

# Getting used with groupware – a *First Class* experience

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## Abstract

This article reports on an empirical investigation of long-term use of a groupware system in a spatially and massively distributed network of educators. It is a case study based investigation aimed at understanding the impacts of collaboration technology in supporting social interaction. The paradigm of social constructivism and the perspective of *structuration* are proposed as frameworks for understanding the impacts of technology on mediating social interaction. Utilizing these perspectives in an empirical investigation, the case study findings demonstrate how collaboration technology can serve as a change agent in transforming the culture and structure of social interaction. This is enacted in two ways: through the various meanings which people construct when interacting with technology and in benefiting from the structural properties of a system through its technical *affordances*.

**Keywords:** *Groupware, Structuration, Implementation, Social Constructivism, ICT in Education, Case Study*

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# 1. Introduction

Groupware is a general term for a repertoire of ICT applications that support cooperative work between and among groups of people. Collaboration technologies, cooperative systems, coordination tools, group support systems, etc. are synonymous with groupware technology. Groupware systems are used to support and carry out the social domains of work, i.e. the aspect of one's job in which interpersonal interaction and cooperative processes take place. These are activities that are basic to most tasks but are not officially specified as part of one's tasks. For example, someone sends an email to a colleague asking a favor: if she can get a copy of the presentation he gave the other day because it contains a nice presentation template that she can use for her report. Actions like these are informal, intermittent, synergetic and largely unstructured. These properties make them difficult to specify in advance. Consequently, these are the activities groupware systems are meant to support. According to Andriessen (2003), groupware systems can be distinguished from other ICT applications by having functions that serve the following human interaction processes:

- communication, i.e., exchanging signals
- cooperation, i.e., working together, making decisions
- coordination, i.e., adjusting the work of group members, leadership
- information sharing and learning, i.e., exchanging, sharing information and knowledge
- social interaction, i.e., group maintenance activities, developing trust, cohesion, conflict handling, reflection.

By mediating human interaction and communication processes, groupware systems have the potential to bring about dramatic changes to the social functioning of individuals, groups and organizations. Extensive research has been conducted on the impact of groupware on group performance, dynamics, outcomes, as well as organizational functioning (Galegher and Kraut, 1994; Pinsonneault and Kremer, 1989; Vogel and Nunamaker, 1990). For example, Bikson and Eveland (1990) and Connolly (1996) report that the anonymity feature of a group decision support system enlarges the scope of user participation and enables the expression of negative opinions. In normal face to face meetings such are rather difficult to convey. In return, anonymity helped improve the quality of input to group decision-making. In another study, an integrated groupware system has been observed to bring about changes to the way people collaborate in the form of increased pro-activity, increased utilization and

dissemination of knowledge and new forms of coordination (Orlikowski, 1996). While there have been numerous studies that report the positive consequences of groupware technology, a number of studies have also observed instances of groupware implementation failures (Pumareja et al., 2003; Grudin, 1988). These failures relate to issues such as user acceptance, adoption, organizational and cultural contexts and poor system design (Andriessen, 2003; Grudin and Palen, 1995).

In the following case study, we try to expand the scope of empirical research aimed at understanding the impact of collaboration technology on social interaction. Utilizing a social constructivist paradigm and a *structuration* perspective as theoretical take-off points for analysis, the investigation of the case is guided by the following questions:

- How does a spatially distributed group of workers make sense of groupware technology?
- How do the collaborative features of a groupware system shape distributed social interaction?

The case study was conducted among a network of geographically dispersed educators working for an institute of higher education. Qualitative research approaches were employed in conducting the case investigation – in-depth interviews, demonstrations of system use, system inspection and participation in using the system, and document analysis. A total of 17 interviews were conducted from a representative group of educators (14) and system administrators (3). These respondents were visited in their place of work, which is mostly at home and in the central and regional offices. We asked to demonstrate how they use the system and we observed the interaction with their digital workspaces.

The presentation of the findings of this study is structured as follows. We first discuss the theoretical framework. It is followed by the research setting and work context, the presentation of the case and its analysis. We conclude with a discussion of the findings.

