phone numbers, date of birth, a personal homepage, and a short personal message that is visualized as a speech-bubble can be entered. Moreover, the user can configure the tool appearance in terms of sounds, ring tones, hotkeys, language, and by hiding some features. While the options for tool customization are quite limited, the buddy list is a powerful instrument for customizing a user's communication environment.

To sum up, Skype™ offers real-time communication by integrating Instant Messaging with voice and video capabilities within a controlled environment defined by the buddy list (Lazar, 2006; Mitchell, 2006). The description of its features illustrates that Skype™ is a rather simple communication tool compared to other groupware applications (e.g. Lotus Notes). However, the technical features provide little insight into the emerging forms of its use and indeed its potential to facilitate distributed work and to enable the creation of awareness.

Skype™ and the creation of awareness

Following the technology view, Instant Messaging tools such as Skype™ support what is termed 'presence awareness' (Herbsleb, et al., 2002; Li, et al., 2005; Ljungstrand and Segerstad, 2000; Tran, et al., 2005), that is an understanding for the presence or availability of others (see classification of CSCW tools in Gross, et al., 2005). Presence awareness represents a form of peer monitoring that aims at improving communication (Cameron and Webster, 2005; Zweig and Webster, 2003) by means of allowing users to better reach people and manage their communication events.

Skype™ provides a central feature to facilitate awareness: the availability status icon that is sometimes also referred to as a 'presence awareness capability' (Cameron and Webster, 2005) or 'presence management feature' (Li, et al., 2005). This feature determines the availability of others by technical means, e.g. the system deduces from the user being logged into the system a *present* status; a lack of user activity is usually interpreted as *away* (Grinter and Palen, 2002). Users can override this technically determined status and "explicitly set their own presence to one of several pre-determined states." (Herbsleb, et al., 2002, 172) This signaling feature is often referred to as "one of the primary or most important features of IM." (Tran, et al., 2005, 2) However, it becomes obvious that with this feature Skype™ has only very limited built-in capabilities to enable awareness.

Five cases of Skype™ usage

With our cases we intend to demonstrate how a relatively simple application (such as Skype™) is enacted by different groups in rather different ways: a finding that is surprising and cannot be explained from the vantage point of technological determinism. In our analysis, we will demonstrate how awareness is created by ways of reinterpreting technological features that were not designed nor intended to enable awareness and by embedding them in the shared ways of working in the virtual settings. We will argue that a practice perspective provides the conceptual tools to understand and explain the creation of awareness.

Method

The five cases presented below serve as vignettes for illustrating a diverse set of practices of Skype™ usage with a focus on the creation of awareness in the distributed contexts. Hence, it is not our intention to provide full accounts of all aspects of the cases. For example, we will not elaborate in detail on the introduction of the technology or other technologies used for that matter. We will however provide a rich snapshot of the uniqueness and particularities of the cases and the shared practices that emerged with regards to the creation of awareness. In all cases, Skype™ plays a major role for communication, coordination or collaboration processes in distributed work settings.

We used qualitative research methods to gather data on the Skype™ usage and the shared practices that emerged around the usage of the technology. The cases were investigated in varying detail: two of the cases, *cases one* and *three*, where part of other research endeavors, the results of which have been published elsewhere (e.g. Frößler, 2006). Consequently, for these cases in-depth analyses were carried out drawing on multiple data sources. Specifically, for *case one* several interviews with the focal actor Karl[1] as well as a genre analysis of Skype™, eMail and phone conversations were carried out, which provided a rich picture of Skype™ usage and the communication practices that emerged between Karl and his peers. For *case two*, one open-ended interview with the focal actor Martin was carried out and Martin demonstrated the unique usage of Skype™ in his group. *Case three* was again part of a larger study - 15 interviews were carried out and the researchers analyzed the log files of all group chats; additional observations and document analysis complemented the research that provided a rich picture of the case. The description of *case four* is the result of a three hour open-ended interview with the focal actor Declan as well as a visit to the Dublin office and observations of the office setting. Finally, for *case five* one interview with a length of 45 minutes was carried out with the focal actor Jack, which seems sufficient in light of the rather uncomplex nature of this case. Table 2 provides an overview of the data collection methods used in the five cases.

Table 2. Overview of research methods and data collection applied in the five cases

Case	*Methods*
One	Genre analysis of 977 communication events over a period from 1 June until 30 June 2005 (Skype™, e-mail, phone, mobile phone); supplemental interviews with the focal actor during the time of the research.
Two	One, open-ended, 30 min long interview with the focal actor; demonstration of Skype™ usage.
Three	8 months in-depth case study; 15 semi-structured interviews, document analysis, log files of group chats from 1 Sept. 2006 to 20 March 2007, observations, shadowing of Skype™ usage.
Four	One open-ended, three hour, interview with the focal actor and visit and observation of the office setting.
Five	One open-ended, 45 min long, interview with the focal actor.

