Doing mobility

Alexandra Weilenmann
Doctoral dissertation

Abstract

Despite the widespread adoption of mobile information and communication technology, there are still relatively few studies of their use. Previous studies often fail to capture the situated practicalities of mobility. Further, many previous studies are work-oriented, viewing the office or the control room as a base, and see mobility as a means of transportation. This thesis contributes to our understanding of mobility by presenting five empirical studies, showing how people involved in various sorts of activities go about *doing mobility*. This thesis presents the argument that mobility is something which is ongoingly produced and maintained by the participants.

The thesis presents a collection of studies in very different settings, ranging from practically stationary work to truly mobile leisure activities: the mobility of information inside and outside a traffic information central, mobile vehicle workers cleaning the runways from snow at a large airport, skiers testing a new mobile device, mobile phone use among young people in public places, and the mobility of a teenager seen through her mobile phone conversations. Methodologically and analytically the thesis draws upon the fields of computer supported cooperative work, ethnography, ethnomethodology and conversation analysis. The aim is to capture naturally occurring instances of mobility. Four approaches are identified to capture mobility: follow the actors, follow the technology, study a place, and study the virtual communication space.

The findings from the empirical studies show how the advent of mobile technology has not made people independent of place. 'Place' and 'the local' is important in the mobile world. When communicating with remote others, a lot of work is done in order to negotiate a mutual understanding of the situation at hand. Context is interactionally and continually negotiated. Further, this thesis provides examples of the highly collaborative nature of mobility, and thereby questions some earlier assumptions about mobile technology being private and personal. Results are presented which point to the various ways in which mobile technology is shared, and also how those using the technology get a sense of shared ownership of the technology.

Keywords: mobility, mobile technology, ethnomethodology, conversation analysis, ethnography, CSCW.

Acknowledgements

Contents

Chapter 1: Towards Understanding Mobility

Setting the scene

Mobility is not a new phenomenon. People have been able to interact using mobile information and communication technology for many years. Take for example truck drivers, who use radio systems to communicate while on the road, or the equipment installed on large boats and vessels, allowing sailors and captains to communicate with each others and with people on land. However, what is relatively new is the extent to which mobile technologies are used. It is no longer only available for certain work categories; mobile technologies are now everyday things for everyday people to use, both in work and leisure. With the advent of modern mobile technology, functionalities previously available only in stationary environments are moving out from the offices and control rooms and into the streets, out in the public, and are present in many places and situations where it previously was impossible to communicate and be reached.

Despite this widespread adoption of mobile information and communication technologies, there are still relatively few studies of their use. What is more, previous studies often fail to capture the variety and richness of mobility. Mobility is sometimes reduced into categories, which in no way capture the practicalities of situated mobility. Further, previous studies are

often work-oriented, viewing one place (often an office or a control room) as the base, and sees mobility as a means of transportation between places, rather than an integrated part of the activities themselves.

This thesis provides new insights into the nature of mobility, building on five empirical studies of how mobility is done by ordinary people. Mobility as it is treated in this thesis is part of an ongoing achievement involving the use of mobile technologies, that is mobile information and communication technologies. The methodological aim is to collect data about 'naturally occurring mobility', something which calls for somewhat innovative uses of traditional methods.

The studies show how mobile technologies are brought into play in collaborative activities, enabling individuals to interact remotely or while being co-located. The findings show how mobility is a socially organized ongoing achievement – people are doing mobility.

Adoption and diffusion of mobile technology

It might seem odd to begin a thesis which stresses the importance of qualitative studies with a statistical section. However, it is important to show that the use of mobile information and communication technologies is a widespread and increasing phenomenon.

The rapid diffusion of mobile technologies is most obvious if we look at figures of how the mobile phone has been adopted. If we take Sweden (one of the leading countries in this respect, and also the country in which the empirical work of this thesis were carried out) as an example we see that in 1996, only 39 % of the Swedish population had access to a mobile phone. In the relative short period of four years the number had increased and was 75 % in 2000. It was particularly high among 15-24 year olds; 89 % of these young Swedes had access to a mobile phone (SIKA, 2002).

During the first six months of 2001, 463 million SMS-messages were sent in Sweden. That was an increase with 188 percent, from the same period the year before (*ibid.*). Since 1999, the number of mobile telephone subscriptions has surpassed the number of fixed telephone subscriptions in several countries, e.g. Finland, Italy and Portugal (*ibid.*).

Figures for other mobile technology than the mobile phone, show that every fourth personal computer sold in Sweden is a laptop. The sales figures of notebooks are expected to remain high as the prices are going down, and many universities and schools now supply their students with laptops. The number of personal digital assistants sold increased rapidly, and had in 2000 surpassed the number of laptops sold (Söderlind, 2000), although there are indications that the trend has turned again.

The industry has realized the wide adoption of mobile technologies and is naturally trying to exploit the market, developing new devices, or add functionalities and services to those already existing.

It is important to remember that although new technology is being developed by researchers and the industry, it does not necessarily get adopted by the market. And vice versa, even though a new technology is widely spread, it can take a while before it reaches the attention of researchers. Perhaps surprisingly, the interest among researchers to study a new technology, is not always in pair with how it is taken up in society. To take the most obvious example of such a widespread technology, the mobile phone has not until very recently received much attention in social science research. As one author puts it: "[t]he growth of mobile communications and computing technologies has yet to stimulate as much interest from social science researchers as have Internet technologies." (Townsend, 2001). The relative weak interest in understanding mobile phone use might seem particularly strange, given that it is to large extent social and cultural aspects which determine the success of these technologies (Brown, 2001). A lot of work remains to be done to understand mobility in relation to these new mobile technologies.

Motivation of thesis

This thesis takes as its starting point the fact that mobility in relation to the use of information and communication technologies has not been described in much detail. Despite the widespread use of mobile technologies, as seen in the section above, there are not many studies of the details of mobility, what it actually involves. Earlier studies of mobility are often work-oriented, give extra attention to office work, treat some places as bases, and see mobility as a means of transportation. In this section, a short outline of earlier research is performed, in order to see what motivates this thesis. In the following chapters this research is discussed in more detail.

RELATED WORK

A basic assumption for this thesis is that mobility is a socially organized achievement involving the use of information technology. As such, relevant knowledge is gained from research fields which take into account the social dimensions of technology use. The work in this thesis lends much of its methodological and analytical background from Computer Supported Cooperative Work (CSCW). CSCW is concerned with informing the design

and deployment of collaborative technologies. This field covers a range of aspects around the use of collaborative technologies in the workplace.

However, as the name CSCW indicates, this field has traditionally focused on work settings. Non-work settings have not been in focus, although a number of studies addressing other domains have appeared at the conferences over the years (e.g. Palen *et al.*, 2000; Brown and Chalmers, 2003). Within the work context, researchers have primarily focused on studying and designing for traditional office work. For instance there are studies of supporting awareness in distributed workgroups (Dourish and Belotti, 1992; Ackerman, *et al.*, 1997), and supporting collaborative work in the office (Bellotti and Bly, 1996). Much of this office work consists of work 'inside the computer', dealing with documents, writing emails, collaborating over the web, rather than more hands on work. Apart from office work, other technology-intense workplaces which have received a lot of attention in CSCW are so called centers of coordination (Suchman, 1991; Heath and Luff, 1992; Hughes, *et al.*, 1994).

The mobility of people and their technologies have not been investigated in much detail within the field of CSCW. A field which first explicitly addressed the importance of more empirical work of mobility in design purpose was mobile informatics. A group of Scandinavian researchers argued that it was time for a new perspective on information technology research (Kristoffersen and Ljungberg, 1999a). Up until then, informatics, as the discipline is called in parts of Scandinavia, had focused on fixed technology and stationary work. Further, they point to the fact that most mobile computing research up until that date was of a technical character. Mobile informatics, as Kristoffersen and Ljungberg defined it, should therefore focus on the *use* of mobile technology and on design for mobile work.

This is not to say that mobility has been totally ignored in CSCW. The mobility of workers and their tools has been studied in offices and other technology-intense workplaces, primarily centers of coordination (cf. Suchman, 1991). So for instance, there are studies showing how workers are locally mobile in offices (Bellotti and Bly, 1996) and how underground station personnel are mobile in relation to the control room (Luff and Heath, 1998).

However, as a consequence of seeing the office or the control room as a base, mobility has been treated much like a deviation from a stationary norm. In CSCW as well as in mobile informatics, mobility is treated as transportation between bases, being a desktop computer, an office, a control room, etc. In moving away from these bases, workers experience a number of difficulties. The design challenges often highlighted in studies of mobile work is to compensate for the lack of information, awareness, and technological resources missing when working away from the home base.

Mobility and mobile technology has received a lot more attention within fields with a more individualistic view, such as ubiquitous computing, wearable computing, and human computer interaction. These fields focus on the user's interaction with devices. There are a growing number of academic conferences on mobility issues, e.g. Mobile HCI, MobiCom, etc. However, in these fields there are few studies of the *use* of mobile devices; rather the research concerns ways to improve the technology in various ways, and is sometimes not related to today's usage situation or one which is likely to happen within a foreseeable future. It is very much a technology driven research. The difference in perspective is also visible in the methods used; CSCW studies are mostly qualitative and focus on real world settings, as opposed to quantitative and laboratory studies which are common in ubiquitous computing and CHI communities. Further, CSCW focuses on the collaboration using technology, whereas the more technology-driven fields tend to focus on the interaction between a user and a device, rather than the interaction between users.

Within CSCW there have been a number of studies which rely upon or get inspiration from methods from social sciences, such as ethnography, ethnomethodology and conversation analysis. These approaches were taken up in CSCW for their strength to show the ways in which social organization of work is actually done. They provide a way of reaching an empirical understanding of the detailed practices and particularities of the setting in which work was carried out, an understanding which can provide a useful background when thinking about design and deployment of new technologies in the workplace.

WHY WE NEED A NEW APPROACH TO MOBILITY

So, to summarize the concerns which motivate the work in this thesis: there are few studies of mobility, despite the widespread use of information technologies supporting and allowing for mobility. Those studies that do exist, have largely failed to grasp the richness and complexity of this phenomenon. Four related concerns motivate the need for more studies of mobility.

First, *work* has been the main concern. Previous studies have focused on studying how technologies feature in workplaces. Everyday life is not considered. The ways in which people interact with others using mobile technology in their everyday life, when doing other things than work, has been largely ignored in research up until recently. This is despite the fact that users of mobile technologies are not just found in offices and workplaces; these technologies are now invading society at large and there is consequently a need to look for their impact on everyday life. A number of studies have recently appeared which focus on the social aspects of mobility, where work-

related use is not the primary interest, rather, they aim at looking at how technology feature in everyday life, be it work or not (Brown *et al.*, 2001; Katz and Aakhus, 2002; Ling, 1998, 1999a,b). The widespread use of the mobile phone is the driving force of such investigations.

Second, *office work* is seen as the norm. At the office, the worker has access to fax, telephone, desktop computer with calendars, contact information, etc. Much of the early work concerning mobility starts out with the office situation to see what types of work cannot be done while being away from the workstation, in terms of lack of information, awareness, technological resources, etc. (Bellotti and Bly, 1996; Bergquist *et al.*, 1999). Stationary work at the desk is seen the norm from which mobile work deviates. However, mobile work is more than office work on the go. There are other work types which need to be investigated, and which might need technological support just as well.

Third, and related to the previous point, workers are considered as having a *'base'*: their desk, their office, or a center of coordination of some sort. When people leave these bases they become detached from their resources, and the challenge in terms of designing information technology then becomes to give them the same possibilities in the field as they would have at their base. This idea is reflected in the design challenges often highlighted in studies of mobile work, to give users access to information when working away from the home base. What is noteworthy here is that mobility of workers is seen in relation to a place, from which workers move away. However, mobility can also be seen as a more fluid form of activity, where there is no such thing as a base. There is not one particular place which is given special status as a base.

Fourth, with this follows that *mobility is seen as transportation* between places of work. Work types where mobility is a more integral part of the work itself, and not just a means of moving between locations and people, are not included. Mobility is seen as transportation. Mobile informatics research is to a large extent based on these ideas. This is for example evident in the distinction between types of mobility which this research often uses – wandering, visiting, traveling (Kristoffersen and Ljungberg, 1999a, Dahlberg, 2003). These categorizations are clearly based on office work, people traveling between offices, and moving within them, and so on. There is a lack of studies focusing on the use of mobile technologies in situations, being work and leisure, where people are *mobile as the activity occurs*, rather than being mobile in order to transport themselves to some place to do the work. The 'inbetween-ness' is not treated in its own right, but as an exception which needs to be compensated for.

These four concerns call for a new approach to mobility, and are the motivation behind the work in this thesis.

Aim and scope of thesis

The aim of this thesis is to provide a number of studies of mobility in order to increase the understanding of this phenomenon. From the empirical work, generalized findings about the nature of mobility are presented. The thesis is based on five studies of mobility, and these studies are different in many ways, not only in the setting and people studied, but also in the ways in which data was collected. It is important to grasp the very mobility of the activity, participants and technology in focus. This of course, poses challenges to methods used when doing such studies. In this thesis, a few different approaches to capturing naturally occurring mobility are presented. The empirical studies in this thesis used different approaches, and these are summarized and discussed as a part of the results of the thesis.

Most of the studies conducted within the frame of this thesis also had as a general aim to derive implications for the design of new mobile technologies and services. This aim is in some ways very practical, and implied that some of the studies might lack the sociological and anthropological depth needed if the work was "merely" aiming to give an analysis of the setting. Further, it should be stated that although the thesis provides ideas on how to develop future mobile technologies, and to support mobile people enrolled in mobile activities, the aim of the thesis is not to design such technologies. No new devices, systems or services are presented in this thesis.

So, in sum, the contributions of this thesis include:

- Providing new insights into the nature of mobility, based on empirical evidence from five studies.
- Presenting new ideas on how to collect and approach data of mobility.
- Drawing implications for design of new mobile technologies and services, based on the empirical studies.

Thesis outline

This chapter has so far introduced the aim of this thesis, and briefly outlined the means of achieving this aim. The next chapter, chapter 2, presents previous research of relevance for this work. Computer supported cooperative work, informatics, mobile informatics and non-work studies are presented. The following chapter, chapter 3, takes a closer look on previous work on mobility in relation to information technology, and examines some definitions of mobility. Related work is criticized, and the arguments for the need for a new approach to mobility are presented.

Chapter 4 presents methodological and analytical frameworks for studying mobility. Ethnographic observation, ethnomethodology and conversation analysis are presented, as well as some critique of these approaches and a discussion on how they can be useful for design purposes. The next part of chapter 4 deals with mobility as a methodological challenge, and presents four ways of capturing mobility, including what particular issues are involved when conducting a study of mobility.

These four chapters provide a background for the five empirical studies presented in the thesis. The first study is presented in chapter 5. Centers of coordination have received many CSCW ethnographers' interest. This chapter relates a study of a somewhat different control room, a traffic information central located in Göteborg, Sweden. The traffic information central is not a control room in the strict sense; it is a central aiming at providing road users in the west region of Sweden with updated information about traffic and weather conditions. The study was carried out in this central place of organization. This is one way to study mobility: to find a place where stationary operate communicate with remote participants and receive remote information. What makes the work at the traffic information central especially interesting is that they are located in an office distant from the mobile people with whom they interact. This is a form of remote interaction, where much time and effort is put into trying to inform themselves of the current situation in the field. In trying to take control over a situation that is in many ways uncontrollable, such as the weather, road conditions, accidents, and the behavior of the road users, the operators focus on 'plans' which give them information about the world they work with. In this chapter, two types of plans are examined: maps and weather forecasts. However, it is found that these plans are interpreted and situated within the various contexts in which they are used. The information which the weather forecasts and maps provide is situated in the remote interaction between the operators in the control room and the mobile workers and public in the field. The findings reinforces many of the previous studies of work in control rooms, but also shows how the operators worked to be on top of things happening in the outside world; to bring the world with which they were interacting into the control room.

Having told the story of the work inside a control room, it is possible to move out of this setting, and look up the mobile workers in the field, those who are communicating with the center from the outside world. This is done in chapter 6, which takes place at a large Swedish airport. The people in focus here were the snow clearance crew responsible for cleaning the runways and surrounding areas from snow during the winter season. Clearing the runways from snow is certainly a very mobile activity. At their help, the snow sweepers, as they call themselves, had large vehicles equipped with radio communication for talking with each other and the control tower, and a

newly developed system which allowed the snow crew to see the whereabouts of the other snow vehicles. Methodologically, this study shows the benefit of combining data from field studies with recordings. The field study provided a background from which the conversations over radio could be understood, and was essential to understanding the problems at hand for the snow crew. The study also shows the benefit of doing collaborative fieldwork when studying mobility.

Chapter 7 presents a study of a very different character. This time we follow a group of ski instructors who test a new mobile prototype for awareness information. Being a ski instructor involves both work and leisure, as they stay at the same ski resort as their students and being a good ski instructor also, it seems, calls for a social competency at the social events that comes with the skiing. This chapter is based on a study of a group of ski instructors followed during a weeklong ski trip to the Norwegian alps. Half of these instructors were equipped with a Hummingbird, a mobile device which provided a list of the other instructors in the vicinity. The point of this chapter is to show the ways in which this new device is handled and negotiated by the ski instructors. Is it a work tool or a device allowing for social interaction? Or is it both? One of the characteristics of mobile technologies is that it allows us to cross boundaries between work and leisure. This study was in a way a field trial, since the devices were only prototypes. The fact that the device was new and the ski instructors had no previous knowledge about it or experience in using it, made it possible to study how people adopt a new technology. Methodological contributions of this chapter include how a field trial in a real world setting can be useful to gain knowledge of users' views of a new technology in action.

Chapter 8 presents a study totally in the realm of mundane, non-work related mobility. This time we will look up the new mobile generation growing up today, the teenagers, and look at their use of mobile phones. At the time of this thesis, the mobile phone has become a practically ubiquitous mobile technology for young people in Sweden. This chapter relates findings from a field study of these young people's use of mobile phones in public places. By using these observational methods, it is possible to reveal not before known features of mobile phones in action, things which are unlikely to become evident from other data collection methods mostly used to study mobile phone use, i.e. surveys, statistical data and interviews. It is also an example of the approach to select a place and a technology to study, rather than following a certain group of users.

The last study presented in this thesis is found in chapter 9. It also deals with mobile phone use, but this time the approach is to take a closer look at the conversations, the actual talk, which new mobile technology allow for. It is based on recordings of real mobile phone conversations. The focus is to investigate how issues of availability, activity and location are treated by

participants in mobile phone conversations. The study is of a conversation analytic nature, but also pushes these methods further, arguing that there is a need to combine the conversational data with other types of more ethnographic data about the setting and technology. This is done in order to bring to the analysis a richer understanding of the considerations done by the conversationalists themselves.

Chapter 10 finally, provides a summary and generalizes from the studies presented in previous chapters. This chapter highlights a number of common issues from the respective studies, which contributes to our understanding of mobility. It is discussed how mobile technologies are shared as resources for local interaction, and how they can invoke a sense of shared ownership. Further, issues of mobility in relation to place and local information are discussed.

Dissemination of results

The research in this thesis has been presented at academic conferences and been published internationally. Chapters 6-9 are previously published papers, with minor revisions. Chapter 5 has not been published previously, but is a paper presented at a course held by Lucy Suchman at University of Oslo in 2000.

Below is a list of the most important publications in which this research has been reported, in the order they appear in the thesis:

- Weilenmann, A. (2001a) Mobile Methodologies: Experiences from Studies of Mobile Technologies-in-Use, in *Proceedings of the 24th Information Systems Research Seminar in Scandinavia (IRIS 24)*, Bjørnestad *et al.* (eds) vol. 3: 243-257. (Parts of this paper are integrated into chapter 4 in the thesis.)
- Juhlin, O. and A. Weilenmann (2001) Decentralizing the Control Room: Mobile Work and Institutional Order, in *Proceedings of the Seventh European Conference on Computer Supported Cooperative Work* (ECSCW 2001) Prinz, W. *et al.* (eds), pp. 379-397, Dordreicht: Kluwer Academic Publishers. (Chapter 6 in the thesis.)
- Weilenmann, A. (2001b) Negotiating Use: Making Sense of Mobile Technology, in *Journal of Personal and Ubiquitous Computing*, special issue on Mobile Communication and the Reformulation of the Social Order (ed.) R. Ling, vol. 5: (2), 137-145 Springer-Verlag London Ltd. (Chapter 7 in the thesis.)
- Weilenmann, A., and C. Larsson (2001): Local Use and Sharing of Mobile Phones, in B. Brown, N. Green, and R. Harper (eds) *Wireless*

World: Social and Interactional Aspects of the Mobile Age. Godalming and Heidelberg: Springer-Verlag, pp. 99-115. (Chapter 8 in the thesis.)

- Weilenmann, A. (2003) "I can't talk now, I'm in a fitting room": Availability and Location in Mobile Phone Conversations, under publication in *Environment and Planning A*, special issue on Mobile Technologies and Space, (ed.) E. Laurier. (Chapter 9 in the thesis.)

As well as having been presented to an academic audience the work in this thesis, primarily that concerning the use of mobile phones, has reached the public through newspaper articles, television, radio, and public seminars.

Chapter 2: A Background to Mobility Research

This thesis is based on research from computer supported cooperative work, mobile informatics, ethnography, ethnomethodology, and conversation analysis. In this and the following chapter, each of these research orientations is outlined in order to show how they form the basis of the work to be presented in this thesis. Work of specific relevance for the particular studies is presented in each chapter.

This chapter begins with presenting the field of computer supported cooperative work as the discipline in which the use of information technology in collaborative work has been the focus, and continues with presenting mobile informatics and fieldstudies of mobile work.

Computer supported cooperative work

The first open conference on computer supported cooperative work was held in Texas, USA, in 1986. Since then, the conference has addressed technical, sociological and anthropological issues of relevance for the development and deployment of workplace technologies. These include email (by some argued to be the first successful CSCW application, although appearing before the discipline was established (Kraut in Bannon and Harper, 1991) media spaces

(Dourish and Belotti, 1992; Ackerman, *et al.*, 1997; Adler and Henderson, 1994), workflow technologies, collaborative virtual environments (Benford *et al.*, 1997), collaboration over the web, instant messaging at work (Nardi *et al.*, 2000), and centers of coordination (Suchman, 1991; Heath and Luff, 1992; Hughes, *et al.*, 1994). By now, CSCW is considered as a discipline with its own body of knowledge, problem domains and literature (Crow *et al.*, 1997).

However, as the name CSCW shows, this field has traditionally focused on work settings. Another limitation lies within the very name of the field: computer supported cooperative work, potentially limiting the research to fall under this definition to studies concerning work, and not other types of interaction where mobile technology is involved. Non-work settings have not been in focus, although a number of studies addressing other domains have appeared at the conferences over the years (Palen *et al.*, 2000; Brown and Chalmers, 2003).

Within the work context, researchers have primarily focused on studying and designing for traditional office work. For instance there are studies of supporting awareness in distributed workgroups in office environments (Dourish and Belotti, 1992; Ackerman, *et al.*, 1997; Heath and Luff, 1991), and supporting collaborative work in the office (Bellotti and Bly, 1996). Much of this office work consists of work 'inside the computer', dealing with documents, writing emails, using software in various ways, rather than more hands on work, manipulating physical tools.