## **2. Theoretical framework**

Social constructivism is one of the dominant paradigms used to analyze and understand impacts of groupware technology in the social domain of users (Bijker, 1990; Fulk, 1993; Mackenzie and Wajcman, 1985). This thinking embodies the notion of a social shaping of technology through the shared construction of meaning, interpretation and sense-making by human actors. Within this perspective, technology is considered to be equivocal (Weick, 1990). It can achieve multiple meanings which could be both consistent and conflicting,

despite the fact that there is only one possible technical description through its specification. Drawing from this paradigm are several theories of technology and social interaction that aim to provide more profound conceptual lenses for studying the impact of groupware technology. One example of these is the *structuration* perspective, which takes root from Giddens' (1984) meta-theory of *structuration* (Poole and deSanctis, 1990; Orlikowski, 1992b; Hettinga, 2002; Ruël, 2001). The main ideas of *structuration* theory as synthesized by several authors (Clark et al., 1990; Volkoff, 1999; Hettinga, 2002; Andriessen, 2003) are:

- Structures consist of both social entities and their properties, i.e. organizations, groups are social structures as well as their hierarchies, rules and resources. A groupware system in an organization with its hardware and software components is a structure in the same way an institutionalized system such as taxation with its own rules and procedures is also an instance of a structure.
- Structures serve both as medium and outcome of action. Humans draw upon structures for action which could enable or constrain, and in return reproduce these (structures) as a by-product of interaction. *Structuration* is the process of producing and reproducing (reinforcing) structures in a dynamic interaction between humans and social systems. This is called the principle of duality of structures.
- Human agents are knowledgeable and are capable of exercising their powers to accomplish a social practice, i.e. they can choose to change or confirm structures.
- There are three modalities of *structuration*, i.e. domains in which the interaction between human action and social structures take place. These are in the domains of meaning-constitution, power relations, and norms and legitimation.

Applied in the context of technology, Orlikowski (1992b) extended this perspective into a *structuration* model of technology. She put forward the notion of duality of technology – technology is used as a means to accomplish some action and is likewise created and changed by human action. This is reflected in the two modes of human interaction with technology, namely, design and use. Technology is physically constructed by actors in a given social context and is socially constructed by actors through the different meanings they attach to it and in the various features they emphasize and use (Orlikowski, 1992b). When making use of a groupware technology, users draw upon its features and resources (structures) such as enabling communication across time and space. The continued habitual use of this medium reinforces the structural role of the technology in the organization that implemented it. Over time, the groupware system becomes institutionalized as the medium of communication of

the organization, making office memos and bulletin boards obsolete. The institutionalization of technology is its detachment and objectification from human action, thereby becoming a structural property of the organization. The *structuration* model of technology is also premised on the knowledgeable and reflexive aspects of human actions. That is, agency is the capability to perform action which can have intentional and unintentional consequences. In a related study, Orlikowski (1992a) studied the use of Lotus Notes where it was implemented in consulting organization with the intention of supporting collaboration and knowledge sharing. However, the competitive culture of the organization had resulted into a non-collaborative use of the system. It was instead used a personal productivity tool.

The *structuration* perspective of technology fits well with the notions of improvisations, appropriation, innovations and socio-technical evolution that are associated with groupware implementations. Groupware implementations have been observed to undergo a ‘drift’, where the original intentions for use differ from the actual exploitation and purposes in which it is used for (Ciborra, 1995).

### **3. Research setting and work context**

The case study was conducted among a distributed group of educators who provide training and consulting in the domain of special education and orthopedagogy. This network of educators makes up the teaching faculty of the Institute for Orthopedagogy. The Institute is one of the departments of the Faculty of Education of a large city college in the Netherlands. The Institute for Orthopedagogy is one of three institutes of higher education that provide postgraduate level education in the country. Therefore it operates at the national level, with the head office in Utrecht and regional offices nationwide. Its core line of business is the provision of postgraduate education and training for teachers who would like to earn a qualification diploma in order to teach special education. Teaching special education is a regulated profession, meaning a successful completion of bachelors-level education in teaching is necessary prior to enrolling in the course. Next to this, it also provides in-house training and consulting services to primary schools nationwide that have a special education component. Its clients include most primary education teachers, special education teachers, primary schools and to a certain extent private individuals. Special education is generally understood as educating students, in this case primary school children, with special needs, i.e. autistic, dyslexic, children with handicaps – blind, deaf, mute, children with learning disabilities among others. From time to time, the school also performs clinico-psychological

diagnosis of children with mental and emotional problems. The background of the educators is diverse – some of them are psychologists, teachers with master specializations or teachers with extensive teaching experience.