Case 1: Secure attachment in a distributed research team

Skype™ is used in the collaboration of two research teams, which are located at different universities (A and B) in two European countries and are both members of a large EU project consortium. The project manager Karl, who is also PhD thesis supervisor to a number of team members at both locations, had recently moved from university A to university B and visits university A only 4 times per year. In terms of virtual organizing, the members of the two research teams are involved in multiple research projects in different constellations: some of the projects are joint projects between universities A and B, some take place only in one location. Membership in the different project groups varies.

After Karl had left university A, the morale in the research group had deteriorated, even though a regular flow of email exchanges and occasional phone conversations was maintained. However, the atmosphere changed considerably after Skype™ was introduced in both research teams. The Skype™ status flag made Karl visible and signaled that he was approachable, whenever and wherever he was online. Little routines about signaling and "outeraction", i.e. short messages to negotiate availability for VoIP calls or conferences calls, were developed (cp. Nardi, et al., 2000). Text chats, as well as text and voice conference calls were initiated spontaneously whenever needed. The already high volume of communication events increased even further and added to the fragmentation of Karl's daily routines. However, the perception of connectedness, the improved morale and productivity of the teamwork as well as the ability to quickly address and solve issues more then compensated the negative impact. The frequent verbal exchanges facilitated a regular sharing and "synchronizing" of contextual information, which had not happened in the email exchanges before. This new practice kept Karl and the team members in the loop (for a related analysis see Frößler, 2006).

The sharing of contextual information was reported to be the most important feature for the group, especially from the point of view of the PhD students located at university A. Skype™ provided Karl with a communication channel to signal his availability and extend his presence to the work environments of his PhD students at location A. The

[1] Please note: all names of people and organizations have been made anonymous.

awareness of the Karl's availability and a sense of his presence allowed the team members to explore and look for solutions themselves, while being able to request assistance whenever needed. This form of virtual presence facilitated what developmental psychologists call 'secure attachment' (Holmes, 2001). Being able to respond quickly and provide support when needed allowed the project manager to usually remain in the background and still create a sense of security among the team members; this bolstered the confidence of the team members. In addition, the occasional short text messages and the possibility to upgrade to a richer channel to discuss more complex issues provided a rich environment for productive collaboration even where tacit knowledge was involved and knowledge integration across times was needed.

Case 2: Team coordination

Martin is a professor at a European University C working with a small team of researchers on various projects. Martin has several roles in regards to his team; he is PhD supervisor for some of the team members and at the same time coordinates tasks in his team related to projects as well as the general business of running the teaching environment. His team is located at the University campus but distributed across several buildings and people occasionally work from home. Hence, practices of telework emerged in which Skype™ plays a significant role.

While Skype™ is also occasionally used to communicate using the text chat and VoIP functionality, Skype™ is mainly used for coordination purposes and the creation of awareness. The availability status in Skype™ is supposed to indicate whether a person is currently online and thus potentially available for communication. However, this information was found to be not semantically rich enough since it does not say anything about the actual availability for communication, e.g. the urgency of a task someone is working on and whether an interruption would be possible at a particular time. In order to facilitate the 'negotiation of availability' team members now use the speech bubble feature in their personal profile to provide semantically richer information about their location (i.e. @home, @uni), their current tasks (i.e. writing on my thesis, writing a research report), and additional information such as the need for support ("I am alone in setting up a conference room"). Martin as the team coordinator has set the rule that this information is to be held up to date so that he can monitor ongoing work and the status of tasks.

In addition to facilitate monitoring, the semantically rich signaling also provides the basis for "permission based conferencing", whereby Martin makes decisions about contacting (and interrupting) his team members based on a trade-off between his own urgency and the expected level of disturbance his communication might cause. Hence, while the descriptions provide more transparency about the team members' actual work, they are also meant to reduce or even avoid interruptions or disturbance when being engaged in an important task. The example shows how Skype™ is being used to create a form of awareness that goes beyond the mere signaling using the availability status. Martin has established an almost private code of conduct for Skype™ use within his team, which actually runs against the purpose of the speech bubble. However, the problem in Skype™ is that this kind of semantically rich, contextual information typically would require a differentiation of addressees of the messages, which Skype™ does currently not provide. Currently all Skype™ contacts can see the messages of an individual team member, even though they are primarily intended for Martin as the team coordinator.

Case 3: Software development in a virtual organization

Snowpatrol, founded in 2005, is a Swiss-based internet start-up aiming at developing a new online platform. Because of the fierce competition within the Swiss market, management decided to reduce the time to market and launch the platform as early as possible. The pilot was scheduled to be built within the first three months after the initial business plan was accepted and the development of the platform itself would start immediately afterwards. Recruiting the right people was perceived as a crucial success factor for the whole project. Rather than employing all the required people, an alternative strategy was chosen with the formation of a virtual organization, consisting of five external enterprises plus Snowpatrol with its eight employees. Enabled by the fact that all partner organizations were located in a range of 100km around Snowpatrol's office, on-site team meetings were held every Thursday and Friday. The partner organizations were obliged to attend at least one of them. Being aware of the important role of social capital and a shared passion for the success of the project, management argued that these office days, first, helped to develop a shared understanding of the project as ambiguities were discussed and medium-range targets set, and, second, gave team members an opportunity to socialize and to build relationships (cp. Riemer and Klein, 2003).