The role of paper documents in collaborative work has been investigated within CSCW. Despite the fact that computers are introduced to facilitate certain tasks, paper documents are still in use alongside these new technologies (Luff *et al.*, 1992; Sellen and Harper, 2001). There is no such thing as a paperless office (*ibid.*)[1]. Sellen and Harper argue that new technologies such as the computer, scanner, and printer, provide us with only more possibilities to use paper. One reason for the resilience of paper, according to Luff *et al.*, is that screen-based systems offer fewer ways of differentiating a documentation than paper. Paper documents can be customized and tailored in various ways. This is done not only to support the work of the individual but also to support the collaboration within the work group. Sellen and Harper investigate a number of affordances and limitations with paper in terms of interactionally possibilities. So for instance, paper is light and easy to manipulate which makes it possible to stack bunches of paper together, to file through them, to move them around in the workspace, supporting individual as well as cooperative work. On the other hand, paper must be used locally and cannot be accessed remotely (without technological aid), and take up a lot of storing space.

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[1] In a response to the European Union research program The Disappearing Computer, Harper remarked that the computer is not disappearing, it is only being covered in post its notes.

A crucial aspect in cooperative work is awareness. Awareness has been much investigated in CSCW, as part of collocated as well as remote collaborative work. Being co-located enables people to create a peripheral awareness of their colleagues' activities, location, and what is going on in the surrounding environment.

Awareness is a crucial issue in technology-intense workplaces which have received a lot of attention in CSCW, what Suchman has called centers of coordination (Suchman, 1991). So for example there is ethnographic fieldwork done on air traffic control (Bentley *et al.*, 1992; Harper *et al.*, 1991; Harper and Hughes, 1993), emergency centers (Petterson, 2001; Bowers and Martin, 1999), and underground line control rooms (Heath and Luff, 1992; Heath and Luff, 2000).

Awareness is also an issue when designing for work taking place at different locations. Based on the finding that awareness of work is important in many work situations, the challenge in terms of design of technology becomes to provide this awareness also for distributed work. For instance, Petterson (2001) discusses what aspects of awareness should be supported when dealing with call distribution in emergency centers, i.e. when geographically distributed operators handle a case in collaboration. In such instances it is important to consider how glances, common artifacts and speech techniques are all important aspects which need to be considered in design of call distribution.

Also, there is work on meeting support system, consisting of support for co-located meetings (e.g. Pedersen *et al.*, 1993), as well as support for virtual meetings, where the participants are located in different places (e.g. Streitz *et al.*, 1994).

The CSCW studies described so far focus on stationary aspects of work. Although there are a growing number of studies of mobile CSCW, the mobility of people and the technologies they use is something which has been largely overlooked. Exceptions worth mentioning are found in Walking away from the desktop computer (Belotti and Bly, 1996) and Luff and Heath's Mobility in collaboration (1998).

The fact that CSCW focuses on stationary work is a limitation, if the purpose is to understand mobility. A field which addressed the problem with the lack of field studies of mobile work, is mobile informatics. This is presented in the next section.

Mobile informatics

Informatics is a word initially used in Sweden to define research on information systems. The discipline was previously known as ADB – the

Swedish acronym for administrative data processing. Informatics is used in many languages to denote all computer science disciplines. Since the focus of informatics was meant to be on the *use* of information technology, it was suggested that the word for the discipline should be social informatics. However, the problem with this, as it is argued by Dahlbom (1996), is that social informatics sounds too much like a social science, and does not show the design orientation so important to this discipline. So the name and what the discipline contains is the issue of some controversy. For the purpose of this thesis, informatics is defined as the study of information technology use with a design orientation.

In their book Computers in Context, Dahlbom and Mathiassen (1993) underline the importance of system development which takes into account the human context. They argue that in the field of system development there is a dialectic relationship between different ways of looking at organizations and the role information within organization. Different world views have influenced the understanding of organizations. However, the importance of seeing it not merely in black or white, is emphasized:

> "Real organizations and their information systems are mixtures of different approaches to organizational design. Some are more bureaucratic and formalized in nature, others more organic and less formalized. But none of them operates according to a single strategy. Even if we attempt to design an ideal information system based on a single strategy, *the actual practice of using the system* will mix the two strategies." (Dahlbom and Mathiassen, 1993:45, my emphasis)

In order to make informed decisions about what technology to introduce into an organization, Dalhbom and Mathiassen mention that the system developer should take help from anthropological ideas:

> "The aim of a typical system development project is to support or replace human practice. So the first step involves learning about practice. In doing so, system developers are like anthropologists trying to understand and interpret the practices of a foreign culture." (Dahlbom and Mathiassen, 1993:27)

This idea of moving from an understanding of practice to design, was a guideline for the part of informatics focusing on studying and designing for mobility.

In 1997 an offshoot of informatics began to take form. A group of Scandinavian researchers argued that it was time for a new perspective on information technology research (Kristoffersen and Ljungberg, 1999a). Up until then, informatics had focused on fixed technology and stationary work. They saw a trend in an increased mobility in our society; "the global village is indeed a mobile one" (*ibid.*). Consequently, it was time for traditional IT research to adapt to this increased mobility. Further, they point to the fact that most mobile computing research up until that date was of a technical

character. Mobile informatics, as Kristoffersen and Ljungberg defined it, should therefore focus on the *use* of mobile technology and design for mobile work.

The group of researchers involved in the mobile informatics research program in Sweden has subsequently focused on such studies. A few examples are fieldwork among mobile news journalists, leading to the design of the NewsMate system, aiming to provide journalists in the field with timely information about recent events (Fagrell, 2001), fieldwork of mobile consultants lead to the design of ProxyLady, a system aiming to support opportunistic face-to-face interaction (Dahlberg *et al.*, 2002; Dahlberg, 2003), and studies of mobile technicians of the Swedish phone operator resulting in design of technology to be used in the field (Wiberg, 2001). These examples are typical for the mobile informatics approach; to do the whole chain of field study, design and implementation of a system, and an evaluation.

Although mobile informatics research has recently began to turn to non-work settings for design inspiration (Olsson and Nilsson, 2002; Esbjörnsson *et al.*, 2002), this field is to a large extent grounded on work-based ideas. This is for example evident in the distinction between categories of mobility which mobile informatics research often uses – wandering, visiting, traveling (Kristoffersen and Ljungberg, 1999a) (cf. below: Perspectives on mobility). These categorizations seem more reasonable when considering traditional office work, people traveling between offices, and moving within them, and so on. There are other types of work for which this type of categorization does not hold. For instance, work where the physical movement is an integral part of the work itself, and not just a means of transportation. An example of such a work is road inspectors, who drive around a certain road net inspecting the condition of the roads and attending to such problems as dead animals and pot holes (Esbjörnsson and Juhlin, 2002).

Kristoffersen and Ljungberg (1999b) make the following distinction of mobile work as opposed to stationary office work:

- "Tasks external to operating the mobile computer are the most important, as opposed to task taking place "in the computer" (e.g., a spreadsheet for an office worker).

- Users' hands are often used to manipulate physical objects, as opposed to users in the traditional office setting, whose hands are safely and ergonomically placed on the keyboard.

- Users may be involved in tasks ("outside the computer") that demand a high level of visual attention (to avoid danger as well as monitor progress), as opposed to the traditional office setting where a large degree of visual attention is usually directed at the computer.

- Users may be highly mobile during the task, as opposed to in the office, where doing and typing are often separated." (Kristoffersen and Ljungberg, 1999b)

Kristoffersen and Ljungberg take this type of work into consideration when discussing design of mobile applications (*ibid.*), but do not use their own mobility categorizations on this type of work. For example, traveling is seen as moving between places of work in a vehicle, and it not recognized that the traveling can be the work itself.

Also, as mentioned, the distinctions do not always fit for non-work settings. Users of mobile technologies are not just found in offices and workplaces, these technologies are now invading society at large and there is consequently a need to look for its impact on everyday life and mundane activities.

Moves toward non-work studies

A number of studies have appeared recently which focus on the social aspects of mobility. Here, work-related use is not necessarily the primary interest, rather, it aims at looking at how mobile technology features in everyday life, be it work or not. Many of these studies focus on the mobile phone. In this section, non-work studies of the use of mobile technologies are presented.

One such example is the outcome of a workshop gathering number of researchers, sociologists, ethnomethodologists and CSCW-researchers, to discuss issues in relation to the new 'wireless world'. The outcome of this workshop is one of the very first academic books on social aspects of mobile technologies, primarily the mobile phone.

One of the editors writes in the introduction:

"It is perhaps surprising then that little research has been done on the non-technical aspects of mobile technology. After all, it is largely the social and cultural aspects which will determine the success or otherwise of these massive investments. For mobile technologies, and especially mobile telephones, are as much social objects as technological ones. They impact how we organise our days and evenings, how we work, and even how we make new friends. ... While the technology has certainly changed our culture, culture itself has remade this technology in a thousand different ways." (Brown, 2001:3)

In his chapter in the book, Cooper examines how theoretical concepts from sociology can be helpful when seeking to understand the use of mobile phones. In doing so, he emphasizes the need for such theoretical development to be tied to empirical research: "theoretical work carried out in isolation from the study of the practicalities of situated mobile use can easily

go astray" (*ibid.*:19). For instance, the private/public distinction is a theoretical one, which is only one way of thinking about the significance of the mobile phone in some settings. Cooper suggests instead that the mobile phone should be thought of as an 'indiscrete technology', because "it has the capacity to blur distinctions between ostensibly discrete domains and categories, or more precisely to take its place among a number of social and technical developments that have this capacity: not only public and private, but remote and distant, work and leisure, to name but a few." (*ibid.*:24). What is particularly interesting with this argument is how it shows the need for theoretical investigations of mobile technologies to be empirically grounded.

Another collection of studies focuses on the use of the mobile phone, but uses primarily surveys, interviews and statistical data to draw conclusions about the usage of this new technology. Perpetual contact (Katz and Aakhus, 2002) presents a number of studies of mobile phone use in countries around the world. So for example, one author in the book, suggests that the mobile phone "is considered an instrument that is not very suitable for communication, but perhaps more suitable for a rapid exchange of information" (Fortunati, 2002:44). It is important to point out that the methodological approach used in many of these studies does not take into account the "practicalities of situated mobile use" (Cooper, 2001).

Work in the same vein is often used to make claims about the mobile phone as a technology which privatizes public space, as it enables people to have private conversations in public places. For instance, in discussing mobile phone culture in Finland, Puro (2002) maintains that:

> "[A]s someone talks on the phone, one is in her or his own private space. Talking on the mobile phone in the presence of others lends itself to a certain social absence where there is little room for other social contacts. The speaker may be physically present, but his or her mental orientation is towards someone who is unseen." (Puro, 2002:23)

This same aspect of mobile phone use is also discussed by Ling (1998) who, drawing upon the work of Goffman, argues that when talking on the mobile phone in the presence of others, one needs to juggle two parallel front stages.

> "The intrusion of a mobile telephone call threatens the pre-existing situation. At the first level, one must choose which conversation takes precedence." (Ling, 1998: 71)

Similarly, Palen argues that:

> "[W]hen users are on the phone with an existing contact, they cannot engage others who are physically proximate, reducing opportunities to make new acquaintances.

> Moreover, heavy use of the technology might make users more accessible to their
> existing contacts while rendering them inaccessible to others." (Palen, 2002: 81)

Another often made claim about the mobile phone, which will be discussed later on in this thesis, is that it a personal technology.

> "A mobile telephone is slightly different [from TV or the PC] since the device is, almost by definition, individual and not attached to a physical location." (Ling, 1998:68)

However, there is also work showing the collaborative features of the mobile phone. Taylor and Harper (2002) use anthropological perspectives to understand mobile phone use among young people, and frame the sending and sharing of text messages in terms of gift giving.

The research related so far has dealt with the mobile phone. There is also other non work oriented research. In CSCW studies there is often a problem which needs to be solved, something which makes work life easier and more efficient. It is difficult to define leisure studies along the same lines; everyday life cannot always be made more efficient. In discussing tourism as an example of leisure, Brown and Chalmers (2003) argue that "Good tourist technologies are not only those that make tourists more efficient, but that also make tourism more enjoyable". They urge researchers to not focus too much on utility and efficiency; since tourists' problems are not like work problems. Solving the problems of being a tourist, such as finding the best way around a city, is actually a part of the enjoyment of being a tourist.

> "We would argue that support for leisure is both a new area of interest for CSCW and an area that is amendable to the methods and approaches developed in CSCW. As attention extends beyond the realm of work, it is the social aspect of leisure that may be most important yet most challenging to support since it may involve technologies from those which support collaboration." (Brown and Chalmers, 2003)

During the last years however, there seems to be a recent trend towards accepting other types of studies as well. Examples of non work studies are the study of the adoption of mobile telephony (Palen *et al.*, 2000), the study of senior citizens using internet technologies (Mynatt *et al.*, 1999), the study of a device allowing for social interaction around museum exhibits (Grinter *et al.*, 2002), and the study of music sharing in the age of new technological inventions (Brown *et al.*, 2001), to mention a few recent non-work studies presented at the CSCW and ECSCW conferences. These studies go along with a number of studies concerning the use of computer mediated communication, instant messaging, etc., which could be linked to a work setting, but could take place in other settings as well. In the announcement of CSCW 2002, the organizers played with the acronym, substituting 'work'

with 'world', changing it into the more accepting computer supported cooperative *world*. The CSCW conference has also been talked about as encompassing research on computer supported cooperative *anything*.[1]

This chapter has introduced related research, and provided a general framework of CSCW, mobile informatics, and non work studies of mobile technologies. The next chapter goes deeper into understanding mobility and how it has been approached earlier, and leads up to formulating a need for a new approach to mobility.

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[1] At CHI2002.

Chapter 3: Defining Mobility

Mobility is a term widely used in association with information and communication technology, to describe very different things. In this chapter, a background is given to previous research in mobility, showing how the concept has been used. A few categories of mobility are presented and discussed.

   Sometimes mobility is used in highly technological contexts to signify physical movement (Lundgren *et al.*, 2002), sometimes it stands for remote interaction between individuals who are far apart from each other and use mobile technology to communicate. The ways in which the term mobility is used in this thesis has similarities with the distinction between space and place as some authors use these terms in relation to technology. Space, in this context, signifies the three-dimensional world in which we are localized, whereas place is how that space is used, added with meaning and conventions about its use (Harrison and Dourish, 1996)[1]. Analogous to this, we can make the distinction between movement and mobility. Movement then, is the physical movement of persons or artifacts, whereas mobility is the social dimensions associated with movement and use of mobile technology. Mobility as it is treated in this thesis is part of a collaborative ongoing achievement. Mobility can encompass a wide range of activities involving the use of mobile technologies. At one end are activities where individuals who

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[1] This distinction is not unproblematic. Brown (2003) argues that Harrison and Dourish do not take into account the long-standing debate of how these terms are used in geography.

are separated use mobile technology to communicate while on the move. At the other end are people using a mobile device to interact locally, by passing it around. So for it to be called mobility, it does not necessarily mean that people move around. They can be sitting down at a table, using mobile technology to interact in some way with people present or distant. The concern of this thesis is mobility as the social dimensions related to movement while using mobile technology *or* mobile technology use in general.

It is important to make the distinction of research concerning, mobility of individuals, mobility of the setting, mobility of technologies/artifacts and mobility of information. The question is *what is mobile.*

Mobile individuals – individuals in motion e.g. walking. Of course, most if not all human beings are mobile. So in this sense, the common term 'mobile workers' is not that revealing, as no workers, presumably, are glued to their chairs. However, 'mobile workers' and 'nomads' are terms which are used to signify people who are believed to be mobile as a result of their work.

Mobile setting – many times the term mobile setting is used rather vaguely, to signify an environment where mobility is relevant in some sense, because people are moving about or using mobile technology. Contrary to what it might sound like, a mobile setting does not mean that the trees, buildings and streets in the environment are moving. The term can be used perhaps more correctly to signify a setting such as a train or a boat in which individuals are located, more or less stationary in themselves, as the "setting" moves.

Mobile technology – a technology which is designed to be mobile. Stationary computers and telephones, for example, are of course possible to move as well, but they are not designed to be moved. Some mobile technologies are designed to be used while the individual is moving (e.g. the walkman). Other technology is also called mobile (e.g. laptop), but this is more in terms of being portable rather than possible to use by an individual in motion. However, when the individual is stationary in a moving setting, it can be useful.

Mobile information – accessing information remotely. A lot of design-oriented research on mobility deals with the access of information while on the move. It is based on the recognition that mobile workers often find themselves missing a document or some information which is left back in the office, and therefore need to access this document remotely (e.g. Lamming, 2000; Churchill and Wakeford, 2001).

Other distinctions which are important to make in relation to mobility are that between present (co-located) versus distant (remote), and synchronous versus asynchronous. The primary form of communication is often considered to be face-to-face communication. In this form of communication, both parties of the conversation are *present* and can see and

hear each other, thereby simultaneously 'sending and receiving information'. This is *synchronous* communication. Time is important here; synchronous communication takes place at the same moment in time. The participants do not have to be co-located, present in the same place, for it to be synchronous communication. They can be *distant*, located in different places, and communicating via a mobile telephone, or even smoke signals. In *asynchronous* communication, the communication or transmission of information is not taking place at the same moment in time. An example of asynchronous communication is when someone leaves a note at a place for someone. The place is the same, but the participants are not there at the same time. The distinction has been oriented to in a lot of CSCW research concerning groupware (Ellis *et al.*, 1991).

Communication and information technology changes the temporal and spatial constraints on communication and information transmission. The boundaries are blurred. There are different levels of synchronicity in mediated communication; chat, ICQ, email (Hård af Segerstad, 2002). Mobile technology radically changes the possibilities for interacting synchronously with distant others.

Some authors talk about the mobile phone making place less important. For instance, Wellman (2001) argues that "mobile phones afford a fundamental liberation from place". In discussing community ties in the new society, he argues that before the advent of the mobile phone, we would reach places rather than persons when we made a phone call. Now, the use of the mobile phone shifts community ties from linking people-in-places to linking people wherever they are (*ibid.*). This is a person-to-person connectivity. The mobile phone in this view affords liberation from both place and group.

Previous approaches to mobility

> "Mobility is one of those words that are virtually impossible to define in a meaningful way. You either come up with a definition that excludes obvious instances, or your definition is too vague; it fails to shed light on important aspects. At the same time we all have a feeling of what it means; the postman and the travelling salesman are mobile, the secretary and the cook are not. Thus, we seem to be able to conceive of typical situations in which people are mobile and when they are not." (Kristoffersen and Ljungberg, 1999a)

As Kristoffersen and Ljungberg maintain in the above quote, it is very difficult to define mobility but still it is quite easy to come up with examples of mobility and mobile people. I will here present a few attempts to get a grasp on mobility.

Kristoffersen and Ljungberg presented some relatively early attempts to define mobility in the context of IT-use. They characterize wandering, visiting and traveling, as being three dimensions of mobile work. By wandering, they refer to the local mobility in offices, such as short walks to shared resources such as the coffee machine or the photo copier, or to the office of a colleague. Visiting is when a person is a guest, i.e. spending a limited amount of time at a location other than his or her base. The use of information technology is a prerequisite. So for instance, a sales-person who visits a remote site and does some work there using her or his laptop, is an example of using IT while visiting. By traveling is meant going between places in a vehicle. An example they give of IT use while traveling, is a reporter at Radio Sweden, talking to someone on the mobile phone while driving to a place from which to report.

Other often quoted mobility terms are found in Luff and Heath's paper Mobility in Collaboration (1998). They describe the types of mobility they have found in their field data from a number of workplace studies. Although their aim was to describe the details of a number of work practices of which mobility was an issue, rather than making categorizations, the terms they use for mobility in this paper are much referred to in mobility research. They use the terms micro-mobility, local mobility, and remote mobility. *Micro-mobility* is defined as "the way in which an artifact can be mobilized and manipulated for various purposes around a relatively circumscribed, or 'at hand', domain" (*ibid.*:306). An example of micro-mobility from their studies is the ways in which the paper medical record is used as a resource for communication and collaboration, transported around the office and passing through the hands of different people. *Local mobility* is a term used by Luff and Heath to describe mobility within a certain space, such as walking between rooms or floors at an office, or the personnel's walking around at London Underground. *Remote mobility* is when remote users are interacting with each other using technology. It is important to point out that micro-mobility deals with the physical movement of artifacts, local mobility of the movement of people, and remote mobility deals with the interaction between people who are separated.

Local mobility is also described by Bellotti and Bly (1996), who performed a field study of spatially distributed product designers. They found that work was a lot more mobile than they had expected. People moved around, were locally mobile, within the building in order to talk to other people and use shared resources. Because of this they were seldom at their desks, and consequently had less time available for communicating via email and telephone with distant colleagues, which resulted in a lack of awareness of others' work. Bellotti and Bly conclude that "while local mobility enhances local collaboration, it penalizes long distance collaboration severely"

(*ibid.*:209). New CSCW technology should be designed with the understanding that many office workers spend time away from their desks.

More recent studies of mobility with the aim to inform the design of new mobile technology are found in the Wireless world anthology. Sherry and Salvador (2001) identify two key elements in what is often called mobile work: "*remoteness*, which means separation from a resource-rich 'home-base', and *truly mobile work*, which involves both remoteness and motion, or at least more fleeting periods of stasis." (*ibid.*:110). This is an important distinction when discussing mobility, which is not always made explicit. The fact that a person is interacting remotely using some sort of mobile technology does not necessarily mean that the person is moving while doing this. Remote interaction can therefore be something very similar to stationary office work and, as Sherry and Salvador also notice, a laptop, for instance, is often used in a setting very similar to the standard office desktop environment. They also talk about a jazz-like feature of work related traveling; referring to "the need to harmonise among multiple flows of activities and the interplay of planned and improvised action" (*ibid.*:112).

Churchill and Wakeford (2001) make the distinction between tight and loose mobility, and relatedly, between close and distant information. These distinctions of mobility are linked with ideas of temporality and synchrony of communication. Tight mobility, in these terms, is when a person feels a need for real time synchrony while on the move. It is highly collaborative and maintained through ongoing negotiations in established relationships. Loose mobility is the requirement of accessing documents or other information on the move, but asynchronously. Close and distant information does not mean that the information is more or less close in terms of physical proximity of the person who needs it. Rather, it deals with the degree of easy availability, how easy or difficult it is to access the information using mobile technology. Close information is information which is easily obtained remotely, and distant information is information which is more difficult to access, for instance because it is not stored electronically. The framework presented by Churchill and Wakeford does not deal with mobility *per se*, but rather mobile workers' requirements for access to other persons and access to information.

To sum up previous research, definitions of mobility in relation to the use of mobile technologies have been described as belonging to one of the following five types:

I	The movement of artifacts around a small at-hand domain	micro-mobility
2	The movement of people within a local area such as an office	wandering / local mobility
3	The movement of people between sites of work (in a vehicle)	traveling
4	Working away from the home-base	visiting / remote mobility / remoteness
5	Working while in motion away from the home base	truly mobile work

Views on mobility in previous research.

What all the research related above has in common are four highly related concerns:

I. *Mobile work and mobile workers are in focus.* Everyday life in general, including leisure and other activities, are not considered. The ways in which people interact with others using mobile technology in their everyday life, when doing other things than work, has been largely ignored in research.

II. *Office work is seen as the norm.* Blue collar workers are given extra attention. Specifically, focus has been on work that takes place at a desk, in front of a desktop computer.

III. With this follows that *some places are given extra status as bases.* Workers are considered as having a 'base', their desk, at an office or a control room. When people leave these bases, they become detached from their resources, and the challenge in terms of designing information technology then becomes to give them the same possibilities in the field as they would have in the base. Stationary work at the desk is seen as the norm from which mobile work deviates.

IV. With this follows that *mobility is considered as transportation* between places of work. There is a lack of studies focusing on the use of mobile technologies in situations, being work and leisure, where people are moving as the activity occurs, rather than moving in order to transport themselves to some place to do the work. The 'inbetween-ness' is not treated in its own right, but as an exception which needs to be compensated for.