The provision of postgraduate education and training is organized in such a manner that the teachers (the students of the school) receive instruction at the place where they live and work. The spatial distribution of the educators across the country is a consequence of this organizational set-up and work configuration. Most of the educators work at home. The Institute provides them with a home-office facility that includes furniture, computer and software. The educators would then have to provide a space in their homes as work area. The work is structured in a flexible manner, not an 8–5 schedule. Sometimes, an educator finds herself giving a 3 hour lesson in the morning or in the evening, or attending a meeting with the administrators of the school. When not attending meetings, giving lessons or having appointments, most of them perform their other tasks at home, i.e. curriculum development, lesson planning, checking papers, etc. When working at home, they have the freedom to structure their own schedules, i.e. having an appointment with the plumber during the day and compensating that by working late at night.

The execution of one's tasks is largely performed on an individual basis. Collaborative activities take place in between, i.e. curriculum and instructional development, course evaluation, planning and coordination, etc. Most of these activities take place through the groupware system. The central office together with the competency centers which each educator belongs, also organize several face to face meetings to further stimulate collaborative activities. However, in most instances, the educators work alone. In some locations, an educator hardly sees her colleagues in the region nor is she familiar with them. But that does not mean that she gets the feeling that she does not know them or cannot be acquainted with them. The groupware system helps her overcome that obstacle.

#### **4. Background to the acquisition and implementation**

Eight years ago, the ICT Manager and a core group of educators were acquainted and impressed with the experiences of a similar institution from Sweden in implementing a groupware system. The Swedish institute was using a Macintosh-based groupware for supporting its teaching and learning processes. The Macintosh compatibility of the system augured well for the Institute, who at the time was using those kinds of machines. Further, the Institute was keen on applying ICT applications for educational and support purposes in the

light of the increased diffusion of information technology. Providing the motivation for this is the generally shared view in the educational sector that regards the use of ICT applications positively. This is inline in bringing about renewal and improvements in the quality of education for which massive support and funding was available.

The collaboration system that the Institute acquired and implemented is an integrated COTS (Commercial Off The Shelf) groupware application called First Class Client ([www.firstclass.com](http://www.firstclass.com)). The users usually referred to it as FCC for brevity. It was originally built for Macintosh machines. Its collaborative features were mainly marketed in the beginning as support environment for online learning. Among its very first users were schools and educational institutions. Its design concept and intention as tool support for online learning continue to hold despite having been proprietarily bought by a third-party software development company. It remains to be associated in the domain of educational and learning support.

As an integrated collaboration system, First Class Client contains a range of built-in features for enabling collaboration. These are email, shared workspaces, asynchronous chat, conferencing, individual and shared calendars, private and public directories. Further, the system has an accompanying programming environment for developing customized applications.

The system was bought in 1995 and was put into pilot use among 23 educators living within the environs of the central office. Later it was implemented with the secretaries in the main office. This process was administered by a former educator who later became the administrator for the system together with other technology-savvy educators keen about the system. These technology keen educators saw the bigger potential of the system as a communication infrastructure for overcoming the challenges of a distributed organizational set-up. These people became project champions for the eventual roll-out of the system throughout the Institute, effectively replacing the existing email system. The implementation was supported by mandated policies for use which were integrated with the home-office package support provided by the Institute for its employees. Most of the computer units acquired for the home office were IBM compatible PCs, hence the Institute also switched to the PC version of the system which was already available.