However, for their day-to-day work, software developers unanimously confirmed the paramount importance of Skype™. While they also made occasional use of the VoIP functionality offered by Skype™, it was rather the chat

feature that had a strong impact on how work was organized within Snowpatrol and across the whole virtual organization. More specifically, the software developers started to use the chat function in a quite innovative way, which many of them did not know before. Chat channels were set up for different topics, such as 'Broadcast Development' or 'Trash and Talk', to which further employees of Snowpatrol and the partner organizations were invited over time. As Skype™ allows bookmarking these channels, they became institutionalized over time and highly frequented by almost all employees. Within the virtual organization, the channels played the role of keeping everybody updated on topics and events that were of general interest thus facilitating topical awareness of ongoing issues. Within the 'Broadcast Development' channel, developers proactively announced when servers needed to be shut down or applications needed to be updated. In this way everybody was made aware of ongoing activities and the implications they might have on their own work. However, besides these institutionalized channels, ad-hoc chats were created for more work specific topics. The ad-hoc channels had a more limited number of participants and a shorter lifespan. For instance, if problems occurred during the development of a certain piece of code, one of the affected developers would create a text chat and invite the others to discuss the topic. If required, further experts or the management were invited to either attain alternative perspectives or inform the management on important decisions that needed to be made. To sum up, both the institutionalized channels and ad-hoc text chats helped to create a communication infrastructure, which proofed to be crucial for the way work was organized between the dispersed team members. Skype™ enabled fast and focused discussions for trouble shooting that became part of software developers' work practices. Effective coordination in the virtual organization was made possible by both a specific task-related awareness in regards to activities happening in the workspace and more general awareness for the ongoing topics and issues within the virtual organization.

Case 4: An open virtual office

Sunrise is a small, four year old software development company headquartered in Dublin. Its founder and the three other employees, who are all in their thirties, develop specialized software applications for large international companies. Due to the size of Sunrise and the long established working relationships among its members, the organizational culture is very casual but at the same time highly professional. All members perceive themselves as pioneers within their area who frequently experiment with new hardware or software devices that could either be used for their own work or might open up new product and business opportunities.

In 2004, a turning point occurred when Declan, the founder of Sunrise, announced he would get an apartment in Barcelona and spend half the year in Spain, mainly because of the better weather conditions and life style. To adjust to the changing organizational structure, the team decided to use Skype™ to link the Dublin office with the Barcelona office. The computers of all team members were equipped with microphones and loudspeakers instead of headsets. While over the first few months the team members experienced no organizational problems, Declan started to feel isolated in Barcelona and cut off from the rest of the team, exacerbated by the fact that he had in the beginning no friends in Barcelona. While their former communications via Skype™ were generally quite subject-driven with talks being terminated after the main purpose was achieved, communication patterns changed significantly over time. After one discussion about some code, Declan did not hang up and neither did his colleagues in Dublin. While this seemed to be a bit strange in the beginning, as they could hear each other breathing as each of them worked intensively on the code without saying anything, both sides agreed to letting the channel open all day. By doing so, a shared audio context was created for the two offices, which did not only ease Declan's feeling of being isolated under the Spanish sun, but it also affected the way work was organized. Rather than having to initiate communication events, team members could now address each other, ask questions and start discussions as if they were all at the same location. Furthermore, as Declan eavesdropped on all the discussions in the Dublin office, he was constantly aware of the working status, problems and social activities. On the other hand, the team members in Dublin were released from constantly updating Declan on ongoing events and decisions.

Case 5: A travel companion

Jack is the CEO of German IT provider Javatown. With 30 employees Javatown is a small company that was founded as spin-off of fashion retail company Smash. Today, Javatown is still located in Smash's main building and manages its mostly IBM-based IT environment. In both companies, Lotus Sametime® has been available to all employees for the last five years. Instant Messaging is extensively used to coordinate work-related issues like meetings and to improve informal communication. Hence, Instant Messaging has become an integral part of Jack's

communications portfolio. Since Lotus Sametime® is restricted to internal usage Jack also uses Skype™ in order to stay in contact with some of his external partners.

However, Skype™ plays the most important role when Jack is traveling. Besides his external contacts, Jack's Skype™ buddy list also contains the 15 most important people within Javatown and Smash. When traveling internationally Jack uses public wireless networks or mobile dial up to connect to the Internet. Since Skype™ is very effective in establishing a connection under a large variety of network conditions, it is for Jack a reliable way of staying in contact with people at work. At the same time the Skype™ buddy list serves as a prioritization mechanism in that only the most important people have access to Jack while he is traveling and thus under time pressure.