A new take on mobility

This section presents a discussion on what we need to focus on in order to get a fuller picture of mobility. As mentioned above, earlier studies of mobility are often (i) work-oriented, (ii) give extra attention to office work, (iii) treat some places as bases, and (iv) see mobility as a means of transportation. These four aspects are discussed below.

BEYOND 'WORK-RELATED MOBILITY'

Previous studies have focused largely on mobility as an issue in work situations, aiming to on inform the design of information technology to be used in mobile work (Luff and Heath, 1998; Kristoffersen and Ljungberg, 1999a; Fagrell, 2001; Wiberg, 2001). Consequently, the distinctions and discussions of mobility which exist today are the result of studies of mobile work. When we take away the context in which the categories were created, the office work context, and apply them on other activities they become less useful. The ways in which people interact with others using mobile technology in mundane activities as part of their everyday life, when doing other things than work, has been largely ignored in research.

BEYOND 'OFFICE WORK'

Many studies, although not all, focus on office work particularly, and start out with the office situation to see what types of desk work cannot be done while being mobile, in terms of lack of information, awareness, technological resources, etc. (Lamming *et al.*, 2000; Churchill and Wakeford, 2001). Stationary work at the desk is the norm from which mobile work deviates. Work as it is treated in these studies mostly deal with traditional office work, where the base is a desk (Bellotti and Bly, 1996). In moving away from this desk, workers experience a number of difficulties. The design challenges often highlighted in studies of mobile work is to give users access to information when working away from the home base.

BEYOND 'MOVING AWAY FROM...'

The fact that mobility is seen as only temporary 'excursions', also gives some places extra status as bases. The questions have been what problems do we encounter when we are walking away from the desktop computer, what happens when we leave the control rooms, etc. This idea is reflected in the design challenges often highlighted in studies of mobile work, to give users access to information when working away from the base. Starting out with the stationary situation to see what types of desk work cannot be done while

being mobile, in terms of lack of information, awareness, technological resources etc. These are not relevant questions for the teenage girl using her mobile phone to socialize with his friends. She is not moving from any particular place, there may be several places which are relevant to her (home, school, friend's house, café, etc.). She is not moving away from any place; rather she is living her life and is sometimes mobile as a consequence.

BEYOND 'MOBILITY AS TRANSPORTATION'

Further, there is a lack of studies focusing on the use of mobile technologies in situations where people move as the activity occurs, rather than moving in order to transport themselves to some place to do the work. The movement itself can be a topic for investigation. One example of when movement is not seen like transportation but as the main activity, is tourism. Traveling and finding out where to go is part of the enjoyment of being a tourist – "getting there is half of the fun" (Brown and Chalmers, 2003). Also, a number of studies have been carried out where the physical movement is an integral part of the work itself, and not just a means of transportation. An example of such a work is road inspectors, who drive around a certain road net inspecting the roads and attending to problems (Esbjörnsson and Juhlin, 2002).

Towards participants' perspective on mobility

The aim of this thesis is to contribute to the understanding of the nature of mobility by presenting a number of empirical studies of mobility. The use of mobile technology is a widespread phenomenon, yet we still now little of the practicalities of its use.

In this chapter, we have looked into previous research of mobility in relation to the use of communication and information technology. We have seen that there have been a number of attempts to define categories of mobility. However, as the use increases and spreads to new domains in society, these categories are not enough to describe the phenomenon. Trying to fit the rich character of an ongoing practice into categories results in simplifying the complexity of mobility. Categories are sometimes relevant, sometimes not. It is true that people sometimes are locally mobile and sometimes remote. It is not denied that it can sometimes be helpful to use these categories as an analytical handle, especially when the aim is to design for mobility. However, one should be aware of the pitfalls of predefining such categories, as they can be contraproductive when observing what people are really doing. In order to grasp mobility, these categories are obstacles

potentially preventing us from seeing what is going on. They are abstract concepts, capturing very little of the ongoing activities. When we shift focus from these categories we notice a whole lot of other things going on. It is time to move on from these categories of mobility, and instead ask what is relevant for the participants. These categories were created as results of studies of mobility as seen as a move away from the office desk. Thus, categories such as wandering and visiting were created in a context, but this context also limits what they can be used for. On the other hand, categories which are more generic, local and remote, can seem empty of meaning. So it turns out then, that it is sometimes very difficult to put a label on an activity as adhering to one type of mobility.

We need to take a new approach to mobility. This thesis presents the argument that mobility is something which is ongoingly produced and maintained by the participants, people themselves are doing mobility. One way to approach mobility is to investigate what the participants themselves are orienting to in their actions. The question is rather what categories or issues of mobility are relevant for the actors, involved in the activity in focus. For instance, one can ask whether the physical movement or position is relevant or not? Is the movement or location itself a topic of discussion?

Based on the empirical studies a few issues are identified as relevant to people doing mobility. In order to perform studies of the practicalities of situated mobility, a number of social science methods were used. These are introduced in the next chapter.

Chapter 4: Studying Mobility

"[T]heoretical work carried out in isolation from the study of the practicalities of situated mobile use can easily go astray" (Cooper, 2001:19).

"For the many who appeal to other sorts of data to ground their inquiries, let me just suggest again the long-term pay offs of setting new technological inventions in the proper context, an analytically conceived context. For they are like naturalistic versions of experimental stimuli: given precise analytic characterizations of the field into which they are introduced, their effect can be revelatory. Examined as objects in their own right, they may yield only noise." (Schegloff, 2002:298)

Many of the studies related in the previous two chapters rely on or get inspiration from methods in social sciences, such as ethnography, ethnomethodology and conversation analysis. These fields are concerned with investigating the ways in which social order is produced, and providing rich descriptions of a setting and the interaction taking place there. As such, they can be helpful when seeking to understand the practicalities of situated mobility.

In the first part of this chapter therefore, the contribution of ethnography, ethnomethodology and conversation analysis is outlined. In the second part of the chapter, the specific methodological challenges involved when studying mobility are discussed.

Ethnographic fieldwork

The history of ethnographic fieldwork has its root in anthropology. The first fieldworker is often said to be Malinowski, a British scholar whose first fieldstudy was performed in the years of 1915-1918 on an island in the Pacific Ocean. Up until that time, ethnology and anthropology was the concern of classically trained academics who wrote speculative stories about exotic tribes based largely on second and third accounts of travelers and missionaries (Anderson, 1996). For some time after that, ethnographic fieldwork was carried out solely in faraway exotic places. With the Chicago school of sociology, observation became a method to investigate social structure in the hometown.

It is important to point out that ethnography is more than fieldwork (Anderson, 1996; Button, 2000; Dourish and Button, 1998). Ethnographic fieldwork is a technique for collecting material, and can be used by researchers not adhering to all principles of ethnography. The difference lies in the 'analytic mentality' with which the field is approached and the data analyzed. An ethnography is not just a description of what has happened in the field, it also involves interpretation and analysis. Ethnography is a particular analytic strategy for collecting and interpreting the results of fieldwork gathered very often by participant observation (Anderson, 1996).

Ethnography as a research approach has come to be used in many disciplines, among them CSCW. Harper writes the following about the strengths, and the difficulties, of using ethnography for design purposes:

> "One does need to be very careful when one starts discussing and reporting ethnography. It is not always quite what it seems. It is not as facile as it sometimes appears, nor yet as elusive and difficult to undertake as some discussions pretend. But it is useful and can uncover important materials that need to be taken into account when systems are being designed, implemented and evaluated; it can make the difference between good and bad, between the nearly good and the just right." (Harper, 2000:239)

Traditionally, ethnographic field studies are carried out for a long time period, often several months or years, allowing for the researcher to immerse (and often participate) in the culture. The time spent in the environment is often not that extended in CSCW studies. This is partly because of the design interest, which calls for a more focused and structured study, often with more specific questions. Hughes *et al.* (1995) present the idea of *quick and dirty ethnography*, where a shorter time is spent doing fieldwork, and gives the designer an informed but general sense of a setting. They argue that a quick and dirty approach "is capable of providing much valuable knowledge of the

social organisation of work of a large work setting in a relatively short space of time" (*ibid.*:61).

Another form of ethnography which also addresses the time issue is *rapid ethnography* (Millen, 2000). This approach is also presented as a way of using ethnographic fieldwork within a design project where there is a limited time available.

Recently, ethnography as an approach to understand social interaction has been used in new, experimental ways, to get a hold of new situations. One such example is Christine Hine's Virtual ethnography (2000). She presents an approach which adapts ethnography to the novel situation that life on the internet is. *Adaptive ethnography*, as Hine calls it, is needed in novel situations. She argues that "[t]he methodology of an ethnography is inseparable from the contexts in which it is employed and it is an adaptive approach which thrives on reflexivity about method." (*ibid.*:13). Hine concludes that studies need to be methodologically innovative, if they are to take both offline and online contexts into account. "Extending and adapting ethnography provides both a site for reflection on what counts as ethnographic experience and a site for reflection on the implications of mediated communication (*ibid.*:156).

One researcher called the ethnographic approach 'deep hanging out'[1]. Of course, mere hanging out is not the point of ethnography:

> "[W]hile ethnography is frequently caricatured as simply 'hanging around' a worksite – and much of ethnography does indeed involve 'hanging around' – this is not its point but a means of achieving the objective of uncovering the sociality of work." (Tolmie *et al.*, 1998)

Classical ethnography has been criticized for missing the 'interactional what' of the activities and organizations studied (Button, 2000). This critique comes from ethnomethodology and conversation analysis. These perspectives are introduced in the following sections.

Ethnomethodology

In the 1960's, Harold Garfinkel proposed a radical new approach to social action than was to be found in sociology. Rather than focusing on typification and generalizations, it should look at the details of the methods used ordinarily by people in their everyday activities. Garfinkel suggests that order is created by members, it is not there subjectively. This new approach

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[1] Genevieve Bell, http://www.intel.com/labs/about/people/bell.htm#eth (accessed 10 December 2002).

was termed ethnomethodology, for its concern with *people's methods* for making sense of the world around them. Garfinkel defines this area of research as the study of "the rational properties of practical actions as contingent ongoing accomplishments of organized artful practices of everyday life." (1986:309).

Further, an important aspect of ethnomethodology is that it focuses on the categories and methods that members produce and use. Thus, it is important to take as starting point the perspective of the participants whose behavior is analyzed (Goodwin and Duranti, 1992:5). The analyzer is interested in members' categories and methods, rather than the categories and methods of the analyzer. Ethnomethodology is concerned with how people themselves go about to produce social order.

Ethnomethodology was taken up in CSCW for its strength to show the ways in which social organization of work was an ongoing practical accomplishment by the members of the setting. Mainstream sociology of work was criticized for analyzing work in abstract terms distant from the details of what is actually done in the workplace (Brown, 1998:17). Ethnomethodology therefore provided a way of reaching an empirical understanding of the detailed practices and particularities of the setting in which work was carried out. In the words of Brown "[e]thnomethodology can be used to gain an analytic handle of the mundane details of work, while not trivialising these details" (*ibid.*:18). The thick descriptions which ethnomethodology can provide can be useful resources when thinking about design and deployment of new technologies in the workplace (cf. below).

Within CSCW there have been a number of studies which rely upon or get inspiration from ethnomethodology. One of the very first such studies which has inspired many, was Lucy Suchman's study of photocopy use (1987). She video recorded pairs of users of copy machines at Xerox Parc, trying to capture the human machine interaction. Suchman's approach to study the actual use of a technology was successful in finding arguments against the, at that time dominating plan based view on human machine interaction.

Other examples of ethnomethodologically inspired studies of work are the studies by Heath and Luff. The art of analyzing video of workplace activities using and have been further developed by Christian Heath and his colleagues. They have performed a number of video-based field studies in workplaces such as control rooms of London underground (Heath and Luff, 1992; 2000), architectural practice (Luff and Heath, 1993; Heath and Luff 2000), newsroom (Heath and Luff, 2000) and medical practice (Heath and Luff, 1996; 2000). Especially relevant to mention here are their studies of London Underground personnel's use of images from surveillance cameras installed around the stations. Heath and Luff use ethnomethodology as an analytic tool to describe the personnel's looking at the monitors, and how they make sense of what the people they observe are doing.

Ethnomethodologically inspired design oriented research has recently found its way into non-work studies as well. For instance, Hughes *et al.* (2000) present studies of the home, where the aim is to uncover the detailed practices of everyday life in the home with technology, and to move from the empirical understanding of how these persons are doing such mundane things as watching a video or calling the bank, toward design.

Conversation analysis

In the beginning of the 1960's, Harvey Sacks began working on recorded phone calls to a Suicide Prevention Center. He was intrigued by the fact that in some conversations, it was difficult to get the name of the person who called in. He wanted to know how it came about in the conversation that they did not provide their name. He found that if the caller did not provide their name in the opening of the conversation, it was difficult to get the name at a later point in conversation.

By examining in detail transcripts of naturally occurring talk, Sacks began to build a body of observations on conversations. Conversation Analysis is based on the assumption that ordinary talk is sequentially organized and ordered. This order is investigated in everyday naturally occurring conversation. The aim is to examine how order is ongoingly produced, and how each utterance leads up to the next. The aim is to describe the methods used by the participants themselves to make sense of the talk. Sacks was concerned with how it is that a speaker comes to use precisely these words, in this way, in this occasion. At that time, talk was primarily considered at the syntactic and semantic level, where the analytic items were isolated, often invented, utterances or sentences. In conversation analysis, one of the basic ideas is that the *sequence* in which a certain piece of talk occurs, is of utmost importance to its understanding. The sequential organization of talk is crucial to conversation analysis.

As well as being a new way of viewing language, conversation analysis also brought about a new sociology, in line with the ethnomethodological approach being developed at this time. Sacks argued that "sociology can be a natural observational science" (1985:21). If it is so that society is ordered, this order should be observable in the smallest piece of interaction. Conversation analysis is concerned with the *details* of naturally occurring talk. Those new to this approach, find it to be perhaps too much so. This is explained by Atkinson and Heritage (1985) as a result of being concerned with members' methods:

> [T]he sustained focus on the details of interaction is sensitive to the fact that participants themselves observe and analyze each other's action in extraordinarily detailed and systematic ways. Minimally, then, any empirically adequate approach to research into social interaction must presumably seek to come to terms with the phenomena in a no less detailed fashion than is routinely done by participants themselves. (Atkinson and Heritage, 1985:412)

The data used in conversation analysis is naturally occurring conversation. The approach is to begin with a small set of data, and make observations about that, building an understanding of the conversation from that data. It is a highly empirical and practical approach, rather than a theoretical attempt to understand the nature of conversation.

The material that conversation analysts work with is always recorded. There are several benefits with having recorded conversations. First, it is possible to go over them again and again. The possibility of repeated examination is seen as one of the benefits with recorded data. Second, having the data on tape makes it possible for other people to check the analysis. Third, it does not rely on *recollection* of talk. This was something Sacks was concerned with; he described methods relying on recollection as "very bad" (1992/1995, vol II, p. 5). Recollections of sequences of talk, he argued, cannot be taken as fully persuasive evidence for analytic claims. This view makes a number of data collection methods unsatisfactory. Below is a summary provided by Heritage (1984) which shows how conversation analysis regards other such methods:

> "(1) the use of interviewing techniques in which the verbal formulations of subjects are treated as an appropriate substitute for the observation of actual behavior;
>
> (2) the use of observational methods in which data are recorded through fieldnotes or with pre-coded schedules;
>
> (3) the use of native intuitions as a means of inventing examples of interactional behaviour; and
>
> (4) the use of experimental methodologies involving the direction or manipulation of behaviour.
>
> These techniques have been avoided because each of them involves processes in which the specific details of naturally situated interactional conduct are irretrievable lost and are replaced by idealizations about how interaction works." (Heritage, 1984:236)

Sometimes it is argued that it is difficult to get naturalistic data if the persons one is studying know that they are being recorded. This is not considered as a great problem in CA, since most persons who know they are being recorded get used to the idea, and stop attending to the tape recorder

(or video recorder) after some time. Also, conversation analysis is interested in details which are not easily controlled consciously (cf. ten Have, 1999).

Sacks passed away young, and had not published much at that time, so during long time notes from lectures Sacks had held were the only available way of getting to his ideas. The founding works of conversation analysis has now become available in the form of the publication of transcribed lectures, which makes his work available to a wider audience.

As mentioned, the material that initially awoke Sack's interest was telephone conversations, and much of the observations on conversations are therefore based on such conversations, rather than talk between co-located participants. Since then, methods for systematically looking at body movements and visual conduct have been developed (Heath, 1986; Heath and Hindmarsh, 2002).

While the initial investigations were done on so-called trivial conversations, the methods have now been much used to study conversations in institutional settings as well. Conversation analysis has also come to be applied in a number of studies of technology use. Since telephone mediated conversations was the first to be studied, the connection to technology was there from the beginning. The advantage here is that the focus is on how the work or activity in focus is actually being carried out, rather than how it is believed that the work is done. Regarding the collection of data, it is necessary to use data that has been gathered in a setting where the members are "engaged in activities that they regularly and ordinarily do" (Gougen, 1997:42).

What the studies can contribute with is the concern of the next section, where some views on the relation between studies and design are highlighted.

On the relation between studies and design

"[W]e would argue that if we can gain an understanding of the use of a technology, then we should not be afraid of moves towards informing design. If we do not, then technological decisions, and therefore technological predictions, will be based on the opinions of those who know the technology intimately, yet know little of their use." (Brown, 2001:5-6)

It is debated to what extent and in what way sociological studies, workplace studies and the like, can inform the design and deployment of new technologies. Many, like Brown, agree that understanding the ways in which a technology or system is used in the real world, is a strength when changing or replacing it.

In recent years, ethnographic, conversation analytic and ethnomethodological approaches have been used in order to inform the

design of information technology. A well known study which relies on conversation analysis and ethnomethodology is Lucy Suchman's study of the use of advanced photocopy machines (Suchman, 1987). In her book Plans and situated action: The problem of human machine communication, Suchman presents her critique toward the planning model of interaction, commonly applied in Artificial Intelligence and Human Computer Interaction in the 1980's. Her chief argument is that social interaction is of a situated character, and that plans are merely one of a range of resources which guide the moment-by-moment sequential organization of activity. She describes the focus of her studies as "instead of looking for a structure that is invariant across situations, we look for the processes whereby particular, uniquely constituted circumstances are systematically interpreted so as to render meaning shared and action accountably rational." (*ibid.*:67). According to Suchman, individuals who cooperate in an activity, work their way to establish mutual understanding.

In studying how individuals establish this mutual understanding, Suchman partly draws upon the work by Garfinkel (1967). When Suchman describes the detailed practices of situated action, she also argues that information systems have to be designed with this in consideration. Following her line of thought, other researchers have recognized the problem with system designs in terms of plan-based design. For instance, the many studies carried out by Heath and Luff. They maintain that:

> "The individual, plan based conception of task which one suspects informs the design of the various systems, [as] insensitive to the ways in which the tasks are accomplished in situ and in concert with others in the practical circumstances of the day to day work" (Luff *et al.*, 1992:168)

This quote shows in a nutshell the views on the strength of ethnomethodological and CA-inspired studies; that they can provide detailed knowledge about the actual ways in which people go about doing what they do.

As has been described above, the aim of ethnomethodology and conversation analysis is to build descriptions based on what is manifest in a situation and not rely on common sense knowledge. This is not unproblematic. Dan Shapiro (1994) argues that many ethnomethodologists have themselves problems adhering to the descriptive agenda. One example is that ethnographies within CSCW many times are presented with a section on design implications. Shapiro suggests that these are in a way "covert theorising". He shows in three ways the problem in adhering to the descriptive agenda: (i) The description is "just descriptive" only given the choice that has been made. (ii) The interpretive character of what are supposedly "first order" observations. (iii) The apparent willingness on the part of ethnomethodologists to intersperse "second order" observations in

their accounts, which connect them to other kinds of sociological interests. (*ibid.*:194).

Shapiro sees two ways in which these difficulties could be handled. The first is to try harder for the proper empirical sociology which is fully grounded in the studied phenomenon. Second, and this is the way Shapiro himself prefers, is a greater flexibility of ethnomethodology "all for the prize of having something to say across a wide range of social and sociological concerns" (*ibid.*:420). Shapiro argues that the fact that ethnomethodology is so strictly descriptive rather than theoretical, is one of the things which create difficulties when integrating with other disciplines. Particularly when it comes to design, which is a very practical concern, it is necessary to compromise to some extent. In the words of Shapiro: "What one chooses not to do for sociological purposes, one may be forced to do for design" (*ibid.*:421).

Button and Dourish (1996) describe the challenges ethnomethodology faces in informing design of technologies:

> "Given the concern with the particular, with detail, and with the moment-by-moment organisation of action, how can ethnomethodology be applied to the design of new technologies? Certainly, ethnomethodologists have urged that designers take into account the methods and practices through which social action, interaction and categories of work are organised; but in the face of the unavoidably transformational nature of technology and system design in working settings, it would seem that ethnomethodology becomes relatively powerless. *Its tradition is in analysing practice, rather than "inventing the future".*" (Button and Dourish, 1996, my emphasis)

They coin the term 'technomethodology' to describe the relationship between ethnomethodology and design of technology. According to Button and Dourish, the solution to the challenge of abstraction is to focus not so much on the details of the specific work practice under investigation, rather to focus on the details of the means by which such work practice arise and are constituted (*ibid.*).

Not only within CSCW but also within the traditionally more cognitively and psychologically oriented field of human-computer interaction, ethnomethodologically inspired fieldwork is beginning to appear. It is increasingly recognized that observational methods can be of valuable means of informing the design. There are many uses for ubiquitous computing which could not be predicted or studied using laboratory evaluations, which is the common method in these fields. As Richter and Abowd (2001) comment:

> "People have difficulty envisioning how they would really incorporate ubiquitous applications into their lives. Evaluating whether a user can interact with such a technology does not help in understanding why and how they would interact with

the technology on an everyday basis. Thus, *in order to truly understand the usefulness and impact of a ubiquitous application, it needs to be evaluated in a realistic setting.*" (Richter and Abowd, 2001, my emphasis)

An alternative approach which still attempts to imbed the study in a real world setting is to conduct 'field experiments'. These involve giving users mock-ups of devices in their natural settings, and let users try these as they do a number of activities. This method can be used when the technology is not yet in use. Iacucci *et al.* (2000), for example, uses this technique to find inspiration for design. The benefits with this approach can be that it takes into account real life situations, and allows the designer to build an understanding about the real world context in which the technology will be used. Rather than evaluating a finished design, this method focuses on *exploring* possibilities for a future design.

   The specific ways in which a study is of use in the design process, is a much debated question. For example, it has been questioned what conversation analysis can provide to change the technology. This can be defended as Robinson (1990) does by arguing that:

> "Analysis of mundane conversation does not lead to a prescription for mundane interaction. [...] To complain that an account does not lead directly to a prescription is to complain that history does not lead directly to a prediction of the future." (Robinson, 1990:49)

Further, Luff *et al.* (2000) claim that:

> "Certainly, there is no method which transforms a study of a workplace into a set of design guidelines. Indeed, many researchers would question whether the development of such a methods would be the most appropriate way for workplace studies to be relevant for design." (Luff *et al.*, 2000:3)

The same thing is argued by Bolzoni and Heath (1997), who maintain that there is no "handbook method" on how to approach design:

> "[I]t is not only premature, but counter to the whole approach of ethnomethodology and conversation to consider generating a handbook method. It can be relevant to design, like other approaches, a case by case basis." (Bolzoni and Heath, 1997)

Hughes *et al.* (1992) are on the similar track:

> "[T]hese precepts cannot be simply 'applied to' or 'mapped onto' a domain in such a way as to yield, in mechanical fashion, a set of results. Rather – and in a manner which mirrors the overall relationship between ethnographic studies and systems design – they act as a resource, as a set of alerting mechanisms, and as a means of orientation." (Hughes *et al.*, 1992:117)

So, social scientists argue that there is no handbook method, and the results from studies cannot be mapped onto a domain. Rather, they argue that studies should be used on a case by case basis, as a resource and a means of orientation. Still, there a several examples of attempts, some by the very same researchers, to generate "patterns" and "methods" which could be used by people not themselves trained within social science. The aim is to provide the empirical data as "a resource for design, both as a series of 'sensitising concerns' and as an empirical reference for the developments of "patterns" (Hughes *et al.*, 2000:29).