## **5. Features of long-term groupware use**

The deployment of First Class Client enabled a series of changes in the Institute particularly in terms of facilitating communication and social interaction as well as transforming work. The long-term implementation of the system can be classified into two phases of use: early use phase and an established use phase.

### **5.1. Early use phase**

The early use of the system in the Institute is a period of adjustment for getting used with the system. It is characterized by efforts aimed at promoting the use of the system.

#### ***Positive and opportunistic attitudes towards technology***

The implementation of the system was largely brought about by a positive and opportunistic attitude towards technology of the small group of people responsible for the IT resources of the Institute. This was reflected in their tech-savvy mindsets that eventually made them the system's sponsors for the entire Institute. These were the people who have made their acquaintance eight years ago with the Swedish educational institute that was using First Class Client. Their positive mental model of technology was reflected in their profound appreciation of the collaborative features of groupware technology which they thought is something the Institute needs.

#### ***Institutionalization***

The profound appreciation of the possibilities of groupware technology was influential in establishing an institutionalized use of the system. This was enacted through an official mandatory use policy of the system. The system administrator, being in a powerful position as IT resources manager and having advanced knowledge about FCC, played a key persuasive role in formulating and executing the policy of compulsory use. All educators working for the Institute had to make use of the system. They were given installation CDs for their home PCs. Every new employee who was entitled to a home PC would get the unit with a pre-installed system. At the same time, they have two weeks to get familiar with the system and be online.

#### ***Drift in intended use***

While the core design concept of FCC was to promote an online learning environment, i.e. support the communication between teachers and students, the system sponsors in the

Institute have instead chosen to use the system to support internal communication in the Institute. The system was utilized as a communication infrastructure for bringing together the geographically distributed educators. This action is a by-product by their opportunistic outlook about the possibilities the system and relating it to the current problems encountered by the educators. This is reflected by the system administrator:

*“Before, the teachers had to drive all the way to [the Institute] to bring their materials for reproduction. Or they sent it to each other by post and fax. A portion of their telecommunication expenses is reimbursable. With FCC, all of that has become easier and faster.”*

### ***Technological accommodation***

Despite getting no official training on how to use the system, the educators however compensated for the system. That is, they spent extra time to learn about the system as well as taking efforts in asking for help. This is attributable to the fact that users do not have a choice – it is the only computer-based communication tool available next to the telephone and they are mandated to use it.

## **5.2. Established use phase**

As system use intensified, with more users becoming part of the online network, a series of changes were observed, and the system took a more defined role in the Institute.

### ***New forms of communication and collaboration***

Communication and collaboration in the Institute took a massive transformation with the implementation of FCC. All educators agree that with FCC, communication and collaboration have become more efficient, i.e. faster and more convenient. Whereas before, most of them would send each other material by post and fax, they now send each other digital files through FCC. Time savings were realized through FCC with the capacity for accomplishing more tasks enabled. Likewise, it enabled them to communicate and collaborate with colleagues from other locations whom they do not even know. It is also now possible for them to send messages to a large group of people at the same time. The system also facilitated the knowledge-sharing among educators in ways not previously possible. One educator remarks:

*“When I have a question or I need some references about a topic, say dyslexia, I just send an email in that particular knowledge center or to my group and I get replies right away.”*

### ***‘Closed system’ mental model***

The convenience of not having to remember a colleague’s email through the public directory feature of FCC had led the users to a mental model of FCC as a closed system. They have formed a rather consistent and shared view of FCC as an exclusive system, and thought that for other people outside the Institute, it is not possible to send email to or receive email from them. However, the system in fact does allow this. All they need to do is simply type the email address of the person they would like to send email to. Only because they cannot find the names of these people in the public shared directory, they thought it is not possible. As a consequence, most educators maintain a second email address from free email services such as Hotmail and other internet service providers. The following educators’ comments give insight to this:

*“When I went to Malaysia for vacation last winter, I was able to access FCC through the web. I can read my email and get in touch with my work. However, I applied for a Hotmail account so that I can send email to my children. But I didn’t know that it is possible to do that via FCC. However, my children are not part of FCC, they are not in the system and they don’t have it.”*

*“I also have another email address. I use that to communicate with the clients. I do that because they are not on FCC and they do not have FCC.”*

Likewise, this mental model of a closed system is also shared by the system administrator. Before this research was undertaken, the system administrator suggested that it is better for the researcher to be part of FCC in order to gain access to the educators. An account was created for the researcher for the purpose of accessing and coordinating with the users.