Besides using the Instant Messaging capability for quick coordination or information gathering with people in his organization, Jack also uses Skype™ to place voice calls. These can be either voice calls to people in his buddy list or SkypeOut calls. By using SkypeOut, Jack is able to place phone calls to customers and partners in Germany from anywhere he can get Internet access at a very low price. It becomes obvious that for Jack Skype™ is a travel companion or mobile communications gateway that allows him to stay connected from wherever he is and allows selected people in his organization to get in contact with him when they see him log on to the network. People thus do not have to try and reach him on his phone when he might not be available. Knowing that Jack will go online frequently they can wait for Jack to make himself available for communication. Through this shared practice team members at home become aware of Jack's travel rhythm and can postpone communication in anticipation of the next time Jack is available for communication. This significantly reduces the burden of staying in contact and frees Jack from being interrupted in meetings he is having while traveling.

Case Analysis and Discussion

The case vignettes show a huge variety of Skype™ usage. Diverse practices can be identified with different Skype™ features at the centre of the respective work practices. In all cases, practices of creating and maintaining awareness emerged in which Skype™ has become embedded. At the same time, however, these practices cannot be fully understood by only looking at Skype™ and its features. Rather, one has to shift the perspective from a technology view to a practice view that sees Skype™ embedded in a set of organizational and individual routines. Only through a practice perspective are we able to grasp the full spectrum of using Skype™ for awareness creation. Skype™ can only be properly understood in context because the users shape the forms of usage to a large extent through processes of *appropriation,* i.e. shaping and embedding of technologies into practices, and *enactment in situ* (Orlikowski and Iacono, 2000). While technology is constructed by developers having specific assumptions about the artifact in mind, within their social practices users may heavily draw upon some features from a set of technical properties proffered by an application, while at the same time re-interpreting or neglecting others. In each of our cases only a few technological features are embedded at the core of the shared practices.

The actors in our cases all work in physical environments. Through shared practices of using Skype™ a range of ways emerged to extend these physical environments to include colleagues in remote locations. Hence, the remote colleagues and part of their working environment (location, tasks, noises etc.) become part of a hybrid, i.e. combined physical and computer mediated, environment. The creation of awareness plays a key role in this process. We will show that, while enabled by technology, awareness is not determined by the technology, but the result of shared practices in which the technology becomes embedded:

In the *first case*, Skype™ is at the core of flexible distributed collaboration that nonetheless delivers a sense of secure attachment from the PhD students' point of view. By drawing on the status feature of Skype™, Karl signals his availability for communication. However, this signaling turned out to be an idiosyncratic practice rather than a matter of simply using the Skype™ status feature. In order to manage his communication load, Karl turned to a practice of signaling "away" as his default status; a fact that was only known to a subset of people in his buddy list including his PhD students. Hence, whenever they would see Karl on Skype™ they knew he was present and potentially available for communication. Such a practice resembles the light shining from an office, but with the door shut: Karl could be busy. In order to determine his availability, people would then send a short message such as "Are you free?" – thus engaging in a communication genre called 'outeraction' (Nardi, et al., 2000). From the point of view of the PhD students, the signaling of availability indeed took the form of a potentiality, which they can draw upon in case of need for communication; moreover it created a context of social awareness ("canvas of awareness"). Karl on the other hand was able to "extend his presence" to the work places of his PhD students in the virtual environment and thus make himself available in case he was needed.

In the *second case*, the speech bubble feature has been appropriated in a unique way that creates task-related and location awareness of team members and their activities. Such awareness allows Martin to optimize task coordination and team deployment and also leads to a more effective and less interruptive communication. Again, the creation of these forms of awareness is the result of a shared practice, in which Skype™ has been appropriated in an innovative way - the speech bubble feature was re-interpreted to carry this type of signaling information. The practice is idiosyncratic in that the signals are only meaningful to Martin but not necessarily to other people in team members' buddylists. From Martin's point of view, Skype™ functions as a coordination dashboard; the signaling enacts in a simple way, the rich and complex shared workspace of the team and its tasks. The signals do not determine the response; they just enable Martin to maintain a sense of awareness of ongoing team activities.

In the *third case,* Skype™ is appropriated as part of task-focused practices of coordination and collaboration. Text chat and chat channels are used to collaborate on shared software development tasks and to broadcast task-related status and progress information and thus create detailed task-related awareness to enable coordination of distributed work. The continuous documentation of ongoing discussions in the virtual organization also creates a common information sphere that provides awareness of collaborative issues and is at the heart of creating team identity.

In the *fourth case*, the free VoIP call functionality enabled the formation of a shared virtual (audio) space that creates rich social awareness and creates a sensation of virtual presence or co-presence for the distributed team members. Essentially, the open audio channel facilitates a virtual open office. This extends the sense of awareness for the *Befindlichkeit*, i.e. a broad, holistic emotional state of team members, work rhythms etc. (Ciborra, 2004). Latent awareness creates a common context that enriches purposeful and directed communication.