Finally, it should be added that a benefit of using social science methods like ethnomethodology and conversation analysis in the design process, is that they are helpful in the sense that they provide ways of looking at the use of technology without bringing too much previous knowledge and assumptions into this looking.

Towards a mobile methodology

The thesis provides a number of studies of mobility. One of the aims is to explore and discuss new ways of collecting and approaching data which can be used to understand mobility. This is based on the fact that despite the widespread adoption of mobile information and communication technology, there are still relatively few studies of the use of such technologies. Earlier studies tend to focus on the use of technologies in stationary, often work, settings. As mobile technologies enable many people to interweave work with other daily activities, and as communication technologies move out from the offices and control rooms and into the streets, there is a need for new approaches to get a hold of mobility.

One might ask if there is a need for developing new methods. Do not traditional social science methods, like ethnography, provide enough tools to understand mobility? I believe they do provide useful tools, but these need to be adapted to fit new situations, as technologies and people go mobile. The widespread use of mobile technology is a relatively new phenomenon in our society, and it is only natural that it takes some time to establish research methods to study it.

Much like Christine Hine (2000) adapts ethnography to fit her aim to understand the complexity of the internet, I have drawn upon ethnography, conversation analysis and ethnomethodology in order to grasp mobility as it features in the studies presented here. Adaptive ethnography, as Hine calls it, is needed in novel situations.

> "The methodology of an ethnography is inseparable from the contexts in which it is employed and it is an adaptive approach which thrives on reflexivity about method." (Hine, 2000:13)

For example, she suggests that in order to understand the role of lurkers (according to Hine a group not yet understood in internet studies) there is a need to use new approaches. One way could be to focus on offline contexts of use, and for instance examine how lurkers relate to other media, like the television. So this offline, adaptive approach to ethnography might be necessary to reach groups of users not yet understood. Hine concludes that studies such as these described above call for methodological innovation, if they are to take both offline and online contexts into account.

> "Extending and adapting ethnography provides both a site for reflection on what counts as ethnographic experience and a site for reflection on the implications of mediated communication" (*ibid.*:156)

Mobility as a methodological challenge

> "Observation is most suitable as a method when the question is linked to a limited and accessible geographical area" (Repstad, 1999:25, my translation)

Collecting data about the use of mobile technologies is difficult simply because the technology is mobile. Many previous studies of mobility are limited in the use of data collection methods in that they use the office, control room or other fixed setting as the primary location to study mobility. For instance, when interested in the work of an ambulance crew the research is carried out in the control room where the ambulances are coordinated rather than in the vehicles, and when interested in the work of airplane pilots the researchers go into the control tower. In this thesis, some ideas are provided on how 'truly' mobile people and technologies can be studied in the locations where the mobile activity is actually taking place.

In this work, it is argued that as the geographical scope of mobility widens, from the co-located form of mobility termed micro-mobility to the more geographically dispersed and unbounded forms of remote interaction, so does the difficulty to study the phenomenon. As the interactants get further away from each other, and the location in which the interaction takes places expands, the unpredictability of the situation grows. The complexity increases, as the geographical scope widens, not only for the participants, but for the researcher interested in studying the mobile activity. Naturally, as is captured in the above quotation by Repstad, observation as a study method is easier to use when the focus is on a limited geographical area. This poses challenges to studying naturally occurring mobility which can occur over

vast geographical areas. Also, studying the collaborative aspects of mobility, as opposed to individuals' problems while on the move, is a methodological challenge since mobility can occur over vast geographical areas and interactants be separated. This section will shortly repeat the terms of mobility used in this thesis, and then go on to discuss how these different forms of mobility call for different study approaches.

Micro-mobility is defined as the sharing of mobile artifacts. In micro-mobility, the interactants are co-located people, who perhaps share a work task together. The fact that they are co-located is what enables people to share, pass around and manipulate mobile artifacts such as documents or devices. Local mobility is found in situations where people share a work task or an interest which is carried out within a limited area. People who move around in this area are locally mobile. The mobility is typically constrained to a certain area because the work task is carried out in the workplace, and is perhaps also dependent on an infrastructure in a certain place. Depending on the size of the area in which they are locally mobile, people can sometimes see each other and / or hear each other. How difficult it is to study local mobility depends more or less on the size of the area in which the mobility takes place. Remote interaction is the most challenging thing to study, along with the argument that as the scope of mobility widens, the difficulty to study the phenomenon increases as well. Such activities might occur over a larger area, and are more unpredictable when it comes to geographical place, making it difficult for the researcher to select a particular place to carry out the study. It is not necessarily that the specific activities are more complex or difficult to understand or collect data about, but the problem is that *it is more difficult to be present as a researcher.*

These four forms of mobility are used as analytical handles to the data, and are not meant to been seen as exclusive categories which hold for all situations. Certainly, they co-exist. Micro-mobility of mobile technologies can occur in many types of activities, and thereby form a part of local and remote interaction. For instance, the mobile phone can be micro-mobile, as has been shown in this thesis in the study of teenagers in this study. But these teenagers are also mobile locally, for instance in a café or in the amusement park. When their activities occur over a larger area, and not in a designated place, remote interaction is a more appropriate term to define the sort of mobility they are involved in. Micro-mobility is relatively easy to study, since it occurs in a very limited domain – within hands reach of the participants. However, as micro-mobility forms part of other, more extended forms of mobility, it becomes more difficult to capture.

In order to find and study the use of mobile technologies, these different sorts of mobility can be a challenge. The overall purpose of the study has to guide the choice of approach to use. If the purpose is to understand a particular group of people or users, and what sorts of technologies they use

and might have use for, e.g. patrolling police men (Nuldén, 2002), a different approach is used than if the purpose is to understand how a particular mobile technology is used by whomever is using it in whatever activity they happen to be doing, e.g. mobile phone adoption (Palen, 2000).

Four approaches can be distinguished, to capture the use mobile interaction. These approaches can shortly be described as follow the actors, follow the technology, study a place and study the virtual communication space.

FOLLOW THE ACTORS

The first approach is to follow actors around, study them in the places they go and see how they use technology in the various situations they encounter. This approach has many similarities with traditional ethnography, as it allows the researcher to be part of the activity, form an understanding based on interaction with the people studied, and ask question as the activities unroll. This approach has proven particularly useful when a specific group is under inspection, most commonly a work related group activity. For instance, several studies of mobile workers of various sorts use such an approach (e.g. Fagrell, 2001; Laurier, 2001). Non-work activities can be studied using this approach as well, but might prove more challenging because it is difficult to get access to and be a non-participating observer of non-work activities (see below). One interesting example of a leisure study using this approach is Esbjörnsson's field work of mobile motorcyclists (2002).

FOLLOW THE TECHNOLOGY

The second approach is to follow the technology. This means to follow the technology around, wherever it takes the researcher. This does not mean that mobile devices wanders around at their own will, riding the bus, going to work and hanging out in the pub, but rather that the study begins with an interest in understanding in what situations the technology features and how it is brought about in general, or perhaps a more specific situation or by certain persons. The mobility phenomenon, which is the concern here, can be captured by studying mobile information technology or other more low-tech artifacts such as maps. Mobile technologies of all sorts can be studied using this approach; mobile phones, laptops, PDA:s, mobile music devices, Gameboys. Also, mobile technologies in the wider use of the term can be studied using this approach: e.g., pens, keys, bags of various sorts, trolleys, etc.

Following the technology might involve difficulties as technologies are involved in activities crossing the line of work and private life, and used in

several locations, both public and private. Although some of these places are probably accessible, it can be difficult to do a useful field study of technology use in all these locations and situations.

STUDY A PLACE

The third approach is to find a place where mobile people spend time or pass through, and do the field study there. The aim is then to study mobility in this place. Centers of coordination can be such a place, where mobile workers move in and out. A little bit different is the method to find a public place as the place to do the study. This does not require access in the same way, as there may be a greater flow of people through this place and the focus is not on a particular group with which one can negotiate access beforehand. With this follows that the activities people are involved in can be more diverse.

   This is a way to capture remote interaction, as well as truly mobile activities. One example of a study using this approach is PumpTalk (Vesterlind, 2003), a field study where the aim was to gather information about road users, i.e. people traveling and spending time on the roads. Since they are mobile and distributed over such a vast geographical area, it is difficult to get a hold of them. One approach to use was then to choose a place to do the study, a place where these road users paused and were less mobile. A useful approach when studying a truly mobile activity, can then be to find a similar such place and catch the activity and interaction going on in that place.

STUDY THE VIRTUAL COMMUNICATION SPACE

The fourth approach is to study the virtual communication space. This means to capture another place where mobility 'takes place', in virtual space. This is a solution to the problem of being present when remote interaction takes place, as it is unpredictable in many ways. A way to get around this problem is to use other data collection methods than field studies. Audio recording is a way to collect day about this. To study the virtual communication space means that the data can sometimes lack some information about the context in which the technology is used, and this is a problem. Therefore, it is useful to have ethnographic data where possible. Combining the approach to study the virtual communication space with the approach to follow the actors, can provide richer data.

SUMMARY

This section has dealt with answers to the question of how various sorts of mobility can be captured. This is summarized in the table below.

DOING MOBILITY – SUMMARY OF STUDIES					
	Chapter 5: Situating remote interaction	Chapter 6:Decentralizing the control room	Chapter 7: Making sense of mobile technology	Chapter 8: Mobile phones in local interaction	Chapter 9: Location and availability in mobile conversations
Mobility	Remote mobility	Local mobility	Local mobility	Micro-mobility, local mobility	Remote mobility
Research question	How do the operators interact remotely with mobile workers?	Original question – how is the SnowCard system used? When it turned out it was not widely used, focus shifted to the other technology for carrying out work, i.e. UHF radio	How are the devices used? (Although aim was to evaluate the use, thus assuming it would be used in some way)	How are mobile phones used in the everyday life of teenagers?	How do mobile phone conversationalists treat issues of location and availability?
Study approach	Study a place	Follow the technology Study the virtual communication space	Follow the technology Follow the actors	Study a place Follow the technology	Study the virtual communication space

A summary of the studies of mobility presented in this thesis.

Access and the role of the researcher

The studies presented in this thesis differ in the general field approach. Studying mobility took me to different locations, from public places with easy access – just leave the office and the field is there – to highly restricted areas like the airport, where visitors, including fieldworkers, have to be registered and checked beforehand. These different settings also implied different roles for the researcher to take on. In this section, difficulties and challenges which each approach entails are discussed.

ACCESS

In the study of the ski instructors' use of the Hummingbirds, access was given through one of the instructors, who was a friend of mine. When he liked the idea of trying the devices, he talked the rest of the group into doing it as well. In that way, I got a member of the group to negotiate my access.

This type of "direct sponsorship by a gatekeeper" (Hammersley and Atkinson, 1995:39) can be very helpful.

In the study of the snow crew at Arlanda airport, we had some difficulties getting access to the field. Arlanda is a large organization, and we were sent to several people before we found someone who let us do the sort of study we wanted. First, we were offered to meet with and interview the people who designed the system, since "they are the ones who know all about it". When we insisted that we wanted to study the people who actually used their system in their daily work, we were told to interview the snow crew. Finally, we found somebody who realized that we actually wanted to go with the snow crew in their vehicles when they were doing their regular job. People can sometimes be very helpful and have many ideas about how one should perform the study, and it can be difficult to turn them down politely in order to do what one is there to do.

The field approaches described so far differed in that the phenomenon to be studied could only be studied in a certain place, with certain participants. This is a different type of field approach compared to when you study behavior in public places. The mobile phone study differed from the others in that the phenomenon we wanted to observe was easily accessible in many public spaces. Choosing a place to carry out the fieldwork did therefore not include having to negotiate access. The role of the researcher can be problematic even if the access is easy (see below).

The recordings of the mobile phone conversations (chapter 9), lead to some difficulties in finding someone to participate in the study. When having identified such a person access had to be negotiated with that person; access in this case meant to get access to her conversations over the mobile phone. She was then herself told to negotiate access with the friends she regularly talked to, that is to check with them whether they wanted to be part of the study. This is a way to delegate to the participant the work to get informed consent.

ROLE OF THE RESEARCHER

When entering a field or beginning a study of the use of a mobile technology, the researcher has to decide whether to be active, asking a lot of questions, or more passive, without interfering too much. The studies in this thesis, range from being highly involved in the activity, to passive, covert observations.

When doing a field study of a particular system or device, it easily happens that the participants being aware of this purpose, initially focus on explaining the use of the system. This was the case in the study of the snow sweepers at the airport (chapter 6). Since our main explicit motivation for our study was to evaluate the use of the SnowCard system, we very soon

became "the people who are here to look at the new technology" in the eyes of the snow crew. Since some of them thought that the technology was a failure, it became difficult for us to get them to understand that this was not the only thing we were interested in. When in the actual field with the snow crew, different members took different notice of us. Some of them did not speak at all with us; they went on doing their job. Others were very interested in talking to us, and wanted to explain the ways in which they carried out their work and what they thought about the technology.

During the Hummingbirds study (chapter 7), my role during the actual ski trip and the testing of the devices was quite peripheral. The ski instructors were not asked a lot of questions about their work or their use of the Hummingbirds. This was because I wanted them to form their own opinions about the devices. This approach turned out to be successful.

These two studies were both open field studies, where everyone was informed that they were part of a study and what the purpose was. In the case with studying the use of mobile phones by young people in public places, it was different (chapter 8). Here the study was conducted with the researchers covert. We did not make ourselves known to the people we studied; rather we were anonymous observers. This ensured that the participants had a natural focus on the technology, and they did not have to demonstrate or explain their use. Also, there is an important difference in how much the researchers beforehand know about the technology being studied. The mobile phone is a common and well-known technology, whereas the SnowCard had to be explained for the researchers.

The role of the researcher in public, conducting a covert study is of course very different from that doing an open study in a workplace. For one thing, getting access is different. However, just because it is easy to get access to the field, it does not necessarily mean that it is easier to do a field study in a public place. Hammersley and Atkinson (1995) write about the difficulties of being present in public as a researcher:

> "It might be thought that problems of access could be avoided if one were to study 'public' settings only, such as streets, shops, public transport vehicles, bars, and similar locales. In one sense this is true. Anyone can, in principle, enter such public domains; this is what makes them public. No process of negotiation is required for that. On the other hand, things are not necessarily so straightforward. In many settings, *while physical presence is not in itself a problem, appropriate activity may be so.* [...] The fieldworker who wishes to engage in relatively protracted observations may therefore encounter the problem of managing 'loitering', or having to account for himself or herself in some way" (Hammersley and Atkinson, 1995:55-56, my emphasis)

When doing our study of mobile phone use in public, we did encounter some problems of being involved in relevant and appropriate activities. The most obvious example is perhaps note-taking, which is not considered to be a

relevant activity in all environments. For instance, when we conducted fieldwork at Liseberg, a large amusement park in Göteborg, we felt a bit awkward taking notes while standing in line for rides and such activities.

On the other hand, we had age in our favor. We both were (or at least appeared) relatively young, so the age difference between us and those we studied were not that apparent. It might have been more difficult for two middle aged men to hang out by the arcade in the evenings.

Naturalistic data in the mobile world

As has been discussed earlier on in this work, making recordings of naturally occurring interaction in order to be able to undertake detailed analysis, is very common within conversation analytic and ethnomethodological approaches. In one of the studies discussed here, we set out to look at the details of the interaction, but without the aid of recordings. In studying teenagers' mobile phone use, we used the approach to follow the technology in public place, and collected our material through ethnographic fieldwork, and documented our observations in field notes. Only having fieldnotes to rely on proved to be a shortcoming at some points. When analyzing the data, many times we lacked some crucial piece of information, which we could not remember, had not written down, or simply had missed. For instance, sometimes we wanted to know how and where the phone was placed on the table after using it, but had no notes of this. In order to do a more detailed and comprehensive study of how the phones were used in the interaction, we would have needed video and audio recordings.

However, it is important to remember that it would have been difficult if not impossible to get audio and video recordings of the natural occurring action described here. Studying the use of such a highly mobile technology as the mobile phone, poses difficulty to the use of audio and video based analysis. It would perhaps have been possible in the cases where people were a little less mobile, such as the cafés, where we could have recorded a certain table, for instance. In other locations, e.g. the amusement park, we would have needed several cameras and microphones in quite a lot of places in order to collect as much material as we have done through observations. One possible solution would be to use mobile recording equipment instead of fixed, where the people observed can be followed around and recorded. This clearly raises many ethical concerns, at least when studying people in public settings. Having mobile equipment would imply that no specific place is used for collecting data, which makes it more difficult to inform people of where they might be recorded. Until these issues have been satisfyingly resolved, there is much interesting and useful data to collect through ethnographic

observations. In relation to this, I want to stress the benefits of being two people in the field at the same time, which is discussed in the next section.

In the study of the snow sweepers, the approach to follow the technology out in the field was combined with the approach to study the virtual communication space, in this case to make audio recordings of the radio communication between the snow crew itself, and between the control tower and the snow crew. One of the goals with the study was to investigate the use of radio, which made it necessary to look into the conversations in closer detail. These recordings made it possible for us to look at the details of the conversations, details we were unable to grasp when in the vehicles overhearing the radio. Furthermore, the recordings proved valuable when considering our field notes; many times the radio conversations clarified the situations we had gathered in our field notes.

More generally, the difficulties with collecting recordings of mobile interaction are that the people in focus are not necessarily a particular group of people, and they are moving about. The traditional way to get access to the field and do recordings, that is to ask a manager or the participants if it is okay to do recordings, is no longer valid when the aim is to study mobile people who might only be in focus a few seconds, and then move on as new people come into the field. This is true when studying public use of mobile technologies.

Collaborative fieldwork

In two of the studies described in this thesis, there were two researchers in the field at the same time. Doing collaborative fieldwork can be a great benefit when studying mobility. The main benefit with doing collaborative fieldwork is that it makes it possible to get different perspectives on the same situation. For instance, in the study of the snow crew, we placed ourselves in different vehicles. On one occasion, I would sit in the front vehicle (whose driver was responsible for radio contact with the control tower) and the other researcher would sit in the 'brake vehicle' (whose driver was responsible for testing and reporting the friction and level of iciness on the runways). On other occasions, one of us would sit in the front vehicle, and the other further back in the line of snow clearing machines. This made it possible for us to get observations from different positions in the overall system. Also, the drivers of these different vehicles had different responsibilities, opinions and experiences, which they would often talk to us about.

Note that being several people in the field at the same time is not substitutable to being several people involved in the project. The point is to actually be more than one person in the field at the same time. However,

when data is collected in audio and video, this is somewhat different. This type of data makes it possible for several project members to look at more 'raw' data when analyzing it.

Another point with being more than one person in the field, and something which is true not only when studying mobility but for observational research in general, is that it is possible to observe and take note of more *details* of the ongoing interaction if there is more than one person doing the fieldwork.

Observing "non-use"

When in the field, it is sometimes tempting to draw too strong conclusions about the extent of use of the technology one is aiming to study. This is perhaps natural, when the explicitly formulated goal of the study is to see how the technology is used, and if it is not used to a large extent, one can easily be disappointed and over-interpret the few instances in which it is used. In this section, I want to argue the value of taking a closer look at situations where the technology might have been used but was not for some reasons, what can be called non-use. It is an observation about something which is not happening. Looking into these reasons could give a lot of information about the technology and how it could be improved to be more useful. For instance, when I set out to study the use of the Hummingbirds, the aim was to study the use of these devices in a natural setting, but technological difficulties lead to limited actual use of the devices. This was a disappointment at first, but it soon became evident that the study was not at all wasted because of this. Instead, it was a great opportunity to study the negotiations around the Hummingbirds use. Also, in trying to understand why and in what situations the device was *not* used there were still useful ideas of how to improve it.

Similarly, when in the field focusing on mobile telephone use, it is important not to forget to look at situations where the mobile telephone is *not* used. It is easy to focus so much on use situations, that evident and interesting situations where the phones are not used are avoided. It is argued here that the non-observations are interesting because they can give information about in what situations the phones are *not* used, *not* present or *not* made visible. These instances have to be understood, in order to get the full picture of mobile telephone use among teenagers.

Furthermore, in the study of the new awareness display in the snow vehicles at Arlanda, the same thing occurred. We set out to study the use of these devices, and even though we had an interest in the radio as well, the display was in focus initially. For one thing, the official reason for doing the

study there, and consequently the reason which we told the snow crew when they asked us about our purposes, was to study the use of the new display. Pretty soon we realized that the display was not a big part of their work. Instead the radio and the glancing and looking out the window to get information about the other's whereabouts, formed the basis of their collaboration. In a way, the non-use of the displays, opened up for possibilities to think about the reasons for the limited use of the new device, and how it could be improved. What information could they not get from the display that they seemed to need and got through the other resources? The answers to these questions sprung out of our observations of the non-use of the display, in combination with observations of the use of the other resources.

A different aspect of non-use can be something similar to what Hines (2000) call offline use in her internet studies. For example, she suggests that in order to understand the role of lurkers there is a need to use new approaches. One way could be to focus on offline contexts of use, and for instance examine how lurkers relate to other media, like the television. So this offline, adaptive approach to ethnography might be necessary to reach groups of users not yet understood. Similarly, in order to understand for instance how mobile phones are used for everyday coordination, it can be useful to look at 'offline coordination'. This means to investigate how people meet and talk about meetings, times and places to meet up, and to examine the places the normally meet at, in order to gain insight about how these things are done not just online, on the mobile phone.

This discussion on methodological issues concludes the background section of this thesis. The following five chapters present studies of mobility, beginning with a study of mobility of information in relation to a center of coordination.

Chapter 5: Situating Remote Information

A snowy day in West Sweden. A person from the road maintenance crew, Göran, calls in to the Traffic Information Central in Göteborg. The operator Monika answers. Monika and Göran talk about a construction work going on at a major highway. They go on to discuss the weather. When talking about the weather, Monika looks on one of her screens with the satellite pictures of the current weather situation. She also looks at the printed paper-copy of the forecast received from the weather authorities, and tells Göran that it is going to be warmer. She then goes on to say "it was almost a little bit tricky on the steps outside my house this morning". They end the discussion about weather, and go on to talk about Göran's current redecoration of the bathroom…

Introduction

"The individual, plan based conception of task which one suspects informs the design of the various systems, is insensitive to the ways in which the tasks are accomplished *in situ* and in concert with others in the practical circumstances of the day to day work." (Luff *et al.*, 1992:168)

Within the field of transport and road informatics today, there is much talk about intelligent systems. The Swedish National Road Administration (Vägverket) is currently involved in several projects that concern intelligent *support* for road users or even *control* of road users. Much of this work is considering road use as a mere rule-following activity, ignoring the fact that road users are actors in a social context (Juhlin, 1999).

This chapter relates a study of the situated work at a Traffic Information Center, hereafter abbreviated the TIC. The TIC is an attempt to have a central place for co-ordination of traffic. What makes the work at the TIC especially interesting is that they are *located in an office distant from the mobile people with whom they interact.* This is a form of remote interaction, where much time and effort is put into trying to inform themselves of the current situation in the field. In trying to take control over a situation that is in many ways uncontrollable, such as the weather, road conditions, accidents, and the behavior of the road users, the TIC members focus on plans that give them information about the world that they work with. In this chapter, the aim is to investigate how remote information is situated in a control room. The remote information here consists of two types of plans, maps and weather forecasts. It is found that these plans are interpreted and situated within the various contexts in which they are used. *The information which the weather forecasts and maps provide is situated in the remote interaction between the workers in the control room and the mobile workers and public in the field.* This is something which gives implications for the design of intelligent systems for traffic information.