### ***Socialization platform***

In this later period of use, the system had become the de-facto socialization space, especially for new employees. This is the space where new employees get to know their colleagues and introduce themselves. This is because the set-up of the work in the Institute does not allow for the usual new employee introduction and socialization. This is reflected in the comment of a newly-hired educator of the Institute:

*“I met with the regional manager and the first thing he asked me was, ‘are you already on FCC? You know, the coordinator of the knowledge center you belong also lives here in the area. You can find her name in the address book and maybe it is useful to introduce yourself to her’.”*

### ***Norms for interaction, social responsibility and forced reciprocity***

In the course of continued use of the system, informal norms for interaction emerged. These norms were formulated out of an unconscious process, i.e. it was not planned. Implicitly, everybody is expected to respond promptly to messages as a form of courtesy. Users were pleased and at the same time surprised at the prompt replies of their colleagues when they ask a question or request information. In return, they get the feeling that they are obliged to reply back as soon as they can. This way, the system evokes in them a sense of forced reciprocity.

### ***Sense of urgency***

The features for supporting communication not only enabled faster communication among the educators but it also induced a continued sense of urgency. With colleagues responding quickly and promptly, some educators felt the increased pressure of work.

*“I find the system rather stressful. It increases work pressure unnecessarily. It gives you the feeling that work does not stop.”*

### ***Balancing individual privacy and work responsibility***

On the other hand, some educators find the system supportive in striking a balance between their individual private life and work responsibility. The system afforded them the convenience of receiving messages when they are not at home or responding to a message at the time when it is convenient.

*“You see, with the telephone, you have no choice. You have to pick it up right away when it rings. But with FCC, you can use it when it is convenient for you.”*

### ***Changed work rituals and habits***

The system has also brought about changes in work rituals and habits among the educators. For example, it had become a ritual for most of them to go and check their email first thing in the morning or before going to a meeting for any last minute changes. Likewise, work patterns have changed, i.e. working in the weekends and late at night. Some of them even cannot go to bed without checking their email for the last time. While these changes in work patterns are largely attributable to the nature of work in the Institute, the system however, forges a reinforcement of such.

### ***System as the conceptual representation of the organization***

In the absence of a physical space symbolizing the organization within their sight, the users have turned to the system and their computers for orientation. In other words, the system serves as their reference for anything related to their work because they are distributed in space. It is their window to the organization they work for. One educator puts it:

*“That little FCC icon on the desktop for me represents the Institute.”*

### ***Reflection and compassion***

Characterizing the later implementation and its sustained use is the continued reflective activities shared by the educators relating to the system. When they have the occasion for face-to-face meetings, they talk about the problems they encounter with the system.

Altogether, they make suggestions on how they can improve their skills in using the system better and more efficiently. For example, a group had asked the system administrator to provide training for them. They also ask each other how they perform certain tasks with the system when the system administrator is not available.

Reflection concerning the system at the individual level is also observed. This led to an increased appreciation of the value of the system and to enthusiasm in sharing this with others outside the Institute. As one educator puts it:

*“You see I also consult for a series of primary schools. I heard that there are plans of setting up a digital knowledge network for the teachers. I would like to advise them to consider using FCC.”*

Likewise, they are also concerned when one is having problems with using the system, i.e. someone is not used to using computers. One particular educator manifests her compassion with her colleagues this way:

*“When I make a reply or send a forwarded message, I remove the unnecessary information on the text that is not relevant. I find that pollution and not necessary. We already had a lot of work to do and we do not have time to sort all information.”*

### ***Institutional inevitability and invisibility***

Over time, the FCC had become an inevitable tool for the Institute. The cooperative aspect of the work of the educators is effectively supported by it, such that had become invisible in the communication and collaboration process:

*“I use FCC nowadays more than I use the telephone.”*

*“When I want to ask a colleague something, my first instinct is to use FCC. Unless it is something that needs to be discussed more thoroughly, then I call or we make an appointment for a meeting.”*

## 6. Discussion

The findings of the case analysis demonstrate how technology can serve as an agent of change in transforming the culture and structure of social interaction in a distributed organization. The notion of a mutual shaping of technology and social structure encapsulated by the *structuration* framework is useful in gaining an insight of the mediating effects of collaboration technology to social interaction. These notions are operationalized in terms of two analytical frameworks:

- Shared construction and assignment of meaning to collaboration technology
- Shaping of social interaction through the technical features and *affordances* of collaboration technology

### 6.1. Shared construction and assignment of meaning to collaboration technology

As early as the planning and initial use of the system in this case, social construction and assignment of meaning is already in place. This was manifested in the taking advantage of the collaborative functionality as a communication infrastructure. The system sponsors did not proceed with the intended use of the system as an online learning environment. Instead, they implemented the system as a communication infrastructure for bringing together the spatially dispersed educators. This decision is brought about by their reflective examination of the problems they encounter as a distributed organization where communication and effective performance of tasks were time-consuming, inefficient and sometimes irritating. Through their widened mental model of technology indicated by their profound appreciation of the collaborative features of groupware technology, the systems sponsors had constructed the system as a solution to their problem.

In the later established use of the system, various mental models of the system were evoked among the users as a result of interacting with it. First among these is the mental model of a closed and exclusive system where the system, unintentionally, had become instrumental in drawing the boundaries of social interaction for the group. For the network of educators, it was clear to them who are part and not part of their social network on the basis of who are the people they can see as listed in the public directory. At the same time, people reify their membership and make their presence visible in the social network by making use of the system to participate in the online interaction. This creates another level of social bounding

which distinguishes those people who are active online and those who are not. Next to this is the mental model of a window to the organization. Despite that work is executed largely on an individual basis, the supporting processes and information needed in effectively accomplishing the tasks have a social context. By being distributed in space, the educators felt isolated in their work and they turn to the system for orientation and for keeping in touch with the organization and their colleagues.

## **6.2. Shaping of social interaction through the technical features and affordances of collaboration technology**

Independent of the meaning users assign to a system, the collaborative features of a technology in interaction with its users also shape the structure of social interaction. Likewise, it can also bring about unintended consequences to the social environment. These are known as the *affordances* of technology.

Becoming a virtual space for socialization is a foremost example of the technological *affordances* of the groupware system. It supplanted the physical space where socialization takes place into something symbolic and virtual.

The implementation of FCC in the Institute also led to the formation of several structures and behavioral changes. These are in the form of norms, i.e. making agreements, replying promptly, new culture of collaboration and communication, such as increased social responsibility. On an individual basis, the system brought about changes to the work habits of people by making the system part of their work ritual. The assimilation of technology into their work in return affects the other people in the network. Giving prompt and quick reply, or replying late at night to the email of a colleague gives the recipient the feeling of forced reciprocity, a sense of urgency when not necessary, and stress.

Consistent with the *structuration* perspective, the presence of reflexivity is also observed in this case. Reflexivity is found in the shared effort of the users to talk about the system. FCC was not only the medium of communication for the users, but it is also the object and subject of communication for them. In other words, the system was used to mediate communication about itself. Consequently, this had helped in sustaining a positive view about the system, appreciating its usefulness and putting it into continued use.

Lastly, it is also observed that when a collaborative system has succeeded in becoming a useful mediation tool, the tool becomes invisible. It is assimilated into the communication

and collaborative processes of the users, such that when it breaks down, the social interaction also breaks down.