Table 3. Analysis of the awareness creation in the five cases

	Case 1	*Case 2*	*Case 3*	*Case 4*	*Case 5*
Focal Skype™ features	Availability status	Speech bubbles	Chat channels Text chat	Ongoing conference call	Buddy list, Availability status
Short description of Skype™ usage	Practice of signaling availability provides sense of secure attachment and facilitates communication on-demand	Current task status allows for effective team coordination and reduces unintended interruptions.	Coordination of work on distributed tasks enabled by signaling and communication in various text chat channels	Open audio channel creates persistent virtual communication environment and lessens feeling of physical separation	Buddy list allows to prioritize communication partners; signaling to deliberately make oneself available
Type of awareness	(Latent) awareness of availability	Task-, location-, availability-related	Task-related, general topics and issues	Rich social awareness, sense of co-presence	Availability and awareness of travel rhythm
Presence & awareness	Practices of availability signaling. Extended availability in the workplace of team members. Mutual awareness of team members.	Improved awareness of availability for communication through differentiated signaling.	Extended awareness of ongoing work through the creation of a common information sphere. Mutual understanding supported by a continuous flow of topical information.	Mutual sense of awareness increased by open audio channel. Sensation of co-presence. In essence a virtual open office was created.	Practice of signaling of in a mobile environment (en route). Awareness for travel rhythm supports the anticipation of communication.
Main benefit	Secure attachment, maintaining shared sense of context.	Real time coordination dashboard, reducing interruptions.	Task coordination & common information space.	Virtual open office environment with sense of social presence.	Efficient coordination of mobile communication.

In *case five*, Skype™ is used as a mobile communication tool. The buddy list is a way of prioritizing and channeling communication events in the restricted time slots during international travel. A practice emerged whereby team members wait for Jack to log on to Skype™ in order to get in contact. From Jack's point of view, signaling availability is a way of making himself available for communication in an otherwise precarious situation (en route with time constraints). Team members on the other hand experience awareness for Jack's travel rhythm and can anticipate and plan their communication events around the time slots when he makes himself available.

The observable differences in these practices of awareness creation reflect the particularities of the different contexts in which the technology became embedded: different managerial cultures (more laissez faire in case *one*, more actively coordinating in case *two*), different task structures and different levels of semantics in what is shared: the status flags and open audio channel on the one side, clearly defined protocols of documenting status information (case *two*) or ongoing development work and related issues in case *three*.

Our discussion demonstrates that the creation of awareness in the cases is the result of social practices in which Skype™ has become embedded through processes of shaping, re-interpretation and appropriation. In the next section we will further elaborate on awareness and its sister concepts presence and co-presence from a theoretical view, while also drawing on the cases. We will first spell out the underlying theoretical assumptions of a practice theoretical view and then propose a re-conceptualization of the main concepts. Table 3 provides a summary of the identified practices of awareness creation in the five cases.

Towards a practice understanding of awareness, presence and co-presence

A practice theoretical view

Practices can be defined as a "routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, things and their use, a background knowledge in the form of understanding, know how, states of emotion and motivational knowledge"(Reckwitz, 2002: 249). Practice theory treats practices as the smallest unit of analysis, with single individuals as 'carriers' of socially shared practices (ibid.). A practice theoretical perspective introduces cultural and social dimensions of experience (cf. Ijsselstein and Riva, 2003; Mantovani and Riva, 1999; Riva and Mantovani, 2000). By doing so, a practice theoretical understanding appreciates the ambiguity of everyday situations and the role cultural frameworks hold in managing the complexity of everyday life in specific contexts.

Awareness is understood as an active embodied process that is generative of meaning and which is experienced by people as they immerse themselves in their lived world (Robertson, 2002). It is argued that awareness is a learned, embodied, skilful action, which is why awareness can never be a property of any technology (ibid.). Awareness can only be achieved by the skilful activities of participants in a shared environment, who draw upon technological resources in the creation of awareness. However, it is important to recognize that the meaning of those resources is not pre-given; rather, people learn and negotiate the meaning over time. From a practice theoretical perspective, analyzing awareness cannot be separated from human action but should rather be interpreted as an integral aspect of practice, with *being aware of something* as one aspect of these practices (Heath and Luff, 1992; Heath, et al., 2002; Schmidt, 2002). Accordingly, to know what a person is aware of can only be answered with reference to the practice s/he is engaged in. The practice theoretical perspective presents individuals as competent agents who are actively involved in activities that are meaningful to them and who ascribe the same meaning to events if they share common experiences (Schmidt, 2002). Practices of being aware and maintaining awareness are based on the intertwined processes of monitoring the activities of others and the (intentional and unintentional) signaling of one's own activities in such a way that they can be picked up by others (see below). In the literature a practice understanding of awareness creation is only just emerging, selected quotes are presented in table 4.

Table 4. Quotes indicative of a practice understanding of awareness production

Quotes	*References*
"Awareness is not the product of passively acquired 'information' but is a characterization of some highly active and highly skilled practices."	(Schmidt, 2002, 292)
"The practical production of awareness is embedded in and inseparable from organizational routine and practice."	(Heath, et al., 2002, 344f.)