This chapter focuses on the work inside a center of coordination, the TIC. From fieldwork at the site, it is shown how the situated and local practice is of importance when the operators communicate with the outside world. This can be compared to the study presented in the next chapter, where the focus is on the mobile workers in the field, who communicate and coordinate their work with the control center.

Related work

In this chapter, I seek to explain the work practice at the TIC, partly drawing on the framework of plans and situated action. This framework proves helpful when trying to understand how intelligent systems are designed according to a plan, and how users in their daily work manage to solve problems and tasks that frequently deviate from that plan. This section shortly introduces this framework, as it was described in Suchman (1987). Along with this is a short summary of relevant findings from other

ethnomethodological studies of work places similar to the Traffic Information Center, primarily studies by Heath and Luff.

In 1987, Lucy Suchman presented her critique toward the planning model of interaction, commonly applied in artificial intelligence and human computer interaction research in the 1980's. Her chief argument is that social interaction is of a situated character, and that plans are merely one of a range of resources that guide the moment-by-moment sequential organization of activity. She describes the focus of her studies "instead of looking for a structure that is invariant across situations, we look for the processes whereby particular, uniquely constituted circumstances are systematically interpreted so as to render meaning shared and action accountably rational." (*ibid.*:67). According to Suchman, individuals, who cooperate in an activity, work their way to establish mutual understanding. In studying how individuals establish this mutual understanding, Suchman partly draws upon the work by ethnomethodologist Harold Garfinkel (1967). When Suchman describes the detailed practices of situated action, she also argues that information systems have to be designed with this in consideration. Following her line of thought, other researchers have recognized the problem with system designs in terms of plan-based design. For instance, the many ethnographies carried out by Heath and Luff. They describe "[t]he individual, plan based conception of task which one suspects informs the design of the various systems, [as] insensitive to the ways in which the tasks are accomplished in situ and in concert with others in the practical circumstances of the day to day work" (Luff *et al.*, 1992:168).

The field study of the work at the Traffic Information Center revealed findings similar to what Heath and Luff have found in various studies of the London underground control rooms (Heath and Luff, 1992; Luff *et al.*, 2000; 1992). The operators in these control rooms are monitoring the public using Close Circuit Television (CCTV) monitors. From the scenes displayed on these monitors the operators make sense of what is going on at the station. This provides some challenges:

> "The world they are presented with is not complete, it is disjoint and fragmented, transformed by the technology available to them. The supervisors have to make use of what is available to make sense of the remote environment and then act accordingly." (Luff and Heath, 2000:195)

However, it has been observed that the operators have a skilful practice of revealing not only that going on within the sight of the camera, but also that going on "off screen". So for instance, the operators can tell from the monitors that a line of people are passing by and glancing towards something which is off camera, and the operators can from this understand that something is going on there that they might need to attend to.

Another relevant domain for this study is the work done on how paper is used in collocated collaborative work. The work at the TIC is carried out using newer screen-based systems alongside paper document. Despite the fact that computers are introduced to facilitate certain tasks, paper documents are still in use. The same observations have been made in various studies by Heath and Luff (1992; 2000). They argue the resilience of paper, noting that paper documents of various sorts are still very much in use, despite the fact that computers are introduced to do similar tasks. A reason for this, according to Luff *et al.* (1992) is that work practices have been developed based on the mobility and tailorability of paper documents. Further, "[s]creen-based systems also offer fewer ways of differentiating a documentation than paper." (*ibid.*:167). This is something that we will look closer at in the field material from the TIC. Further, Luff *et al.* have found that paper documents are sometimes customized in order to support collaborative work. They note that "the participants customise or tailor their document in order to differentiate and highlight particular items." (*ibid.*:164). This is done not only to support the work of the individual but also to support the collaboration.
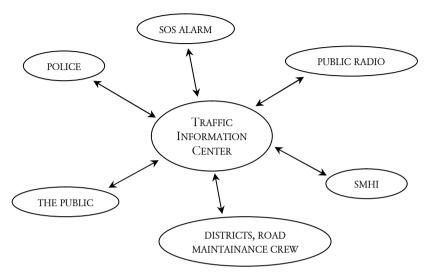
In this study, the focus lies on how two types of plans, weather forecasts and maps are situated in the remote interaction between the workers in the control room, as well as the mobile workers and public in the field.

Data collection and site

This chapter relates findings from an ethnographic study conducted at the Traffic Information Center (TIC) in Göteborg. The TIC receives information from remote sources through different types of technology, such as fax, email and telephone, as well as specially designed traffic and weather information systems. Their task is then to distribute and use this information in their work informing people of the current traffic and weather situation.

The TIC is normally operated by two persons who work in pairs, responsible for the south or the north region respectively. They work 12-hour shifts. During office hours an extra operator is seated next to the north and south operators, answering calls from both regions when the other two are busy. The 12 hours that they work can be hectic 12 hours, with constant ringing, many things to stay informed of, and hardly time to have lunch or even use the bathroom. Other times the shifts are calmer, with mostly routine work, giving the operators time to watch TV, browse the web, write personal email, etc. The TIC has daily contact with a number of people and institutions such as the weather authorities, the police, alarm centers, the Swedish National Road Administration Production, as well as the public.

Below is a figure illustrating the various remote contacts and information sources the TIC has:

```
              ( SOS ALARM )
                    ↕
( POLICE )                        ( PUBLIC RADIO )
        ↘              ↗
          ( TRAFFIC
            INFORMATION
            CENTER )
        ↗      ↕      ↘
( THE PUBLIC )                      ( SMHI )

          ( DISTRICTS, ROAD
            MAINTAINANCE CREW )
```

The Traffic Information Center and the various sources with which they interact remotely, and receive information.

A comment can be made in connection with the figure showing the work contacts of the TIC. The figure above signifies that the TIC indeed is what the name says: a traffic information *center*. However, many times this is not so obvious. Much work is done to trying to maintain the workplace in the center of action. The TIC is dependent on many remote sources to get their information, and there is constant negotiation going on in order to continuing receiving this information. The Traffic Information Center as a more peripheral actor is discussed below in the final section of this chapter.

The field study that this chapter is based on began in December 1999. It was difficult to gain access to the site. The personnel at the TIC expressed worries that their work would be interrupted. They seemed tired of having people coming and going in their work area; previously there had been various consultants – both from within the own organization, and others – who had been there to look at the work. Finally, it was agreed that I could study them for a short period at first, and then continuing as the personnel found it suitable.

Due to this hesitance of being studied among the TIC-personnel, various techniques for collecting material had to be excluded. It was not possible to record the interaction and conversations in the operating room. This was very unfortunate, as many details in the practice were lost. I was left with the

possibility to take copious field notes. I was also given access to the various documents and maps used in their work. It has been made sure that the observations should cover all aspects of the work at TIC. I have therefore participated during all types of situations, storm, snow and rain, as well as calm weather, and day as well as night shifts.

Results

THE SITUATED USE OF WEATHER FORECASTS

In trying to take control over a situation which is in many ways uncontrollable, that is the traffic situation, the TIC members focus on plans. This section deals with a particular type of plans: weather forecasts. In this context, the forecasts can be considered to be plans for the work at the TIC. It is assumed that the forecasts are predictive representations in that they predict how the weather will be, and accordingly predict how the road conditions will be. Moreover, by predicting the weather and traffic conditions, the TIC personnel can attempt to predict their workload for the remainder of their work shift.

If forecasts are considered as plans, they can be compared to the argument made by Suchman about instructions. As plans, the forecasts are indexical formulations of possible future actions. The forecasts' significance with respect to the action it calls for, is not to be found in the forecast itself, but has to be found by the operator in the situation of its use (Suchman, 1987:61). This plan is represented through technology: forecasts are given on a web-based system, in written text using a special register of language, and with satellite pictures of the current and expected weather situation. The TIC receives weather forecasts from the Swedish Meteorological and Hydrological Institute (SMHI) twice a day; the forecasts are supposed to be delivered once around noon and once around midnight. The web based weather forecast system was introduced in October of 1999. Before this point in time, the forecasts were delivered to the TIC in telephone conferences with the SMHI.

All this weather data in form of satellite pictures, temperatures and measurements, has to be rendered meaningful. The weather information has to be situated in accordance with what is used for. In the following section, I will give examples of how the weather forecasts situated in the daily activity at the center.

INTERPRETING WEATHER FORECASTS

The weather data received through various types of information technology has to be interpreted in relation to the context in which it is to be used. This is difficult, due to the obvious difficulty to predict the future state of the weather. The operators at the TIC have been taking courses on how to interpret weather data. The work practice of interpreting weather information is then something which is reproduced in the work.

The TIC members have to situate the weather forecasts within the context relevant for the person with whom they talk. For instance, when a person calls in to ask whether it is best to travel up to the ski resort that day or wait until the following, the TIC operator does not simply tell the measurements results from the road temperature and the measurements from the ground temperature. However, when the road maintenance crew call in to check the weather, it is relevant to tell the exact measurements of the road temperatures.

Below is an example of an operator interpreting weather information data, when talking to a person calling in:

Excerpt 1

Someone calls in to Sture. It is a private person, who's calling in to check the road conditions before starting a journey.
Sture: Let's see, you're going out to night are you
Sture looks at the screen where he can see the road temperatures from the VVIS.
Sture: The road temperature is at three so there's probably no problem

Here, Sture interprets the road temperature as being good enough, thus telling the person that "there's probably no problem" to start the trip to night. The information given from the weather stations (VVIS) is interpreted in relevance with the current context. This example shows that what the forecast mean is not fixed, but depend on the activity to which it is made relevant. The road temperature three can mean different things, something that can be related to the indexicality of language, allowing expressions to be used signifying different things in different situations. Thus, what the road temperature is taken to mean, is decided "with reference to situation particulars, rather than being discharged once and for all by a stable body of shared meanings" (Suchman, 1987:50-51).

Below is another example of the operators relating weather information. This operator is more careful in her formulation:

Excerpt 2

> Monika: They write here SMHI that it culminates in the evening here on the West
> Coast

In the example above, Monika uses a face-saving strategy (Brown and Levinson, 1978). By explicitly naming the source SMHI, she avoids committing herself or the Vägverket to the utterance. She does not simply say "it *will* culminate". The construction she uses is much weaker. In the case that there will not be a culmination in the evening, she cannot be held responsible.

Below is an example where the different weather information sources have opposite information. This is Sture talking about the weather situation on the phone with a person from the maintenance crew:

Excerpt 3

> Sture: Yes it is according to the VVIS, but not according to the forecast

The operator in this example, Sture, is one of the less experienced operators who has not worked at a TIC for a long time, implying that he has not gotten much practice in how to interpret the weather data. This could be another reason for him mentioning the both sources instead of providing his own judgment. The material is not extensive enough to do an exhaustive analysis of the difference in strategies used by different operators.

When talking to the road maintenance crew, the TIC operators talk about the weather in special terms, using a special register of language. However, interestingly enough, this does not mean that layperson terms are absent in these conversations. Au contraire, the operators use many colloquial words and slang. For instance, on one occasion when talking to a person out in the district, Monika describes the weather conditions in the Hult area, as being "really crammed with clouds".

Collaborative weather interpreting

As discussed above, it is difficult to interpret the weather forecasts. The examples we looked at above, were interpretations of the weather situation that the operators did when talking on the phone with people calling in from remote locations.

But there are also instances of *collaborative interpretations*, that is, instances of when the operators together talk about the weather, together trying to make sense of the weather forecasts and the satellite pictures. One example of this is found below. In this case, the two operators are working the

nightshift, and at about 11 o'clock at night, they are looking at their respective screens with the satellite pictures, trying to get a view of the coming weather situation that night. There are some signs of clouds.

Excerpt 4

Sture: There is some crap here too
Monika: Yeah, it's probably gonna become something outta that

Here we can see how they talk about the satellite picture, and how they are building a shared sense of what this picture means. For the TIC operators, it is important to know how the weather will develop during their shift, as it helps them anticipate the workload. In the case above, Sture is commenting the clouds he observes. Monika is looking at her screen, and noting what these clouds will mean for them. She believes that the clouds will give rain or snow, something that will probably lead to more work at the TIC that night.

In relation to these collaborative interpretations, more experienced operators can teach less experienced operators how to interpret the weather. This can be seen as a continual learning of the work practice. The operators are thus "learning how to see one's environment in an informed way" (Suchman, 1991:55).

The employees at TIC have different experiences of their work; their competencies differ. The teams are put together so that a newly employed works with someone with more experience. Those who have more knowledge of the work and more routine of how to perform it, instruct the others. In some teams, the experienced member has been observed to "educate" the less experienced member. Interpretations of how the work should be done are carried on from one experienced operator to another, thus reproducing the work practice.

Unauthorized weather information sources

In situating the weather data in order to the context, not only the information given by the weather authorities is used. The field study reveals that the TIC members use several unauthorized sources in their interpretation of the weather situation. The following section will give a few examples of this.

Below is an example of how one operator combines the authorized weather sources with her own personal experiences when relating the weather:

Excerpt 5

A person from the road maintenance crew calls in. Monika answers. They talk about a construction work that is going on a major highway. They continue by talking about the weather. When talking about the weather, Monika looks on one of her screens with the satellite pictures. She also looks at the printed paper copy of the forecast received from SMHI. She tells Göran that it is going to be warmer [there is snow on the ground] She then goes on to say "it was almost a little bit tricky on the steps outside my house this morning". They end the discussion about weather, and talk about Göran's current redecoration of the bathroom.

Monika her let her own experiences when walking out on her porch that morning, contribute to the interpretation of the weather forecasts.

Another unauthorized weather information source is the visual information the operators get simply by looking out the window. The room, in which the personnel are located, is furnished so that all the workstations face the windows. The windows on this wall in the room, basically goes from one end of the room to the other, thus giving a good view of the outside weather situation. The screens that the operators use are located so that the operators can be peripherally aware of the current weather situation.

Another example when unauthorized information is used in the interpretation of weather. On the first day of the field study, a windy and snowy day, two operators, Peter and Monika, talk about the wind-force. Monika says:

Excerpt 6

Monika: It has gone up lately. It's gone from 10 to 11.5. You can see that on the flag too.

Peter understands that this sounds strange to the uninitiated observer, and tells me that they look at a flag on the top of a flagpole that almost reaches up to the windows of the TIC office. He also points out two light ramps located at two places, which also tell about the wind-force.

That they actually do pay attention to what is going on outside the window, is confirmed later that day, when Monika says:

Excerpt 7

Monika: Jeez, how the flagpole is blowing now! I wonder how long it will stand

What is interesting is that these unauthorized weather information sources are currently used in the work at TIC, and the entire work practice depends

upon it. Since the weather is one of the most important circumstances in the work at TIC, the weather is also something which is very much talked about in various activities. The operators talk about the weather when they are carrying out their tasks, but also when they are talking informally to each other, at meal breaks, etc. Also, it is very common that other persons, who for various reasons come into the TIC room, initiate a conversation about the weather situation. In these conversations, personal weather experiences are often related, such as how the weather was that morning when going to work, or how it is expected to be and how that will effect the rest of the day.

Since the weather system does not give any information about when it is updated, the TIC members inform each other of this. When they observe that they have received a new satellite picture, they normally tell the other operators.

THE SITUATED USE OF MAPS

The previous section focused on how the weather forecasts were interpreted and used in the daily work at the TIC. Other information frequently interpreted is where in the region that a certain incident is taking place. This information is represented as maps. This section describes the use of maps, beginning with a general discussion of maps as representational artifacts, then describing the specific maps used at the TIC, and finally giving examples from the field study of how these maps are used.

Maps as representations rather than reproductions

In this study, maps are considered as representations of reality, an attempt to show how reality is. Different types of maps contain different kinds of information. One particular road map can for instance show the location of all hamburger restaurants or gas stations along the roads, while others do not contain this information. Maps are created by someone for particular purposes.

Considering maps as plans means that the map can be taken to show how reality can be expected to be. For instance, when a map shows a road through a forest, it implies that it is possible to use this road to get through the forest. The plan does not contain information of the changing status of the road, and, to take an example from the field study, it does not show that a road at the moment is blocked because a beaver has gnawed off a tree making it fall over, and blocking the road. The plan is then not a representation of reality; it is merely an attempt to represent a changing and unpredictable reality.

As mentioned above, maps are created by someone for particular purposes. This is important when considering the findings of this study. Maps can therefore be different depending on the context in which they were created.

In the book The Power of Maps, Wood (1993) argues that maps are made by an actor in a social context. Maps are social constructions rather than reproductions of the world, as is sometimes suggested. Wood uses the window metaphor as a means to question the view of maps as reproducing reality. Wood writes that:

> "As long as the map is accepted as a window on the world, these lines [contour lines on the map] must be accepted as representing things in it with the ontological status of streams and hills. [...] But no sooner are maps acknowledged as social constructions than their contingent, their conditional, their... *arbitrary* character is unveiled. Suddenly the things represented by these lines are opened to discussion and debate, the interest in them of owner, state, insurance company, is made apparent. Once it is acknowledged that the map *creates* these boundaries, it can no longer be accepted as *representing* these "realities", which alone the map is capable of embodying." (Wood, 1993:19, original emphasis)

What Wood writes about the lines on the maps as being opened to discussion and debate, is something that becomes very clear in the use of the various maps at the TIC.

The maps at the Traffic Information Center

The TIC operators use many different maps, paper and electronic, in order to locate the roads and places they need to know about.

The different types of maps used at the TIC:

- Three large maps on wheels, which can be moved around the room thus adjustable to the activity. These maps have two sides with different information. One of these maps shows a large tunnel system that the TIC is responsible for. Another map shows the locations of the so-called VVIS-systems, which measure and report ground and road temperatures. One map shows the region that TIC is serving. This map is also divided into regions. On the side of this map is a list of phone numbers to the regions. The other side of this map, is a map of the whole of s

- Screen-based maps. The so-called TRISS system can be used to search for towns and places as well as road numbers. Via the Internet, the TRISS system can also be accessed by the public. The idea is that the TIC should update the TRISS continually, with information about current roadwork, etc.

- Maps of every region in Sweden. These maps are found in a shelf covering a wall in the operating room. The maps are ordered alphabetically, in shelves marked with the letters of the alphabet.

- A general road map placed on the side of the desks of the north and south operators, making it easily accessible.

- Maps showing which roads belong to the Vägverket, thus separating them from the roads maintained by the city. These maps are cut out from the Yellow Pages, and put in plastic folders in a binder. The roads that are the responsibility of the Vägverket, have been highlighted with markers. The binder is placed in the shelf between the north and the south operating tables.

Augmentation of maps

The maps described above lack much information needed in the work at TIC. For instance, descriptions of what the road conditions are like at a certain road or whether a road is the responsibility of the TIC or of the county, is not to be found on a map. The people who work at TIC therefore have certain methods of making this information known to the other group members. There are certain ways of augmenting the maps, thus 'customizing' them in order to support collaborative work (Luff *et al.*, 1992).

One method used in the work at TIC is to mark fallen trees by putting different colored stickers on a map posted on a wall. This method is used when the weather conditions are extreme, resulting in an unusual number of fallen trees. This could be an efficient way of letting others know of the current situation. Below is an excerpt from the field notes, where one employee expresses a wish to begin marking trees that fall during a stormy day. The operators working are Peter, Sture, and Monika. Here Monika has received two reports of fallen trees in sequence. Having finished the last phone call, she hangs up, stands up and walks toward the big map on wheels. She looks at it, probably trying to find the location of the fallen trees. The following conversation takes place:

Excerpt 8

Monika: Should we begin with dots?
Peter: What?
Monika: Dots for trees. I have started to get trees
Sture: Oh okay
Peter: Nae:
Monika: Okay, but I had a tree that fell in Gällinge so if you hear anything about that then you know

What could be seen as the plan – mark fallen trees when there is a storm – is here negotiated in the operating room. Monika, who is a very conscientious worker, seems to want to begin marking the trees, but the others do not seem to agree. First, they are not sure what she means by "should we begin with dots?". Peter then says no to this suggestion. Peter is not one of the ordinary

operators; he has the role of manager within the group. When he disagrees on the idea of marking the fallen trees, Monika does not insist.

This example shows an uncertainty of when to begin with a certain work practice. The plan is thus interpreted in the context, and the team makes the collaborative decision not to begin marking the trees. Whether they follow this plan or not seem to depend on many things, such as how many trees are actually falling, do they expect more trees to fall, do the operators working that day think it is a good idea to use stickers, etc. Thus, what could be seen as the plan, or the correct way of doing something is not always followed. Instead, they inform each other verbally of the fallen trees. This implies that the information about the fallen trees is not to be found in any computer system or on any paper document; *the information is only possessed by the operators in that room.* In the transcription above, we can also see another phenomenon. When Peter does not seem to think that they should start marking the fallen trees with stickers, Monika still wants to make sure that the other operators in the room will have the same knowledge that the stickers would convey, namely that a tree has fallen. This is probably why she says: "so if you hear anything about that then you know".

Getting help using maps

The TIC serves a large geographical area. It is impossible for the operators to know of every little road and every little town in the region. The screen based map system that they use therefore has a search feature, where they can search for the place that they are looking for. However, many times the operators ask the other members of the group instead of using the computer system. Through conversation with the other operators as human resources, they can establish a mutual understanding of where a road is located. But when using the computer system one has to know where to begin searching, or know the exact road number. The system does not allow the flexible form of collaborative work that human beings do so well.

Since asking each other for help locating roads and places is a common activity at in the TIC room, the operators seem to be aware of that they can be asked for help at any time. Similar to the work practice in most control and operating rooms, the team is peripherally aware of what is going on in the room. They have various methods for making the other members aware of what tasks they are currently handling. This is similar to what Luff *et al.* (1992) have found in their studies of the London Underground control rooms, where the operators read aloud when they mark changes in the time table. This is a strategy to make private information public in order to support collaboration.

When on the telephone, the TIC operators many times say the place or road, and repeat what is going on with this place. This is probably not only to be clear in the conversation with the person in the other end of the line,

but also to give the others awareness of what s/he is talking about, in case the other operators need to know or can give valuable extra information about the current case.

Below is an example from the field study, of how Paul and Lisa are helping each other finding a place on the map. Notice also how their conversation has several threads, as their first conversation is interrupted by the telephone:

Excerpt 9

The telephone rings. Paul answers. After a short conversation, where there seems to be an uncertainty about where a road is located, he closes by saying:
Paul: There is a rock in the road anyway
[other end short turn]
Paul: Okay, we'll try that. Allrighty.
[He hangs up.]
Paul: Spårhaga road [quiet, mumbling]
Lisa: What did you say
Paul: Spårhaga road [louder this time]
Lisa: Is that the road out by [description of where the road might be]
Paul starts looking up something on the computer.
The telephone rings. Lisa answers. She has a short conversation about another issue, with a person whom she seems to know before. When she finishes the phone call, she and Paul continue talking about where Spårhaga road could be.
The phone rings again. Someone asks about a roadwork in a tunnel in Göteborg. Lisa has to ask Paul during the phone call. She finishes. Paul receives a short phone call also. When they both have finished their respective phone calls, they talk about the tunnel for a while.
When they stop talking about this, Paul, sighs and says:
Paul: Oh well, the Spårhaga exit.
Paul calls someone in the road maintenance crew to inform them about the rock in the Spårhaga road.

In this example, Paul got help from Lisa, through mumbling the name of the road. This is a frequent strategy to get help from others when looking for a place on the maps, to say the name of the place or road out loud. Another example of this is found below, where Monika is trying to find a place, and cannot find it on her map on the computer.