## References

- Andriessen JHE (2003) Working with groupware: understanding and evaluating collaboration technology. Springer Verlag, London.
- Bijker W (1990) The social construction of technology. PhD Thesis, University of Twente.
- Bikson T and Eveland JD (1990) The interplay of work group structures and computer support. In Kraut R, Galegher J and Egido C (eds) Intellectual Teamwork. Erlbaum Associates, Hillsdale, NJ, 245–290.
- Ciborra CU (1995) Introduction: what does groupware mean for the organizations hosting it? In Ciborra CU, Groupware and teamwork: invisible aid or technical hindrance? John Wiley & Sons, Chichester.
- Clark J, Modgil C and Modgil S (1990) Anthony Giddens: consensus and controversy. Falmer Press.
- Connolly T (1996) Electronic brainstorming: science meets technology in group meeting room. In Kiesler S (ed.) Research Milestones on the Information Superhighway, Social Science Research Council Press, New York.
- Fulk J (1993) Social construction of communication technology. *Academy of Management Journal* **36**: 921–950.
- Galegher J and Kraut R (1994) Computer-mediated communication for intellectual teamwork: an experiment in group writing. *Information Systems Research*, **5**: 110–138.
- Giddens A (1984) The constitution of society: outline of the theory of structuration. University of California Press, Berkeley, CA.
- Grudin J (1988) Why CSCW applications fail: problems in design and evaluation of organizational interfaces. In Proceedings of the Conference on Computer Supported Cooperative Work 1988 (CSCW '88), ACM/SIGCHI & SIGOIS, NY, 85–93.
- Grudin J and Palen L (1995) Why groupware succeeds: discretion or mandate. In Proceedings of the Fourth European Conference on Computer Supported Cooperative Work (ECSCW '95), Kluwer, Dordrecht, The Netherlands, 263–278.
- Hettinga M (2002) Understanding evolutionary use of groupware. PhD Thesis. Telematica Instituut, Enschede The Netherlands.
- Karsten H and Jones M (1988) The long and winding road: collaborative IT and organisational change, Proceedings Conference on Computer Supported Cooperative Work (CSCW '98), Seattle, WA, ACM Press, 1998, pages 29–38.
- Mackenzie D and Wajcman J (1985) The social shaping of technology. Open University Press, Milton Keynes, UK.
- Orlikowski WJ (1996) Evolving with Notes: organizational change around groupware technology. In Ciborra C (Ed) Groupware & Teamwork, J. Wiley, Chichester et al. 1996, pages 23–60.
- Orlikowski WJ (1992a) Learning from Notes: organizational issues in groupware implementation. In Proceedings of the Conference of Computer Supported Cooperative Work (CSCW '92), ACM Press, 362–369.
- Orlikowski WJ (1992b) The duality of technology: rethinking the concept of technology in organizations. *Organization Science* **3**: pages 398–427.
- Pinsonneault A and Kraemer KL (1989) The impact of technological support on groups: an assessment of empirical research, *Decision Support Systems*, **5**: 197–216.
- Pipek V and Wulf V (1999) A groupware's life. In Proceedings of the Sixth European Conference on Computer Supported Cooperative Work (ECSCW '99), Kluwer Academic Publishers, 199–218.
- Poole MS and DeSanctis G (1990) Understanding the use of group decision support Systems: the theory of adaptive structuration. In Fulk J and Steinfeld C (eds.) Organizations and Communication Technology, Sage Publications, Newbury Park, 173–193.



Pumareja DT, Bondarouk T, and Sikkel K (2003) Supporting knowledge exchange isn't easy: lessons learned from a case study. 14<sup>th</sup> Information Resources Management Association International Conference, Philadelphia.

Ruël H (2001) The non-technical side of office technologies. PhD Thesis. University of Twente, Twente University Press, Enschede, The Netherlands.

Vogel D and Nunamaker J (1990) Design and assessment of a group decision support system. In Kraut R, Galegher J, and Egidio C (eds.) Intellectual Teamwork. Lawrence Erlbaum Associates, Hillsdale, NJ, 511–528.

Volkoff O (1999) Using the structurational model of technology to analyze an ERP implementation. Americas Conference on Information Systems 1999, August 13-15, Milwaukee, WI.

Weick K (1990) Technology as equivoque: sense-making in new technologies. In Goodman PS, Sproull LS & Associates (eds.) Technology and Organizations, Jossey-Bass, San Francisco, 1–44.