Reflecting the concepts

As a synthesis of the discussion so far – the critique of the technology view, our case analysis, and the practice theoretical understanding introduced above – in this section we spell out our understanding of the main concepts. In doing so, we claim that 'virtual' presence and awareness cannot be technically 'produced'. In the following, we therefore draw on the work of Giddens (1984) to develop a practice theoretical understanding of these concepts. More specifically, we argue that the notions of presence, co-presence, presence availability and awareness are relational constructs and need to be clarified, delineated and contextualized. In order to do this we posit a distinction between the perspectives of Alter (the other, the others) and Ego. We use our cases as well as metaphors from classical office settings to illustrate the differences between the mentioned notions. While we first concentrate on the presence and availability of people, we later extend awareness to other entities such as tasks and documents.

Presence

Giddens (1984) denotes with presence a 'being there' (*Dasein*) of Ego - that is the situation of the *active body* oriented towards its tasks. Presence means that Ego is thrown-in-the-world and exists towards her tasks, which always already implies modes of understanding (*Verstehen*) and feeling (*Befindlichkeit*). As such, Ego has the *potential* to act, to communicate or to respond, sometimes even a sense of acute attention. Consequently, presence emphasizes the embodied personal engagement of Ego who exists and is always bound towards a particular local (work) context. Emphasizing with presence the embodied engagement of Ego directs attention to the fact that even in 'virtual' settings Ego's bodily existence remains the only source for her to discern the (computer-mediated) world. Ego's corporeal engagement poses constraints not only on what she is discerning in her situated context but also on forms of social participation with others. From this, the need arises to create awareness of Ego's presence for Alter to be able to act upon and align his own actions in accordance with Ego's presence and local context.

In each of the five cases, the actors' contextual presence had strong implications on how they engaged with both their co-located and dispersed colleagues. Most prominently this can be illustrated in *cases one* and *five*. Karl moved to another location, which led to a decline in the PhD students' awareness for his presence and context. By means of using Skype™ Karl was finally able to bridge this gap and extend his presence availability (see below) to the work environment of his PhD students. In *case five*, Jack is traveling. This constrains his ability to engage socially with colleagues who remain in their local work contexts. However, by using Skype™ Jack is able to make himself available and create awareness of his travel rhythm, i.e. his changing presence over time.

Presence availability

Presence availability defines "means whereby actors are able to 'come together'" (Giddens 1984: 123). While in traditional societies, means of transportation posed constraints on people's availability, ICT and its separation of time and space radically changed the nature of presence availability as people can communicate without being physically present. In co-located settings, buildings shape the nature of presence availability in various ways. As people are working and living in the direct vicinity of others, presence availability is usually taken for granted. However, in a distributed environment presence availability does not occur naturally but has to be re-created by means of using communication technology; presence availability thus is always mediated through some kind of technical device.

In the five cases, we found that Skype™ enabled new means for actors to come together who are not any longer limited to their physical location. For example, in *case one,* by means of a shared practice of signaling, Karl was able to make himself available for his PhD students, thus being 'virtually present' (i.e. available) in the work context of his students in order for them to turn to Karl whenever they needed him.

Hence, for Ego, by making herself available to Alter by using communication technology, she is introducing new forms and levels of presence availability into the (distributed) working environment. In the case of Skype™, the green status icon indicates that Ego's machine is online, which is typically taken as proxy for Ego is online. Ego becomes available in the virtual space regardless of Alter paying attention or acting upon noticing Ego's signal. A metaphor for this signal is the light in the room indicating someone's presence. However, Ego is present to Alter only as a result of an active process by Alter of 'making her present' (*Vergegenwärtigen*), i.e. by way of imagining Ego in her work context. That is, the signal is interpreted as part of Ego's overall working context as Alter imagines Ego's current situation based on his awareness of her routinized practices.

Co-presence

Referring to Goffman, Giddens defines co-presence as a sensation agents have whenever "they are close enough to be perceived in whatever they are doing, including their experiencing of others, and close enough to be perceived in this sensing of being perceived" (Giddens, 1984: 67-8). A traditional setting for co-presence is being together in a large room without being adjacent to each other. However, the notion of 'being close' is not limited to physical proximity, rather Giddens argues that computer-mediated communication also permits some of the intimacies existing in unmediated contact between those who are physically present (ibid). In fact, the perception of *closeness* depends on creating a social context that facilitates the development of a sense of community.

Co-presence as a concept is closely related to presence availability. At the same time as Ego can extend her own availability to the context of Alter, she can also perceive Alter's availability in the virtual environment. Ultimately, through intensive communication and the sharing of her work environment with Alter a sensation of co-presence might occur, if Ego senses mutual closeness with Alter in that Ego believes that Alter can perceive what Ego is doing. While presence availability exists regardless of any interactions between Ego and Alter and acts as a potentiality, it is the actual encounters in the virtual environment and the mutual awareness (see below) of each others' presence that creates a mutual sense of co-presence between Ego and Alter.

In the case of Karl, for example, presence availability facilitated a *feeling* experienced by the PhD students of being in the presence of the supervisor. Presence availability signaled the potential to act or respond, i.e. Jack remained in the background for the large part, but was available and therefore close just in case. Hence, the experiencing of co-presence, even in the form of a distanced presence of Ego, when noticed by Alter, may convey a comforting (or – depending on the type of relationship - unsettling) sense of "I am not alone" with Ego being available if needed.