Excerpt 10

Monika has just finished a phone call. While she is looking up the place on the computer, she says aloud:
Monika: Between Fotskäl and Sätila
Annika: Is that there in ...
Monika: I don't know let's see where the road is
Monika calls someone

> Monika: Hello this was Monika at the TIC. There was some angry person who'd called the police about a road in Sätila [...]
> Note that Monika does not explicitly ask for help; she merely mentions a place. However, Annika takes this a request for information.

In another example from the field study, an operator receives help from another operator while on the phone with a person requesting information.

Excerpt 11

> Annika is on the phone. Meanwhile, she is trying to find a place on a paper map. She has difficulties unfolding the map while holding the telephone. Monika, the other operator sitting next to her, notices this. Annika tells the person on the phone to hold on, and puts her telephone down on the table while she looks at the map. Monika now stands up and walks up to Annika. Together they manage to find the place, and Annika can get back to her phone call.

In this example, Monika is aware of what Annika is doing, and understands when she needs help. Monika understands from Annika's behavior that she needs help. It can be said that Annika, by putting her phone down and "quarreling" with the map, is rendering her activities visible to the other operators.

Discussion

The aim of this paper has been to investigate how remote information is situated within a center of coordination. What makes the work at the TIC especially interesting in terms of mobility, is that they are located in an office distant from the mobile people with whom they interact. They have to communicate with mobile workers and public using technology. Other information they receive is also mediated. In this study, I have tried to use the framework of plans and situated action, seeking to understand how maps and weather forecasts are used in the working practices at a Traffic Information Center. It has been argued that maps and weather forecasts can both be seen as plans, or representations, that maintain the social working order. But without the interpretations, and verbal negotiations of what the plans mean and how they should be interpreted, these tools are useless.

This is a form of remote interaction, where much time and effort is put into trying to inform themselves of the current situation in the field. In trying to take control over a situation that is in many ways uncontrollable, such as the weather, road conditions, accidents, and the behavior of the road users, the TIC members focus on plans that give them information about the

world that they work with. In this chapter, two types of plans are examined: maps and weather forecasts. However, it is found that these plans are interpreted and situated within the various contexts that they are used. The information which the weather forecasts and maps provide is situated in the remote interaction between the workers in the control room and the mobile workers and public in the field.

The maps lack much information that is needed in the work at TIC, and are therefore augmented in various ways in order to support both the individual and the collaborative work. When looking for a place or a road, the operators are frequently seeking help from each other, rather than looking up the location in the computer system.

Regarding the weather forecasts, it has been observed that the weather is a much talked-about issue at the TIC. Predicting how the weather situation will be is a way to anticipate the workload for the remainder of the work shift. Further, it has been found that authorized weather sources are combined with unauthorized sources, such as personal experiences or information that can be obtained simply by looking out the window.

A lot of the information that is handled in the TIC is not to be found in any computer system or on any paper document; the information is only possessed by the people working there. This study has also shown the unique position of verbal communication on many levels of this practice. In designing intelligent traffic information systems, one has to consider the flexibility of human language. This is something that will be discussed in the following section.

The TIC is maintained by the Swedish National Road Administration (Vägverket). They are currently facing major cut-downs in the budget, something that will effect the TIC. There has been talk about minimizing the amount of people working at the centers. Already, tasks that earlier was performed by people is now carried out through the use of technology. For instance, the weather forecasts that earlier were given to the TIC over the telephone by a meteorologist, is now sent by fax, thus radically changing the possibilities to mutually establish an understanding of how the forecasts should be interpreted.

WORKING TO BE A CENTER IN CENTER

In the method section of this chapter, a figure was presented showing the various remote contacts and information sources upon which the work at the TIC relied. The field study revealed that the operators did quite a lot of work in order to be a center, and they expressed a concern that they were not a center to the extent that they thought they should be. Much work is done to trying to maintain the workplace in the center of action. The TIC is dependent on many remote sources to get their information, and there is

constant negotiation going on in order to continuing receiving this information.

What makes the work to be in the center especially difficult is that there are uncertainties as to of *what* they are supposed to be in the center. When describing a typical coordination center, Suchman (1991) argues that the various "information and communication technologies make it possible to maintain one site as central by providing connections from that place to activities located elsewhere" (*ibid*.:45). In the case of the TIC, the difficulty of maintaining themselves as a center is related to the many outside information sources, as well as uncertainties of the work task. The coordination center that Suchman describes is an airline ground operation center. Perhaps the work in a center of that type is more easily defined, in that it is more obvious to the people working there what their task is, and they are all depending on that the work is carried out properly. At the TIC, there are somewhat diverse views of what the TIC should actually do, and who their main contacts should be. For instance, the management of the TIC are now talking about minimizing the contacts that the TIC have with the maintenance crew out in the field, whereas some of the operators describe their main task as giving support to the maintenance crew.

Another example is the contact with the public. Most people at the TIC seem to think that to inform the public should not take up much of their time. However, the name Traffic Information Center could signify that the center holds traffic information that can be obtained by contacting them. Indeed, the TIC started up by having this task as their main task. There used to be signs along the roads in Sweden with the phone number to the TIC and the text "call for traffic information". These signs have been taken down, and the TIC has changed their motive of work. It seems as if these changes have not been done with a clear goal, as there are now diverging views of what the task of the TIC really is today.

To summarize, the figure below represents the TIC and its contacts and information sources in a rather different way than the figure presented earlier in this chapter.

The Traffic Information Center and the various remote sources with which they interact.

In this figure, the TIC is more peripheral than central, and their various contacts are not using the TIC as their main information source. This figure probably represents reality more adequately.

DESIGNING FOR INTELLIGENT TRAFFIC INFORMATION

With today's technology, and considering the widespread use of mobile telephones in Sweden, a possible scenario would be to receive weather and traffic information via SMS (Short Message System) to a mobile telephone. This would give information to people upon request. In this perspective, it is highly relevant to ask what type of information that should be given, and how it should be represented. In a scenario like this, there would not be any possibility to create a mutual understanding. A service like this would also pose high demands on how the information is represented. According to the findings in my study, it would not be satisfying to simply send the road temperatures, for instance. What does the road temperature actually mean? What significance does it make in the particular context? In order to make this information meaningful, a person has to situate the information. I have tried to show how this situated interpreting is done at the TIC. It is difficult to see how this can be done without any possibility of communication and negotiation of meaning.

Further, a system giving traffic information is dependent on that it is updated, either automatically or by people. As was observed in the TIC study,

the operators did not always have time to update the web based systems, leading the updated information to be available only on paper documents in the TIC room. Much information was not written down anywhere at all; the operators working there were the only source of information. How can an intelligent system work around this?

Chapter 6: Decentralizing the Control Room[1]

It is a cold and snowy day at Arlanda Airport. The so-called sweeping group, responsible for clearing the runways from snow and ice, have a busy day. They have to make sure they do their work in time, so as to not delay air traffic.

The lead sweeper, with the rest of his snow group lined up behind him, calls the control tower on his radio, seeking permission to cross the runway:

– Tower the sweeping group at Yan::kee (0.5) can we go Zulu south via Zulu Kilo? #

The tower does not seem to hear him; instead the controller answers the call of another vehicle on the ground. The lead sweeper sits with the radio in hand, waiting for a response. He knows that he is not allowed to cross the run way without permission from the tower; that is in the book of regulations. Still, after a while, he looks in both directions, and crosses the runway. Having done this, he reports back to the tower:

– Tower sweeping group (.) we went Zulu south via the entrance Zulu Kilo (.) Just so you know #

– The sweeping group driving Zulu south #

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[1] This chapter builds to a large extent on the paper Juhlin, O. and A. Weilenmann (2001) Decentralizing the Control Room: Mobile Work and Institutional Order, in *Proceedings of the Seventh European Conference on Computer Supported Cooperative Work* (ECSCW 2001) Prinz, W. *et al.* (eds), pp. 379-397, Dordreicht: Kluwer Academic Publishers.

By repeating the sweepers information in present tense, as if it is about to happen rather than has just happened, the tower and the sweeping group repair the breech against the regulations.

Introduction

Air traffic is constantly increasing. In the middle of the last century centralized air traffic control was introduced to handle the growing number of planes in a safe manner (La Porte, 1988). Today, as the growth continues, traffic control itself becomes a problem. In northern Europe, mainly in Sweden, a new concept for air traffic control, called CNS (Communications, Navigation and Surveillance), is being introduced. This is a joint research and implementation collaboration between the Swedish, Danish and German civil aviation administrations as well as Lufthansa, Scandinavian Airlines Systems (SAS) and the European Commission. It is a major effort aiming for a decentralization of the coordination system, by moving some responsibility out of the control tower to the pilots and other vehicle operators. This is addressed by launching a new communication system based on a standard (VDL Mode 4), featuring various new applications to support individual vehicle operators in the system (SCAA, 1999). It is in the process of being adopted as a global standard from November 2001.[1] Important keywords in this effort are *collaboration* and *situational awareness*: Air traffic management should "make sure that the best use is made of all available resources and that potential problems are resolved in a collaborative and pro-active manner" (*ibid.*:5) It introduces ideas of support for group work to a practice that traditionally has aimed for hierarchical and centralized control. Not surprisingly, the approach is therefore considered radical, and is meeting resistance in air traffic management circles.[2]

This chapter presents a study of mobility where the participants are interacting with each other locally as well as interacting with a control center. In comparison with the previous chapter then, this study takes the opposite perspective, and studies the mobile workers in the field.

The purpose of this study is to inform design of coordination technologies by describing the organization of the everyday work practices of a certain airport ground personnel category very important for air traffic management, namely those who keep the runways free from snow. The snow clearance personnel we have studied use two systems two carry out their work: the traditional radio communication system and a new system (the

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[1] Press release, Swedish Civil Aviation Administration, 2000-03-30

[2] Niklas Gustavsson, Swedish Civil Aviation Administration, Norrköping, Interview, October 2000.

first application for their use based on the design principle described above). The snow clearance vehicles are equipped with SnowCard. It is a "situation display", that provide the sweeping crew with a moving map where they could see dots representing other ground vehicles as well as those airplanes equipped with the new system. This is motivated by work-overload in traffic control, as well as too much talk on the radio system. The radio system is conceived as technically insufficient, and the talk itself can cause misunderstandings and failures in achieving coordination. The SnowCard system addresses these issues by giving the snow maintenance crew and the control tower an awareness system enabling them to see the location of snow clearing vehicles. However, during our fieldwork it became evident that the personnel did not rely on the new system in carrying out their work. Rather, they used the 'old' technology, the radio, to coordinate their work on the runways. Therefore, in this chapter, we examine what the snow crew is doing with the radio, in order to be able to draw conclusions about how to design better tools for this activity.

In the first part of the chapter we present related work, our data collection, as well as explain the tools and manuals that influence snow clearance operations. We then present selected items from the fieldwork, together with our analysis. Finally, we draw conclusions to inform the design of support for this specific type of air traffic management.

Related work

AIR TRAFFIC CONTROL

Two distinct ways of understanding work practice figure in the design of support for traffic control. In the documents from the Civil Aviation Administration, they discuss coordination either between autonomous users, or centralized coordination:

> Concept options will range between a "managed" ATM [Air Traffic Management] environment based on traffic structuring, greater traffic predictability, longer planning horizons and extensive automated support, to a "free flight" environment based on free routings and autonomous aircraft separation (SCAA, 1999:6).

The CNS system will provide additional support for traditional forms of centralized management which structure and order the movements of the planes. The new and innovative approach concerns ideas that, in their most radical formulation, allow for free flight where the operators have the freedom to select their path and speed. Then, individual pilots will organize traffic through decentralized collaboration. The traditional perspective in

aviation control understands coordination of air traffic as a centralized achievement, where traffic control holds a unique position, monitoring the system. The traffic controller has a number of information sources, e.g. radar and other personnel. Based on this information the controller visualizes the current state of the entire system, and decides on appropriate next action. This decision is based on a list of appropriate actions to take in the given situation. To coordinate the many people in the system, it is necessary that they behave in a predictable way, i.e. follow formal procedures.

The distinction is central in terms of CSCW research, where an important design choice is understood as either automating organizational work, understood as routine work in a predictable environment, or supporting the articulation of contingent and situated organizing activities (Schmidt and Simone, 1996; Gerson and Leigh Star, 1986)

In the new perspective, coordination is achieved as a distributed activity where people and technology in collaboration achieve coordination (Goodwin and Goodwin, 1998; Hutchins, 1995). Air traffic control holds a less privileged position, as one of many local settings. The controller's understanding of the system is only partial, and decisions about next action must be negotiated with other localities where participants have different understandings. To achieve coordination it is essential that people account for the local circumstances and contingent situations in which they are involved. Thus, people do different things and hold different views on the system. Collaboration and mutual understanding is interactionally negotiated.

In the studies of control rooms of various sorts, it is usually the controllers and their teamwork that are in focus. Hughes *et al.* (1992) and Sanne (1999) show how the managers make their own work accountable for their colleagues, and how this is seen with peripheral awareness, as a way to e.g. repair mistakes. Hutchins (1993) considered the task of navigating a large vessel as a collaborative and distributed achievement. Watts *et al.* (1996) have considered voice communication support for managers launching a rocket. They argued that a combination of different virtual meeting rooms increased awareness for the benefit of the collaborative work at hand. Further, Mackay *et al.* (1998) study air traffic controllers who were not located in a control tower, but had radar screens as a visual source of information about the location of the planes.

However, in order to influence the design of a more decentralized traffic control it is necessary to consider coordination as seen from outside of the control room. As pointed out by Bellotti and Bly (1996) with reference to the studies of navigation at sea, the managers in all these settings are themselves 'locally immobilized'. In their own research, Bellotti and Bly point to the importance of 'local mobility' where people walk between office rooms and then often have to leave their computers at the desktop. Consequently, this

local mobility penalizes long distance collaboration. However, with the aid of mobile technology it is possible to continuously monitor the activities in the center. A similar approach is taken in the studies of traffic management at the London Underground. Heath and Luff (1992) study the local mobility of the station managers. They also found that the managers had much less awareness of the activities when they left the control room to move around at the underground station.

In this chapter we will look at a different form of mobile work, what has been termed truly mobile work (Sherry and Salvador, 2001; cf. chapter 3). The snow crew is undertaking a job where they are almost constantly on the move. The movement is more than an issue of moving to a different place of work – it is the work itself. The snow crew has this in common with many occupations involved in transportation. The thoroughgoing mobility is visible in the talk, the system that supports the work, as well as in rules surrounding the work. For them, the positioning of their co-workers is under constant negotiation.

RADIO TALK

This study is concerned with the practices of radio (UHF – ultra high frequency) communication. The use of radio for carrying out work has been studied mainly within the transport sector. In this section, we briefly outline relevant findings from these studies, focusing on features identified as unique for radio talk.

Pritchard and Kalogjera (2000) have examined marine radio communication. They argue that "the conversational structure and format of most messages is simple, routine-like and therefore predictable." (*ibid.*:186). They show how the actual maritime radio communications differ significantly from the highly formal standards.

In another study of marine radio communication, Sanders examined the talk between vessels, commercial as well as recreational. He is interested in the fact that although these radios are intended for safely operating vessels, and with a prescribed language, they are widely used for other purposes, especially by recreational boaters. His focus is on conversational socializing (specifically laughter) observed over the radio. Both studies show how practices have developed for making a highly restricted technology more adjusted to everyday actual use.

The radio technology has some interesting implications for the talk situation. One main difference between face-to-face communication and radio talk is that when talking over the radio it is physically impossible for more than one person at a time to occupy the floor (Sanders, 2000:5).

Another relevant difference, pointed out by Sanders, is the fact that in order to say something on the radio the speaker has to do something more

than just vocalize. There is a need to take the microphone and press the button before the talk can be transmitted and heard. This of course has the implication that the person speaking needs to have at least one hand free to operate the microphone. When engaged in physical work, this can sometimes be a constraint, and consequently lead to response delays.

The above-mentioned studies have mainly focused on the talk in itself, rather than looking at it in the context in which it occurs. Luff and Heath (2001) describe a setting (a railway in London) where the practices of radio use are closely linked to the practices of using a computer supported display system. They note how "the displays are utilized to make sense of the ongoing talk and also shape the production of interactions within that setting." (*ibid*.:28).

Data collection

The fieldwork reported in this chapter was carried out at Arlanda airport during January-February 2000. Arlanda airport is situated north of Stockholm. With its two runways and intense traffic it is Sweden's largest airport. There is a risk of snow during half of the year. From end of October to middle of April, there are people present twenty-four hours per day to run snow clearance operations. A minor part of their task is to clear the areas around the gates. The major task is to clear the runways and the areas in the vicinity. The aviation administration argues that they currently clean a runway, being forty-five meters in width and 3.3 kilometers long, in eight minutes. Extensive efforts are made to improve the operations.

The snow sweeping operation takes eight collaborating vehicles moving in a falling line (see below). Each vehicle is equipped with means to plough, sweep and blow away the snow. Therefore, they are referred to as the sweeping group.[1] The driver in the first, the lead sweeper, is responsible for radio communication with airport traffic control (the tower). The sweeping group collaborates with a "brake vehicle", a car that measures the friction of the runway before and after snow clearance.

On a total of five snow clearance occasions, we rode with the snow sweepers, sitting in their vehicles while they carried out their work on the runways and the surrounding areas. The vehicles normally had an extra seat next to the driver seat, where the researcher could sit. We normally organized it so that one of us always was in the lead vehicle. Being two people in the field made it possible to get different perspectives on the same situations. Some drivers talked a lot with us and were interested in explaining their work

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[1] We have chosen to use the term 'snow sweepers' and 'sweepers' rather than the more obvious 'snow plougher' or similar, because this is the way that they are referred to at the airport.

and their use of the systems, whereas others did not take much notice of us. It enabled us to focus more on the work and listening to the radio communication. During all this, we took extensive field notes.

When in the vehicle with the snow sweepers, it was sometimes difficult to hear and comprehend the radio talk. In order to get the details of the ongoing talk, we made recordings. This was carried out during two days of the fieldwork. Due to the nature of the work, we had to wait for it to snow before going out with the snow sweepers. This meant that we spent a lot of time in the recreation room, in the garage, etc. That enabled us to talk to the snow crew and get their opinions of their work situation, as well as getting a general sense of the workplace.

The material, the field notes as well as the recordings, were then transcribed. We went through the transcriptions, identifying a set of themes. A few sequences from the transcribed recordings, were then chosen as showing the issues examined in this chapter.

The eight snow vehicles out on the runway, with the lead sweeper in the front and the others in a line behind.

THE SYSTEMS

The snow clearance operation is traditionally coordinated through radio communication on the ultra high frequency band (UHF). It is a simplex system, which means that it is only open for one transmitter at a time, but that everybody with radio equipment can listen. Only the strongest signal goes through if several people try to speak at the same time. The speaker has to push a button in order to transmit. It is possible to hear their use of the button since the beginning of a sentence is often clipped off, and the end is often followed by an audible click. This clicking sound is represented by the sign '#' in the transcripts.

In radio talk it is not easy to understand who's talking to whom. To avoid misunderstandings, formal rules define the way the participants speak. Every statement should be initiated by an identification of the speaker. Permission must be granted by the tower before any maneuver. All decisions must also be check-read to make sure that everybody heard it the same way. The manual states:

> When you want to drive onto the maneuver area, you must identify yourself (give your call signal) and tell where you want to go and – when needed – what way. When the tower gives permission to drive on or to remain on the maneuver area, you shall check-read (i.e. repeat) the permission. Even the request to "hold position" or to hold a certain distance from the runways shall be check-read. End the check reading with your own call signal, so that the tower knows that it is the correct vehicle that is acknowledging the permission.[1]

Further, it is strongly requested that radio conversations be "short" and "accurate". This is also expressed more straightforwardly in the manual, in capital letters as follows: "IN OTHER WORDS, NO UNNECESSARY 'CHAT' ON OUR RADIO COMMUNICATION SYSTEM!"

There are a number of radio channels that the personnel could use when they are doing their work. The channels of relevance for the work in the group are mainly channels one and two. Channel one is intended for communication with the tower. When on the runway, the snow crew is demanded to use channel one. This is mainly for security reasons; the tower has to be able to hear all the communication on the ground, and the ground personnel need to be in constant response to orders from the tower. The manual states:

> The Aviation Administration demands ... that radio communication be possible with vehicles are located and working in ... the airports maneuver area. Here there is a demand for constant radio attention (SCAA, 1999:14).

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[1] From the manual Radio communication on airport (UHF), page 47. [Translated from Swedish.]

As soon as they leave the runways, the snow crew should switch to channel two, so that the tower would not be disturbed by their talk. Channel two is meant for communication within the sweeping group.

The snow clearance operation has been targeted by the designers behind the CNS concept. In the pursuit of expanding the system concept, a number of aircrafts was first equipped with new equipment. Then some snow clearance vehicles were included in the system and provided with situational displays with a moving map (SnowCard).[1] On a display presenting a map of the airports, a number of the sweeping groups' vehicles are represented by small dots. When the vehicles move around the airport the dots follow on the map. This is made possible by the positioning system in each vehicle and the digital radio communication link. The new data link is considered a "major breakthrough" giving each aircraft and other vehicles the ability to broadcast its position and identity to other vehicles as well as to the central traffic control (SCAA, 1999:7). Below is a picture of the inside of one of the snow vehicles.

The inside of one of the snow vehicles. The SnowCard display is in the upper left corner of the picture. The small radio receiver is hanging down from the ceiling of the vehicle, and is visible in the top middle of the picture.

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[1] Swedish Civil Aviation Administration, SnowCard Arlanda, leaflet

Results

In the following we will present our analysis of the fieldwork. First, we will present our observations of the use of the SnowCard system. The remainder of the analysis then deals with the ways in which the snow clearance personnel use the traditional radio system to coordinate their work through talk. The reason for devoting more space to the use of the radio rather than the new system, is simply because the current work practice in the sweeping group relies on radio, and there are several things that the snow sweepers regularly and ordinarily do which do not seem to be possible using the new system. Therefore, in focusing on the current practices we hope to be able to inform the redesign of the new system, something which is discussed later in this chapter.

NEW VISUAL SUPPORT FOR SITUATIONAL AWARENESS

The new display system was introduced to increase situational awareness for vehicle operators in conditions of poor visibility due to the snow. Thus, the use of the system should be observable in the way the drivers looked at the screen in parallel to looking out of the windshield, and in the rear mirrors.

On one occasion during our fieldwork, the sweeping group is sent to clear the runway. They have instructions to vacate the runway by a specific time. The lead sweeper turns and exits the runway. The driver constantly looks at the screen to oversee when all the other vehicles have exited. He then calls the tower telling them: "Tower, the sweeping group has now left the runway". Later he states that the SnowCard system allowed him to report directly to the tower. Before, he had to wait for the last driver to notify him by radio, and only thereafter call the tower. Now he could use the display instead. This lead sweeper consistently used the situational display when turning. He reported it useful for seeing if the group was holding together, and that no one was falling behind. Along with the adoption of the new system, he also frequently looked through the windshield. Interestingly enough, he would look out the windshield first; only after that would he glance at the display.

This lead sweeper had found some use for the new system. However, it was difficult to observe instances of personnel actually looking at the screen. When we addressed the issue, they told us that they did not find it useful. One member of the sweepers, when asked why he did not have his screen turned on, responded: "What does that *[the screen]* tell me then?" The researcher replied: "It tells you where the others are". The final comment by the driver reflects what many of them seemed to think: "I can tell that by looking out the windshield". Thus, in a sense, there were two competing

visuals, the windshield and the SnowCard. The one taking precedence was the view from the windshield.

We conclude that, although the sweeping group found some use for the system, it was not at all important for them in coordinating their activities and doing the work.[1] The SnowCard did not influence the sweeping group's understanding of their situation in any important sense. It follows then that the new system did not have any impact on the coordination of their work. Rather, they continued to coordinate their moves on the runway using the old technology, i.e. the UHF radio. In the following we will therefore concentrate on the radio conversation, and the situational and local awareness provided simply by the view from the windshields of the vehicles.

MAKING DECISIONS ON THE GROUND

During their work on the runways, the sweeping group is in constant contact with the tower to coordinate their movements. The talk between the tower and the sweeping group is regulated by rules (as described above). We will begin by looking at how the visual local information is used in the conversation between the tower and the snow crew. In the following example, it becomes evident that the snow sweepers make their *own decisions based on visual information on the ground*, rather than on information from the control tower.

In the first excerpt from the radio conversations, we will see how the lead sweeper and the tower repair a misunderstanding:

Excerpt 1

SOPLEDAREN: tornet till sopgruppen #
TORNET: sopgruppen #
SOPLEDAREN: jag står på zäta tore vill gå exet västerut #
(13.0)
TORNET: sopgruppen kör exet <u>österutö</u>:: från hh ramp + #
SOPGRUPPEN: sopgruppen vi skulle vilja gå ut på noll åtta tjusex sen när vi kommer ner mot ö exit adam #
(9.0)
TORNET: h «sopgruppen: » jag förstår ni kör alltså exet <u>västerut</u>? #
SOPLEDAREN: a jag såg att dom starta därifrån e de inte bäst å köra därifrån dårå #
TORNET: <u>absolut</u> bäst de e de absolut tänkbaraste bästa <u>men</u> jag trodde du sa <u>österut</u> men kör exet västerut (upp) till mötesplatsen #
SOPLEDAREN: sopgruppen klart till mötesplatsen #

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[1] It should be remembered that the situational display is installed only in a small number of vehicles, and that only a small number of the vehicles out on the tracks are sending information on their identity and position. The promises of the system designers should be evaluated when a much larger number of vehicles are displayed. And in this situation it could perhaps achieve more attention from the driver.

LEAD SWEEPER:	tower to sweeping group #
TOWER:	sweeping group #
LEAD SWEEPER:	I'm waiting here at Zulu Tango want to go Xray west #
(13.0)	
TOWER:	sweeping group go Xray out <u>east</u>:: from hh ramp + #
LEAD SWEEPER:	sweeping group we would like to go out on zero eight twenty-six later when we have come down towards hh Xray Alpha #
(9.0)	
TOWER:	h «sweeping group: » I see so you are going Xray <u>west</u>? #
LEAD SWEEPER:	yeah I saw that they took off from there so isn't it best to go from there then? #
TOWER:	«<u>absolutely</u> the best» it is the absolutely best thinkable <u>but</u> I thought you said <u>east</u> but go Xray out west (up) to the meeting point #
LEAD SWEEPER:	sweeping group ready for meeting point #

In the first section of this fragment, everything seemingly runs according to the manual. The sweeper reports the position – "I'm waiting here at Zulu Tango", and says that they want to continue west. After an unusually long pause the tower repeats, but repeats incorrectly, saying *east* instead of west. The long pause might suggest that the person in the tower was busy doing something else at the moment. The misunderstanding is not revealed until the tower hears the sweeping group's next planned action. The tower then displays uncertainties, shown in the slowly, prolonged address of the sweeping group in the next utterance.

The lead sweeper now states his reasons for wanting to go in that direction. Here is where it becomes evident that the snow sweeper uses visual information as a basis for his decision-making – "Yeah I saw that they started from there so isn't it best to go from there then?" He now shows that he has seen the planes, and from the direction in which the planes are going, has drawn a conclusion about where the sweeping group should go next. The person in the tower agrees with his decision, saying that his planned next action is "absolutely" the best way to go. Here she could have ended her turn, but she continues to explain for the sweeper how the misunderstanding came about. This is all done out of the institutional order of talk. The lead sweeper does not acknowledge her explanation at all in his next utterance, where he simply states that the sweeping group is ready. The repair of the misunderstanding between the tower and the sweeper is done in a conversational mode. They are not using any identification or address. By opting out of the institutional mode, they mark the topic for the conversation as problematic. When the problem has been resolved, they get back into the institutional mode again.

This example nicely shows how the snow sweepers and the tower have different perspectives in the system that the ground air traffic management comprises. There is not one single unit with control; the control is

distributed over various people, and the decisions are consequently also distributed, although against the manual considering both legitimate movements and radio use.

In the next excerpt, we will see a very illustrative example of the sweeping group making their own decisions on the ground. In this case, they cross the runway without permission from the tower, something which is highly prohibited:

Excerpt 2

SOPLEDAREN: tornet sopgruppen på yngve (.) kan vi gå zeta söderut via zeta kalle? #

(17.0)

391:             tornet tre nio ett #
TORNET: e::tt (.) tre:: (.) nio tornet #

[Long section where vehicle 391 speaks with the tower. Meanwhile, the lead sweeper sits ready with his radio in hand, waiting for a response. He looks in both directions, then crosses the runway.]

391:             tre nio ett (.) klart göra vändningar på södra yngve (0.5) vid infart urban #

(1.0)

SOPLEDAREN: tornet sopgruppen (.)vi gick zeta söderut via infart zeta kalle (.)så att du vet (om) #
TORNET: sopgruppen kör zeta söderut #
SOPLEDAREN: opgruppen #

SWEEPER: Tower the sweeping group at Yan::kee (.) an we go Zulu south via Zulu Kilo? #

(17.0)

391:             Tower three nine one #
TOWER: o::ne (.) three (.) nine tower #

[Long section where vehicle 391 speaks with the tower. Meanwhile, the lead sweeper sits ready with his radio in hand, waiting for a response. He looks in both directions, then crosses the runway.]

391:             three nine one (.) ready to make turns at south Yankee (0.5) at entrance Uniform #

(1.0)

SWEEPER: tower sweeping group (.) we went Zulu south via the entrance Zulu Kilo (.)so you know #
TOWER: the sweeping group driving Zulu south #
SWEEPER: eeping group #

In this excerpt, the driver is asking the tower for permission to cross the runway. The tower does not answer; there is a very long pause suggesting that the tower did not hear. Instead he talks to another vehicle, 391. The driver waits for the tower to give him permission to pass. After a while, still overhearing the tower's conversation with someone else, the sweeper crosses without permission, after having looked in both directions to see that it was clear.

What is interesting in this example is that the sweeper obviously does something that is against the institutional order of work, i.e. crossing without permission from the tower. However, the tower does not comment upon this. Instead, when the sweeper calls the tower to say where they have gone, "just so you know", the tower simply confirms. But the repetition is a repair of the breach against the institutional order of work, in that the tower repeats in the present tense. Instead of repeating "went" he says "driving". Obviously, confirming in the past tense would show that he had recognized that the sweeping group had already taken action; now instead he repairs by saying that they are about to do it. The tower and the lead sweeper thus *collaboratively repair the sweepers' breach of institutional procedure.*

In these two examples, it becomes evident that the mobile workers make decisions based on local, visual information. In the first example, the lead sweeper drew conclusions about where to sweep next from his visual information about where the aircraft were departing. In the second example, the sweeper crossed the runway using the same mundane method as one would use to cross a road: looking in both directions and then crossing. This was done without permission from the tower, thus against the institutional order of work as described in the manual. These examples show how the visual and the local are used in decision-making at the airport.

INVERTING INSTITUTIONAL ORDER

In the formal plan of how the work at the airport is supposed to be carried out, it is the snow team which is supposed to ask for permission for their actions. In this excerpt we see the opposite; the tower asks the group (here the brake vehicle) for permission for aircraft to enter the area that the snow crew is currently clearing.

Excerpt 3

TORNET:	«bromsvagnen::» e de okej att vi ställer upp e:: direkt när ni har e: börjat röja på noll åtta? #
BROMSVAGNEN:	arå de e okej #
TORNET:	tack för de #
TOWER:	«brake vehicle::» is it okay that we are getting in position e:: directly when you have e: begun clearing on zero eight? #
BRAKE VEHICLE:	yeah sure that's okay #
TOWER:	thanks #

The tower begins by identifying the recipient (the brake vehicle) in a formal manner. Thereafter, the person in the tower opts out from the institutional to do something rather unusual in the communication between the tower

and the sweeping group – he asks for permission for an action. Since asking for permission to do things is not something that the tower should do from the group, there is no institutional way of doing it. The informality of the question and the way it is phrased, leads the brake vehicle to continue in that mode. The rest of the exchange is conversational, in the lack of identification, repetition, as well as in the choice of words. The last part of the exchange is particularly interesting. The tower thanks the sweeping group. It is remarkable that the tower displays thankfulness to the sweeping group for letting the aircraft be on the runway. This can be taken as evidence of the decentralized practice. The control tower does not decide what to do, the mobile workers have a say in the coordination of work as well.

In the next examples something quite similar occurs. In the formal plan of how the work at the airport is supposed to be carried out, it is the snow sweepers who carry out orders and the tower that gives orders. The tower normally does not give any *reasons* for orders; they simply state where the sweepers should go, not why. However, in the following example we can observe how the tower changes plans, and explains her reasons for doing so to the sweeping group.

Before this segment, the tower has displayed uncertainty about the plans by telling the group to wait. Also, there have been problems with the radio, something that the lead sweeper has commented on to the tower.

Excerpt 4

SOPBIL 391:   a tornet tre nio ett vi ställer upp å håller <u>fem</u>ti på yngve helge #
(0.3)
TORNET: öh tre nio ett me följe:: «tror ni att ni kan» ställa upp å börja vid yngve johan ((radio problems, unhearable)) senare ikväll å då skulle vi behöva ha den röjd #
SOPBIL 391:   a då gör vi de istället (0.1) tre nio ett #
TORNET: <u>jättebra</u> (.) hh håll femti från noll åtta på yngve johan (0.1) tre nio ett #
(0.2)
SOPBIL 391:   tre nio ett vi håller femti på yngve johan

SWEEPER 391:   yeah tower we are getting in position then and holding <u>fif</u>ty at Yankee Hotel #
(0.3)
TOWER: eh three nine one with suite:: «do you think you can» get in position and begin by Yankee Juliet ((radio problems, unhearable)) later tonight and then we would need it cleared #
SWEEPER 391:   yeah we will do that instead then (0.1) three nine one #
TOWER: <u>great</u> (.) hh hold fifty from zero eight on Yankee Juliet (0.1) three nine one #
(2.0)
SWEEPER 391:   three nine one we are holding fifty at Yankee Juliet

In the first line in this excerpt, the lead sweeper tells the tower that they are putting their machines in position, getting ready to sweep Yankee Hotel. The tower then asks the snow sweepers to sweep another runway (Yankee Juliet) than previously agreed on. This involves a change in plans, and a break from the routine. This is obvious in several ways; she formulates a question, asking the snow sweepers if they can do this rather than telling them to do it. This means that she opts out of the institutional order of talk. She uses the polite "do you think that you can...", which gives the snow crew the theoretical possibility of declining to do so.

Furthermore, she does something that is rather unusual in the talk between the tower and the sweepers; she gives the reason for why a certain action should be carried out. She says that the reason why they should sweep another runway than previously decided upon is because they would need it later tonight for some reason. *The decision process in the tower is thus made more transparent to the sweeping group*; they are given reasons for decisions rather than just the decisions without a context.

Furthermore, the tower's use of "great" is a way to show gratitude towards the sweepers for being able to change their plans according to her wishes. There is no institutionally described way of showing appreciation and thankfulness; this is not regulated in the manual.

These two examples show the ways in which the sweeping group takes an active part in the decisions the tower makes about air traffic. The order of work was negotiated over the radio, and there was a discussion about what to do next. The tower was not simply given orders and instructions; they asked the sweeping group for permission and negotiated the best way of carrying out work. It can be concluded that the everyday practice is to some extent decentralized, in that the sweepers take an active part in the everyday decision-making on the airport.

LOCAL COORDINATION

In the following, we will look at the conversation within the sweeping group itself. We will see how the group uses local knowledge, visual contact and radio talk in order to attend to highly local issues and problem on the runway.

In this case, there is a breach against the regulation stating that they should use channel one when on the runway. As soon as they leave this area the radios are switched to channel two. However, despite what the manual prescribes, the snow sweepers and other personnel sometimes use channel two when they are on the runway. This is seen in the following example, where the sweepers try to solve a problem with a machine. The sweepers all know that Peter is a novice. His vehicle is the last in the line of snow machines, but he cannot get it to run as fast as the others. Consequently, the

distance between Peter and the rest of the group increases. This can of course be serious, since the group has to keep together and leave the runway by a certain time. Their talk about the machine is shown below:

Excerpt 5

PETER:	u:h:: varför växlar han inte upp nu då? #
(3.0)	
SOPARE 2:	har du driven i? #
PETER:	driven e i #
SOPARE 2:	>>de e bara å gasa det går så trögt (serrö) du har aldrig åkt dumpern förut?<< #
PETER:	nä inte så här hörru de ligger kvar jag har gasen i botten men femton hundra varv går han bara upp till (0.5) och trettiotre kilometer #
SOPARE 3:	kolla stoppen så den är intryckt ordentligt #
(11.0)	
PETER:	det händer lite grann när jag håller in stoppen med handen (.) då gick han upp till trettifem i alla fall #
SOPARE 3:	*[inaudible]* försök hålla kvar den är lite seg. men han kommer #
PETER:	det gör de #
[deleted section]	

The sweeping group is now about to exit the runway. When turning the corner, the lead sweeper turns around a looks out the window, to get a look at the vehicles lining up behind him. When he sees the large gap between Peter and the rest of the machines, he says to himself: "My God, is that far behind!".

SOPLEDAREN:	Peter ta tvåan# (8.0) Peter ta(r) kanal två #

PETER:	u:h:: why doesn't he change gear now? #
(3.0)	
SECOND SWEEPER:	o you have the driver mounted? #
PETER:	the driver is mounted #
SECOND SWEEPER:	>>I'm stepping on the gas and it's so heavy it hasn't been this heavy before?<< #
PETER:	no, not like this it's on. I have the accelerator pressed to the floor but it only reaches fifteen hundred revs (0.5) and thirtythree kilometers #
THIRD SWEEPER:	check that the stop is really pushed #
(11.0)	
PETER:	omething happens if I push the stop with my hand (.) Then he got to:: thirty-five at least #
THIRD SWEEPER:	*[inaudible]* try to keep it a bit hard. But he's coming #
PETER:	it does so #
[deleted section]	

The sweeping group is now about to exit the runway. When turning the corner, the lead sweeper turns around a looks out the window, to get a look at the vehicles lining up behind him. When he sees the large gap between Peter and the rest of the machines, he says to himself: "My God, is he that far behind!"

LEAD SWEEPER:	Peter take two# (8.0) Peter take(s) channel two #

Peter and the lead sweeper switch channels and discuss what to do with the malfunctioning machine. Peter says "it's hairy". They decide that the vehicle should be taken back to the garage and be replaced. They switch back to channel one again.

Peter starts with an open question about his machine "Why doesn't he change gear now?" This is not addressed to anybody in particular; rather it is a call for help to whoever can help him. The snow sweepers know that Peter is a novice, and the second driver in the group responds quickly to help him out. The lead sweeper has a special responsibility for the group to adapt his own speed so that no one falls behind. He gets a good look at the team when the group turns and exits from the runway. This local awareness, as well as their knowledge of Peter's lack of experience, makes him take action and switch channel. It is likely that the switch is made because he knows that there has been too much to talk already and he wants to avoid further blocking channel one. Although this is against the manual, we observed several instances when the snow sweepers would switch to channel two on the runway to talk about these types of issues.

It is worth noting that the practice of switching channels on the runway is visible to the tower since the request to change to channel two is made on the channel that is overheard by the tower. The lead sweeper claimed that he had never been discouraged or ordered not to use channel two by the tower. Thus, there seemed to be a common understanding that they could shift to channel two if they had to perform extended conversations. This could however be a dangerous way of pursuing co-ordination. If the tower had given the lead sweeper an urgent order, e.g. to leave the runway immediately, the lead sweeper would not hear it. However, the lead sweeper had developed a workaround to be able to receive these messages. The brake vehicle, with which the lead sweeper cooperated, was equipped with two radio receivers, and they were always listening to both channels. If it was within sight of the front sweeper he counted on the driver of the brake vehicle to warn him on channel two if the tower could not reach him at channel one. Thus, the institutional rules for the technical operation of the radio equipment were not in compliance with their actual needs, and they had therefore found other ways of collaboration to achieve safe ways of supporting coordination.

From these examples it is obvious that coordination within the snow crew is based on local, visual information obtained by looking out the windshield. Furthermore, we have seen how this information needs to be discussed over the radio. These examples point to the highly local-dependent information the sweepers use in their work. Keeping an eye on the machine in front of them, letting others know if there is a problem and if so how it should be adjusted. Together they take great responsibility for the machines and for leaving the runways clear. In this work the radio proves important, so important that the sweepers break the rules for radio use on the runways.

Discussion

Coordination of air transport is currently under reconsideration in Northern Europe. Air traffic authorities and airline companies are exploring new principles and technologies to redesign air traffic control. New, innovative techniques are being developed that will not only support air traffic control in the tower, but also engage pilots and other vehicle operators in the coordination of activities. These systems are being considered as an alternative to radio talk. This chapter considers the attempts of decentralizing coordination.

The work in the sweeping group that we have observed has been relatively unproblematic. Breakdowns occur in the system, but are resolved. However, the problem identified by the management and which initiated the design and introduction of the SnowCard system, still remains. There is an increase in traffic at the airport. Currently, they are in the process of building a third runway, something that is likely to intensify the risk of coordination breakdowns. If the goals behind the SnowCard system are to be met, that is increasing traffic capacity and safety, the design should be informed by an understanding of the current social practices.

The coordination of snow clearing can be understood as an ongoing interactionally negotiated practice. The tower and the snow clearers occupy different viewpoints in the system depending on their task and the situation. Coordination is then achieved through negotiations between different localities. There is not one single unit with control; the control is distributed over various people, and the decisions are consequently also distributed, although this goes against regulation. The snow sweepers and the tower have different perspectives in the system that the ground air traffic management comprises. This becomes evident in the topics discussed on radio, as well as in how they constantly would avoid the institutional formats for radio communication for various purposes.

We have found that the new system was of minor use for coordination. Instead the tower and the snow clearers used the radio communication system for coordination and negotiation of next actions. Radio talk and well visual sight are still the most important tools to do the job. By examining radio talk-in-interaction between the snow crew and the tower, we have identified a set of important factors in radio talk. These are necessary to consider when designing alternatives, or additions, to talk, as the SnowCard does. Activities that were carried out in talk were:

- *Repairing misunderstandings.* When there had been a misunderstanding, based on e.g. a mishearing or differences in access to information, this was resolved through talk.

- *Negotiating the task-at-hand and intentions.* When there was a need to talk about what the next planned action was, both from the tower and the sweeping group, this was done through talk.
- *Talking about the work order and the order of talk.* Letting others know that they had done something that was believed to be inappropriate, or asking them the reasons for actions be stated.

These things were all found to be of great importance for the work and are difficult to accomplish within the institutional system. Further, conversational language was used to make it stand out from the institutional, thus stressing its extra importance, and that there was something out of the ordinary to attend to. This chapter has also shown the many things that can be accomplished within a conversational mode. There is an interesting comparison with the talk on the radio and the manual itself. When the manual wants to give extra emphasis to the fact that unnecessary talk or "chatting" on the radio is not appropriate, the text actually switches from institutional, neutral jargon, to more conversational and colloquial language. This implies a need for opting out of the institutional mode in order to mark the text as something that requires special attention, just like conversational mode was used in the radio talk. In the light of this, the need for informal conversations on the radio seems even more evident.

Implications for design

One motivation behind this study was to evaluate the resources available to coordinate the snow maintenance at the airport. The resources included the old technology, namely the UHF-radio, and how it was used alongside the newly introduced technology, the SnowCard. We found that the new system was not widely adopted by the snow crews.

The system is currently under consideration at other airports. Being the first evaluation of this system, we find it important to identify a set of factors that could influence a successful redesign of the system, or at least factors to influence the design process within this new systems concept. We argue that:

- A decentralized approach for developing technical support does fit with current practice. However, the current attempt has not yet become an important enough tool for them.
- In the current use of the system, there are two competing sources for visual information – the SnowCard system and the view from the windshields. The system is not used. Perhaps the system will be used in a greater extent when most of the vehicles on the airport, as well as the planes, are visible on the screen. It could also be used if more information was given on the other vehicles than their positions. We

suggest that it could be of use to display which channels other vehicles are using on the UHF-radio.

- A system giving visual information cannot give the information needed about next action. Information about the location of a vehicle is not enough. It is not possible from the SnowCard system as it is today to ascribe intention to the small dots that represents the snow vehicles. This is something that has to be negotiated through talk.

- Thus, design for increasing situation awareness must go hand in hand with the introduction of better tools for supporting the necessary negotiation work.

- We suggest a design approach which integrates visual information in the system, rather than considering it as an alternative to the radio system.

The main problem and the reason for the limited use of the SnowCard system by the snow crew we have studied, lies in the underlying assumptions about what the system sets out to do. The system is designed so that more information about the current situation can be obtained by simply looking at the screen. This implies giving the snow crew more information, thus decentralizing the decision-making by enabling the crew to make their own decisions about their work. However, the existing formal institutional rules do not support these types of decentralized decisions. We have seen in our fieldwork that the institutional order is frequently opted out of in order to carry out work. *This means that decentralized decision-making is not supported by the organization, as expressed in the manuals concerning snow clearance operations, but this is exactly what the SnowCard system sets out to support.* We believe that this is the key problem, and something that needs to be explicitly formulated and attended to in redesign.

Chapter 7: Making Sense of Mobile Technology[1]

It is a snowy day in Oppdal, a ski resort in the Norwegian mountains. The group of ski instructors had done their work for that day, and had gathered in one of the cabin to prepare dinner. One of the ski instructors, Erik sat on the sofa, holding and looking at his Hummingbird, a mobile awareness device the group was testing. From looking at the display, it turns out that none of the other ski instructors had their Hummingbirds on that night. Erik says loudly: "Not one of you idiots has your Hummingbird on! Come on now!" One of the other ski instructors in the cabin, Linda, immediately exclaims "Sorry!" in a sincere manner. She seems to take the reprimand seriously.

Introduction

"In CSCW, we would like to be able to develop technologies that help people work. Appropriation is endemic to collaborative work; it is a regular part of the picture. So we must be able to build systems that deal with appropriation. Developing a

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[1] This chapter builds to a large extent on Weilenmann, A. (2001) Negotiating Use: Making Sense of Mobile Technology, *The Journal of Personal and Ubiquitous Computing*, special issue on Mobile Communication and the Reformulation of the Social Order, vol. 5: (2), 137-145 Springer-Verlag London Ltd.

> deeper understanding of the technical features that support appropriation can help us bring more appropriable technologies, as well as helping us to analyse the problems that accrue when technology is not appropriable. The second important aspect is a methodological matter. Appropriation lies at the intersection of technical design and social practice. Investigating appropriation and developing an understanding of its consequences for technical design is a way to provide a stronger link between sociological studies of working practice and technological investigations of design in CSCW." (Dourish, 2003)

Many studies have shown that users develop norms for how, when and for what purposes to use new information and communication technology (Ackerman and Palen, 1996; Ackerman *et al.*, 1997; Orlikowski and Gash, 1994). These norms are the result of negotiations within the user group, in order to reach a shared understanding of the use of the device or system. Studies of norms and information technology have generally focused on the stationary setting. The increased focus on support for mobility calls for studies of the negotiation of mobile use. This is the concern of this chapter.