Moreover, such a sensation of closeness and intimacy may at the same time shape communicative practices whose form might be altered accordingly as people enact variations of existing communicative practices. A good example provides *case four*, in which Sunrise team members experienced a form of closeness and intimacy by means of the open audio channel that altered their ways of going about the organization of their work. By experiencing a strong feeling of co-presence not only Declan's feelings of remoteness eased, also the daily work became richer and much more effortless as all team members where able to experience each others' work contexts and the feelings and emotional state of team members (*Befindlichkeit*). Hence, co-presence has implications on practices of awareness creation.

Awareness, attention and practices of signaling and monitoring

The notion of awareness is closely related to the concepts introduced so far. It denotes Alter's latent perception of Ego's presence (or absence). Related to co-presence it denotes the mutual or reciprocal perception of each other. In addition, awareness can extend to other phenomena of the shared virtual space such as tasks, themes, virtual objects, the shared workspace, etc. As such, awareness is the result of shared social practices of signaling and monitoring. Signaling and monitoring can be seen as two sides of the same coin in the creation of awareness; they form a duality with both concepts relying on each other, as the monitoring of activities that are relevant for one person requires that those aspects are displayed by others. Consequently, awareness means that Ego is aware of activities of Alter that are meaningful to Ego.

Signaling and monitoring need not be deliberately acted out; it can be rather latent or peripheral, being an implicit part of other activities. A good example of peripheral signaling can be found in *case four,* where rich information of the shared work and contexts is implicitly transported by the open audio channel. Because of shared stocks of knowledge and a contextual understanding of their surrounding, individuals' observations can take on an almost effortless appearance. That is to say, while Ego is involved in activities, she might at the same time observe aspects related to Alter that are only peripherally relevant to her current activities. Monitoring thus can be implicit almost like noticing the light or noises coming from a colleague's office in passing.

Monitoring can also be more conscious in the sense of paying attention, e.g. as in active monitoring who is online in the buddy list of Skype™. The same holds true for signaling: Ego might skillfully and actively engage in displaying those activities she reckons as meaningful for Alter. Good examples can be found in *case two* with the active task-related signaling via speech bubbles, in *case three* with the signaling of work-related events, or in *case five*, where Jack actively signals availability for communication. A traditional metaphor for signaling availability is the open office door. By means of signaling, Ego might also request Alter's attention. Attention as such denotes an active

state of communication or the preparation of it. An example can be found in *case one*, where a practice of outeraction was established, whereby the PhD students would post an instant message asking "Are you free?" (see above). A traditional way of requesting attention is knocking at the office door.

Technology appropriation and the contextualization of practices

Awareness as portrayed above is not a feature of the technology, but the result of shared practices in which the technology becomes embedded. Essentially, defining awareness only in terms of technical software features ignores the subtle ways in which groups are able to create awareness through their shared practices of using technology "as a resource for awareness, whether originally intended by the designers or not." (Robertson, 2002, 311) Due to its impact on communicative practices, technology plays unquestionably a vital role in the process of awareness creation by enabling and also constraining social practices: while technology cannot *per se* produce awareness, specific features enable (or constrain) the creation of awareness. Such features still have to be appropriated by members of the social community; this can lead to their re-interpretation. Examples can be found in *case one*, where Jack and his PhD students established a practice of signaling that is based on a re-interpretation of the Skype™ status feature. In *case two* the speech bubble feature was reinterpreted for task-related signaling. The examples show that flexible tools, such as Skype™, can be used in manifold ways for the creation of awareness. Consequently, only through processes of appropriation can we understand the emergence of shared practices of awareness creation.

Through appropriation, technology and the resulting practices become deeply embedded in the social contexts of people. In our cases, we encountered two different organizational settings in which issues of presence or availability were embedded: the personal relationship and the virtual working environment. In *cases one* and *two*, Skype™ is used by professors who signal or negotiate their availability in the context of working relationships with their PhD students and research associates. In both cases, the resulting practices of signaling are idiosyncratic in that the signals being used are only meaningful to the two professors and their groups, but not necessarily to other people in the buddy lists. Hence, practices are contextualized and can only be understood in the context of the respective social relationships. In *cases three* and *four*, Skype™ is used to create a hybrid working environment, in which the virtual communication space permeates and extends the physical space. Status information is not focused on a single person but has been incorporated in the daily routines and working environment. The objects of awareness are not just people, but tasks, topics, and emotions. The shared practices are contextualized by and embedded in the shared virtual working environment created by the appropriation of technology.

Implications for future research

Most CSCW studies treat awareness as a design problem: tools need to be built in certain ways to enable awareness. Gross and colleagues suggest that "existing CSCW applications only partially support…awareness" and that in order "to enrich the existing CSCW applications with the missing features" empirical research is needed to constantly identify gaps in awareness support; also, "novel behaviors might be recognized that lead, in turn, to novel features, and so forth." (Gross, et al., 2005, 356) However, such technology might turn out to be too restrictive, it might not fit the particular context and also the need for awareness in context might change over time. As Heath et al. state: "…solutions which attempt to specify the width and focus of awareness a priori are unlikely to support even the most simple forms of collaborative activity." (2002, 345) Drawing on our cases, we suggest to further investigate the potential and use of flexible tools that allow and enable multiple ways of awareness creation. While Skype™ itself is a relatively simple tool, in our cases it was used very successfully in the creation of all kinds of different forms of awareness highly specific to the particular contexts.

Moreover, existing studies often investigate and scrutinize ways of awareness production in traditional co-located environments in order to learn about the ways in which awareness is created. However, the aim of such research typically is to embody this knowledge in an IT artifact, whose aim it is to produce an analogous form of awareness in the virtual space. Hence, while in the beginning such research acknowledges awareness as the outcome of social practices, attention subsequently shifts to a technology view of awareness production. Drawing on our discussion above, we suggest, rather than focusing attention on how to design and built-in more awareness features, more research should investigate the shared practices in context and aim at understanding why some tools appear to be better than others at facilitating or enabling practices of awareness creation.

Also, empirical research to investigate awareness-related issues is typically carried out in a singular context or in prototype-based experiments with students; such studies typically identify certain shortcomings that are

subsequently translated into new design requirements (see for example Scupelli, et al., 2005; Tran, et al., 2005). Given our findings, we see a problem with the ecological validity of such research (Bryman and Bell, 2003). Since real-life situations are much more diverse, we can expect the usage and appropriation of technologies to be as diverse. Consequently, results of experimental studies are very limited in terms of transferability. We suggest carrying out more cross-case analyses that try to capture and learn from the diversity found in context; such research should explicitly aim at understanding the appropriation processes that lead to shared practices – an aspect that was not covered in our study.

As for suitable research methods rich methods for data collection are needed to appreciate and grasp existing social practices and their complexity and embeddedness. Obviously, ethnographic studies and workplace observations are very well suited to gain an understanding of how people draw on and use ICT in their practices of distributed work and awareness creation. Other methods of inquiry are less able to grasp the embedded nature of social practices. Also, people might not be able to give true accounts of how they use ICT in their practices with others. Hence, the application of interviews can be seen as problematic. However, from our own experiences we found open-ended or semi-structured interviews to be very helpful for gaining a first understanding of the case context, the practices and the tool usage. In combination with other methods (such as log files analyses or observations), interviews are necessary to understand how people perceive and act upon the activities of others. Particularly helpful are *interviews in situ*, i.e. interviews in the workplace that can be combined with ad hoc demonstrations of tool usage and communication practices. We found such ways of data collection to provide a rich picture of the social practices comparable to the outcome of observations but with much less effort and cost for both interviewer and interviewee. As for more formalized ways of data collection (such as questionnaires) we question the ability to grasp the social context and the uniqueness and situatedness of the particular case due to a lack of flexibility of such methods and also the distance between researcher and the people under investigation.

To sum up, we argue for a shift in research attention and also new approaches in designing tools. Research should not (only) try to build more and more specific awareness features, but aim to learn about the underlying nature of awareness creation and to design (or select) tools that are flexible enough to enable diverse sets of shared practices of awareness creation in context. Consequently, we need a more elaborate understanding of what is termed the 'interpretive flexibility' of technologies such as Skype™ (see Doherty, et al., 2006).

Conclusion

Technology does not produce awareness. Rather it facilitates and enables awareness in distributed environments by means of becoming embedded in the context and in shared social practices of signaling and monitoring. Our cases demonstrate that work groups can exhibit quite different practices in which different technological features are appropriated. Across the cases we were able to sketch out a diverse set of practices of awareness creation that move far beyond what would be expected for a simple tool such as Skype™. The cases have illustrated distinct organizational settings in which technology is used, appropriated, and shaped. While a limited set of affordances has yielded organizational transformations, some limitations of the technology vis-à-vis the organizational setting also became visible (see *case two*: signaling cannot be restricted only to Martin but is always visible to the whole group).

In the course of our suggestions for conceptualization we have emphasized the actions and practices that have been facilitated and partly shaped by the technology. We conceptualized awareness and presence as related to each other. While awareness is the outcome of shared communicative practices of signaling and monitoring, we interpret presence as the embodied personal engagement of the individual with its work context. Presence availability denotes the ability to make oneself available in the virtual environment, while co-presence refers to the sensation of closeness that is the result of rich awareness of each others' presence (and availability) in the shared virtual context. We posit that technology needs to be seen as embedded in relationships and working environments. The practices we found extend and re-interpret technological features and use them primarily as a platform for communication and the creation of awareness.

Awareness undoubtedly remains one of the most important and challenging issues in distributed/virtual work – further research is needed to extend our understanding of awareness in context. By taking a practice perspective of awareness creation, future research might aim at investigating in context the potentiality of technologies and the ways in which people draw on different (types of) IT artifacts in their shared practices. Rather than designing new features, design-oriented studies might take a holistic approach that extends beyond the artifact and aims at gaining an understanding and subsequently new (socio-technical) methods for facilitating awareness creation in context.

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