The paper is based on a study of a group of ski instructors who used a mobile awareness device called the Hummingbird (Holmquist *et al.*, 1999). This device aimed to support collaboration in co-located groups by enhancing the awareness of the presence or absence other users. When two or more of the ski instructors with Hummingbirds were in the vicinity, this was indicated through a "humming" sound and the name of the user was shown on a small display on the device.

The study shows how users have different opinions of how, when and for what purposes to use the Hummingbird, and they therefore needed to negotiate the use to reach a common understanding. These results are here compared to earlier studies that discuss norms developed around *stationary* technology providing awareness. Studies of the stationary setting are represented here by three studies of media spaces: Dourish *et al.*'s (1996), and Adler and Henderson's (1994) respective studies of the use of audio-video media spaces, and Ackerman *et al.*'s (1997; and Hindus *et al.*, 1996) study of an audio-only connection. These studies are relevant because they all concern technologies that give awareness of other users' activities. Also, the chapters examine awareness provided through audio-video and audio-only respectively, thus representing two different approaches. However, performed in research labs and a traditional office space respectively, these studies are unable to examine norms that develop around technology use in a *mobile* activity. This chapter moves out of the stationary settings, examining how a group of novice users make use of a new type of mobile technology.

The study was performed using two methods: ethnographic observations and focus groups interviews. The ski instructors' use of the Hummingbirds was first observed during a one-week ski trip by this researcher. After the trip, the ski instructors who had used the devices were gathered for a focus group

session. The combination of these methods gave insight into the ways in which the instructors negotiated the use of the Hummingbirds.

The first part of the chapter presents three studies of stationary technology. The second part of the chapter gives a theoretical background to norms and relevant concepts. The third part of the chapter explains the method and site, as well as the Hummingbird device. The remainder of the chapter is dedicated to analyzing the methods employed by the ski instructors to negotiate their use of the Hummingbird, as well as examining which areas these negotiations concern.

Related work

This chapter explores three previous studies of stationary technology use as a comparison in order to examine the negotiation of use and sense making. The three studies are Dourish *et al.*'s (1996) "Your place or mine? Learning from long-term use of audio-video communication", Adler and Henderson's (1994) "A room of our own: Experiences from a direct office share", and Ackerman *et al.*'s (1997), and Hindus *et al.*'s (1996) "Hanging on the wire: A field study of an audio-only media space". The reasons for choosing these studies are several. First, they all deal with a type of technology that provides *awareness*, as do the Hummingbirds. Also, the technology is *stationary*, thus functioning as a comparison to the *mobile* Hummingbirds. Further, the media space studies, as well as this study, look at groups of users that are already established, which is an important aspect when considering how they negotiate the use. This section introduces these studies.

The Dourish *et al.* (1996) study describes the long-term use of two media space connections that were set up between two sets of researchers. One of these connections is also accounted for in Adler and Henderson and will be described further on in this section. Dourish *et al.* note that a special communicative pattern of behavior emerged over time. Their study shows that the users (in this case the authors) adapted to the technology and learned the most effective way to use the system. After a period of use, they developed an understanding on how the person at the other end of the connection needed to be presented with information in order to avoid misunderstandings, and they used the media accordingly. Further, Dourish *et al.* note that they developed what they call a shared sense of ownership of technology. This means that the users felt a common responsibility for the connection and the technology realizing the connection. Dourish *et al.* also note that the technology is used as "public affirmation" of different kinds of relationships (*ibid.*:48), arguing that the way of using the technology can be a way to express cultural norms or "individuals' status within wider groups".

"A long-term connection is an obvious, highly visible, and hence public element of a person's working environment" (*ibid.*:48). Thus the technology in itself can be seen as a group marker.

In the next study, Adler and Henderson (1994) describe their own use of an audio-video connection that lasted nine months. They call their connection a direct office share. By 'direct' they mean that the connection was unswitched; the connection was 'always on' and in effect. They argue the significance of the difference between audio-video connections depending on whether they are switched or unswitched, because the work practices developing around these two types of connections are different. For instance, they note that there is no need for greetings to establish social interaction when there is an ongoing connection.

In contrast with Adler and Henderson's unswitched audio-video connection, is the switched audio-only connection described in Ackerman *et al.* (1997). Here the users could choose when to turn it off and on. What is interesting here is that this possibility to choose is what leads to a need for norms of how to handle the system. Ackerman *et al.*'s results show that the users developed norms for three areas: how to sign on and off the system, how to handle withdrawal and inattention, and how to handle private information.

Ackerman *et al.* conclude that certain norms developed as a result of system characteristics. Thus, the fact that it was not possible to know who was on the system, resulted in norms for signing on and off so that one would get this information. The users would ask who was on at the moment, let each other know when they were leaving etc. The system afforded a certain type of interaction.

Previous studies have indicated the importance of the initial use of technology. According to Orlikowski and Gash, this is when the initial sense making of the technology takes place (1994). Similarly, it has also been noted that this is when the ground for the norms is laid; group expectations are often set by the very first behavior that emerges in a group (Feldman, 1984). This study focuses on a relatively short period of use: seven days. Clearly, long-term implications cannot be drawn from this material. However, the concern of this chapter is the initial sense making and negotiation of use, and this is why the very first days are of interest.

This study uses an ethnomethodological approach, focusing on the ways in which the users negotiate the use of the Hummingbirds. The purpose is to investigate what members were doing and what members were saying in order to make their actions understandable to other members of the group. The focus is on the methods that the members themselves use to make sense of the technology, to define its areas of use, and to express this definition to the other members of the ski group. How do they establish a common sense of the technology?

Norms have been defined as "the informal rules that groups adopt to regulate and regularize group members' behavior." (Feldman, 1984:47). According to Feldman, one reason why norms are enforced is that they "simplify, or make predictable, what behavior is expected of group members." (*ibid.*:48). In order to use the term in accordance with the ethnomethodological framework, 'norm' will be used here to describe the result of the sense-making and negotiation process of the ski instructors. The assumption is that when coming into an activity and beginning to use a technology, people already have expectations and opinions of this technology. It is assumed that the ski instructors did not all have the same views on what a Hummingbird was and what it was meant for. They had different expectations and opinions that were subject to change when interacting with technology and the other users. Negotiations occurred in order to reach a *shared understanding* of what the technology was as well what its intended use was, an understanding upon which to establish norms.
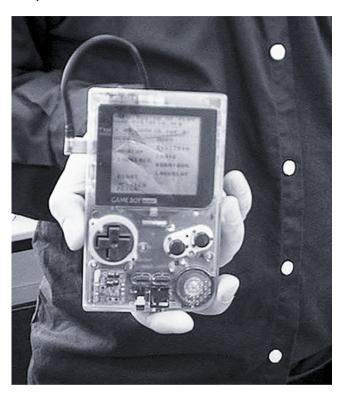
It has to be noted that the norms are not meant to be taken as static. They change as people change their way of working with technology, thinking of technology and talking about technology. "Norms usually develop gradually and informally" (*ibid.*:50). Thus the negotiation process should be seen as ongoing.

The Hummingbird

The Hummingbird is a device developed to provide information of the presence (or absence) of other users, thus enhancing the awareness of other members in co-located groups. The Hummingbird is based on the concept of IPAD: Interpersonal Awareness Devices (Holmquist *et al.*, 1999). The form of awareness that is provided is awareness of the physical proximity of others. The idea is to provide mobile groups with continuous awareness information, something that earlier has been provided mostly for stationary use. The Hummingbird is not designed to be used in a specific activity or to fulfill a certain goal. However, it is believed that the Hummingbirds can be used to support social interaction in mobile groups (Weilenmann and Holmquist, 1999).

The prototypes that were tested by the ski instructors used the Nintendo Gameboy as a platform. A small radio transceiver communicated with the Gameboy through the serial port. The devices did not depend on an infrastructure, simply on the other Hummingbirds. When two or more Hummingbirds were within a distance of less than a hundred meters, the devices produced a sound – they "hummed". At the same time, the name of the user appeared on the display, distinguishing the users. The names of the

ski instructors were divided into two columns on the display: "here" and "away".

Data collection

This study is based on field observations and focus group conversations with a group of ski instructors who tested the Hummingbirds during a ski trip to Oppdal, Norway. The instructors were university students, and amateur skiers, who organized a trip for 200 Swedish university students. The trip took place in the small ski village of Oppdal and lasted a little less than a week. There were 16 ski instructors and eight were selected to use the Hummingbirds. They were selected by a person in the team, Fritte, in discussion with the researcher. These users were chosen because they were distributed over the three types of skiing taught by the instructors: snowboard, telemark, and regular slalom. Also, Patrick, the key person in the

user group, and the main responsible for the trip, was given one. Two of these selected instructors could not be considered as users due to technical problems during the course of the test, leaving the final number of users to six and the non-user group to eight. The group members all knew each other before the test. Some of them were friends who met regularly, even took the same classes, while others only met for ski club related activities.

ETHNOGRAPHY AND FOCUS GROUPS

As was described in the theoretical background of this study, the material was analyzed using an ethnomethodological approach. A common way to obtain data that can be analyzed in an ethnomethodologically inspired way is to go out in the field, using ethnographic field techniques to obtain detailed descriptions of observable actions. Ethnography is thus one of the methods upon which this study is based. However, in a field situation with mobile users who are physically distributed, the observer's task is difficult – it is simply not possible to be everywhere at the same time. Therefore, a complementary method was used here: focus groups. Gathering the informants in focus group conversations after the field experience makes it possible to gain some insight into situations to which it was impossible to attend. Another advantage with performing focus groups after having spent time in the field is that it is possible for the researcher to test his or her understanding of the situation. Also, "ethnography provides broader frames of interpretation in terms of which focus group details take on added significance" (Agar and MacDonald, 1995:78). Ethnographic field study and focus groups are two methods that complemented each other excellently in this case. In combination these methods gave a varied view of the ski instructors' use of the Hummingbird, as well as their own opinion of the device.

The field study was performed over seven days and six nights. Two of these nights were spent on the bus to and from the destination. The researcher lived with the ski instructors during these days, observing and participating in most of the activities. A typical day in Oppdal among the ski instructors started with breakfast in one of the three cabins around 8.30 AM. At 10 AM, the ski instructors met their groups of skiers by the lifts. Two hours of skiing followed. At noon, it was time for lunch, taken in one of the cabins alternatively in the slopes. After lunch, the instructors got time to ski on their own, since there were no ski classes in the afternoon. They skied all afternoon and often ended the skiing session in the bar at the end of the slopes. Around 6 PM they were back in the cabins again, had dinner and then usually went out to party. During all these activities, the ski instructors were observed and detailed notes were taken.

After the field study, a focus group session was carried out with five of the ski instructors who had been using the devices. The focus group was performed in a manner used in social studies (Wibeck, 2000). The purpose was to get the members of the group to talk about the issue in focus – the Hummingbirds – in a free and natural way with as little intrusion as possible from the moderator (the author). The focus group lasted over an hour, and the participants spoke freely around the subject of Hummingbirds and related issues. There were several areas that were covered without any introduction or questions, indicating the relevance of these issues for the participants themselves. The moderator asked a few questions, but remained in the background during the conversations.

When collecting data through ethnography and focus group, an immense amount of material is obtained. It is therefore necessary to begin with structuring the material in a way that makes it possible to go on and analyze it. Careful notes were taken during the days in Oppdal. These notes along with observations from the field were then divided into several categories. These categories developed questions for the focus groups. With the focus groups, it was necessary to transcribe the conversations in order to analyze them further. The researcher got a good feel for the conversations, through listening to the recorded focus groups over and over again, before transcribing them. The transcriptions were originally done in detail, marking events such as overlapping utterances, the length of pauses etc. However, since the focus here is on content (rather than form), the transcriptions are simplified for readability reasons. After the transcription, the material was analyzed looking for certain themes in the data. The conversations were divided into categories, such as when the Hummingbirds were used, for what purposes, examples of verbal negotiations of use, etc. These categories were then closely examined and related to the material from the field study.

Results

The observations show that the users immediately started negotiating around the use of the Hummingbirds. They found themselves in a situation where they had been told to use an artifact with which they had no previous experience. Consequently, they must begin using the Hummingbirds according to their definition of the test situation. This section is concerned with *how* the use is negotiated. What did the ski instructors do in order to reach a consensus? It was found that the ski instructors had two methods for negotiating use: through *talk* and through *action*. Below, these two methods are presented separately. However, it is obvious that they often go hand in hand; presenting them separately is done for sake of clarity.

BOUNDARY BETWEEN WORK AND LEISURE

It is likely that the participants in a test of this kind form their early expectations based on what they are told by the people that introduce them to the technology. The first time that the researcher talked to the group of ski instructors was on the same day that they received and started using the Hummingbirds. This was also the day for the trip to Norway. The majority of the group seemed very cooperative and interested in being part of the test. They were not told when to use the devices or for what purposes. This was intentionally done in order to let the instructors themselves use the Hummingbirds when and where they wanted. One of the users seemed especially anxious to know how to act in the test and asked the researcher "When do you want us to use them?". The answer "Whenever you want to", made her ask jokingly if they should use them on the Après Ski too. The researcher said "If you want to". Everyone laughed at this suggestion, probably because they believed that this was not a proper place to use the Hummingbirds. This shows how, from the very beginning, the Hummingbird was considered to be a tool meant to be used by the instructors when skiing. Here was where the negotiation of use begun, and it continued throughout the week. Even after the trip, it was clear that they had not agreed on this use. As will be presented later on in this chapter, they expressed different opinions of this in the focus group.

During the field study it became clear that the ski instructors had different ways of viewing the potential use of the Hummingbirds, as well as different opinions of the test and their roles in it. Therefore, they had to negotiate the use and establish norms for when and how to use the Hummingbirds. The different activities are listed below, to give an overview of the activities that the negotiations concerned.

Activities related to work:
- Ski instruction
- Morning gatherings
- Organizing the bus trip to and from the destination

Leisure activities:
- Skiing in the afternoon (the instructors' free time)
- At lunch
- Après Ski and when going out at night

Several times during the trip, there were instances of the users negotiating the test situation: when and where were they supposed to use the Hummingbirds. The very first night of the trip, they were going out to have dinner and dance. One of the instructors, Mia, almost brought her Hummingbird along, and Anders hesitated about bringing his. They talked about this for a while before finally agreeing upon *not* bringing their devices since Anders thought that they should not risk losing them. He said "After all, it's on the slopes

that we're supposed to test them". This was his way of expressing his view of when to use the Hummingbirds: they should be used on the slopes.

An explicit verbal negotiation of when to use the Hummingbirds took place on the first night in Oppdal. The ski instructors were off for the day, and they gathered in one cabin to prepare dinner. Erik sat on the sofa, holding and looking at his Hummingbird. None of the ski instructors had their Hummingbirds on that night, which lead Erik to say loudly: "Not one of you idiots has your Hummingbird on! Come on now!" Linda immediately said "Sorry!" in a sincere manner, seeming to take the reprimand seriously. This example clearly shows how Erik expressed his view of when to use the Hummingbird: 'It should be on now'. Linda, in saying that she was sorry, agreed with this view of the Hummingbirds' use and was sorry that she did not use it like that.

That same night Anders and Mia discussed whether or not they should bring their Hummingbirds along at night, when they were on their way to the nightclub. They decided not to bring them. Linda, on the other hand, had not heard this conversation, and the same night in the taxi she shouted: "Do you guys have your Hummingbirds with you?". Maybe she had brought hers along, remembering the reprimand they all had been given previously by Erik. This also shows how the negotiations were continuously going on throughout the week.

It was evident that the ski instructors did not manage to establish norms that they all agreed upon before the end of the trip. In the focus group session that took place after the trip, they were still negotiating the use. When asked about when they felt they where supposed to use the Hummingbirds, this is what they told me:

Excerpt 1

Patrick	on the slopes everyone tried to have their [Hummingbird] on I think
Fritte	yeah
[...]	
XXX	when we were on the slopes[...]
Linda	[...]well, lunch and // well mornings when we go out to the slopes and then at lunch
Fritte	yeah at lunch
Linda	at lunch
Patrick	yeah
Fritte	and that was when we looked MOST // to check where everyone was
Linda	yeah
Fritte	when we wanted to meet

In excerpt 1 from the focus group, there is an example of how the users talked about when they had a use for the Hummingbirds. Before this point in conversation, Linda had told the story about how the Hummingbirds proved useful when getting on the bus before leaving for Norway. After she

related this, she went on to say that this area of use was not intended. It became evident that Fritte believed differently.

Excerpt 2

Linda: yeah but now we were supposed to use them on the slopes and that so I don't know
Fritte: no but yeah but not ONLY [on the ski slopes] [...]at times like getting on and off the bus // we've said this ourselves that they worked really good

SENSE OF SHARED OWNERSHIP

During the course of the test, the users experienced several shortcomings in the Hummingbird prototypes. The technical problems made evident an interesting phenomenon: the users developed a sense of *shared ownership of technology* (Dourish *et al.*, 1996). It was clear that the most active users cared about the other Hummingbirds and the way that these were handled by the other group members. It was in everyone's interest that all the devices functioned. This led more active users to remind less active users of their Hummingbirds, to bring them along and to change batteries.

A very evident example of negotiation around how to handle 'breakdowns' of technology was observed on the first ski day. Fritte's Hummingbird was defective in some way, preventing him from seeing any of the other ski instructors on his list. However, the others could still see him. He decided to bring it along anyway, so that the others could have use of the information. Two days later, Fritte's Hummingbird functioned again, but then Erik's Hummingbird had the same problem. Fritte told him what he did the other day, and they agreed on the benefit of Erik bringing his Hummingbird despite the trouble. Although Erik himself was not able to see the others on his list, the rest of the group could still see if Erik was present or not. This indicates a shared sense of responsibility: bring the Hummingbird along although it is of no use to you but to the rest of the group. To be able to know whose device was working or not, the ski instructors had to check the status of the other Hummingbirds. On numerous occasions during the test, the ski instructors were heard to talk about how their Hummingbirds were working. Below is an example from the focus group, where Fritte told the group how every morning they checked their Hummingbirds before starting the day:

Excerpt 3

Fritte: it was more like this kind of that this feeling every morning when everyone was standing there with their Hummingbirds getting new batteries [Erik: laughter] and everyone's like "now you're here, now you're here, you're here, you work fine, works

> really perfect", like "great, let's go out on the slopes" [...]

This study has shown several examples of how the instructors negotiated the use of the Hummingbirds through talk. In this section, some examples of negotiation through *action* are presented. A common method to express one's opinions of how to use the Hummingbirds was to simply use them in that way.

When and where

The ski instructors expressed to each other when and where they thought that the Hummingbirds should be used, simply through using them in the places and for the activities that they believed were appropriate. Patrick, the group's formal leader, used his Hummingbird all day, during the skiing as well as the other activities, but he did not bring it out at night. This was his way of expressing his opinion on when and where to use the devices. For instance, the first day he sat at a table organizing the lists with the participants in the trip. He put his Hummingbird on the table next to him, and looked at it every now and then. Thus the others could see him use the technology. He therefore expressed through action what he thought was an appropriate use for the device. In the words of Dourish *et al.* (1996), this could be seen as a "public affirmation".

Whenever the ski instructors were seen using their Hummingbirds in any way, they expressed to the others their definition and opinion of when and where to use the technology. They looked at the devices, changed batteries, put them in and out of their pockets, put them on the tables, left them in the cabin when going out, etc. Through action they thus rendered visible to the other ski instructors their way of handling the devices.

Sense of shared ownership

It has been shown how the technical breakdowns and difficulties resulted in negotiations through talk. The ski instructors verbally expressed a shared sense of ownership and responsibility for the technology. This shared ownership was also expressed in action.

The major technical problem was the short duration of the batteries that the Hummingbirds ran on (they lasted from an hour to three hours approximately). This meant that ski instructors had to change batteries during the day. Some of them were not very good at handling this; they would forget to bring extra batteries or just forget to look and see if they needed to change them, many times causing the Hummingbirds to be turned off due to dead batteries.

Every morning the instructors were observed putting new batteries in their Hummingbirds. Changing batteries was often done publicly, which meant that the other instructors could see it and be reminded to change their

batteries too. Patrick, the main responsible for the team of ski instructors, took the test very seriously and was taking good care of his Hummingbird. He had organized the act of changing batteries very efficiently by putting dead batteries in one pocket of his ski pants and new batteries in the other.

It became essential to know whose Hummingbird was working, and whose was not. The users formed expectations about who was "on" the Hummingbird, based on knowledge about the status of the devices. In the focus group, Patrick said that he did not expect Fritte to be visible on his Hummingbird, because Fritte had had problems with his device:

Excerpt 4

Patrick: since your's [Fritte's Hummingbird] wasn't working then we didn't always know if you had it or not, like, we never looked for you then

Discussion

The focus of this chapter has been on the ways in which a group of new users negotiated the use of a new, mobile technology. The results were drawn from a study of a group of ski instructors using a mobile awareness device called the Hummingbird. It has been shown that the users employed two methods of negotiation: talk and action. These findings are summarized below, followed by a discussion on how the negotiations observed in this study differ from negotiations of stationary technology use.

NEGOTIATING USE

It became clear from the study that the ski instructors initially had different opinions and expectations of the Hummingbirds and their test of these devices. These differences became evident in the different ways using and talking about the Hummingbirds. The ski instructors would comment upon others' use of their devices, as well as reprimand those who did not use it the way that was thought to be appropriate. The other method to express one's opinions of how to use the Hummingbirds was to simply use them in that way. The negotiations occurred continuously throughout the week, in an attempt to reach a shared understanding. When the trip was over and they returned their Hummingbirds, the users still had not managed to establish norms that they all agreed upon. This became clear in the focus group session that took place after the trip. The ski instructors were then still negotiating the use.

MOBILE TECHNOLOGY – OPEN CONTEXT

Being a ski instructor is indeed being mobile. Using technology in this mobile context is evidently different from using stationary technology. With a stationary technology, the technology is accessed in the office only, whereas with a mobile technology, it can be carried around and used at all times. This study has shown that the negotiations of mobile use share some common phenomena with negotiations of stationary technology, but also that there are some features unique to mobile use. The findings suggest that the features of negotiations of mobile use depend on what the technology affords, in terms of where, when and for what purposes the technology could be used. Thus, the differences in negotiations can basically be explained by differences in the setting. These differences are discussed below.

First, *where* to use the Hummingbirds resulted in much negotiation among the ski instructors. As has been seen above, the ski instructors had different opinions of this. Should they use the Hummingbirds only on the slopes, when skiing, or during other times of the day (and night)? With stationary technology it is much more evident where to use it. In the media space studies presented earlier, the connections were accessed in the office or at the users' workspaces. There was no need for norms for *where* to use the technology, since the technology provides only one possibility: use it where it is installed. The mobile context of use is more open.

Where to use the technology goes hand in hand with *when* to use it. This was not obvious in the case with the ski instructors. Different persons had different opinions of when to use the Hummingbirds. When to use a technology is especially relevant where there is an option to turn the equipment off or not to bring it. A technology that leaves the users to decide when to use it because of the need to explicitly turn it on leads to another type of norms. This is not to say that there is no need for negotiating when to use a continuous connection, but the point is that the type of norms needed are significantly different depending on what the technology affords. In a case like Adler and Henderson's (1994) continuous, unswitched connection, a different need for norms arise than in the case with the switched Thunderwire-connection (Ackerman *et al.*, 1997; Hindus *et al.*, 1996). For instance, with the continuous connection, there was no need for greetings to show that they were entering or exiting the space. This can be compared to findings from the study of the switched connection, where users were found to announce their presence in various ways. The point here is that the greater the possibility to choose when to use a certain type of technology, the greater the need to negotiate the use. The mobile technology enables more areas of use since it is possible to bring and use at all times.

A similarity in the negotiation that this study has shown concerns a sense of *shared ownership* of technology. This leads to negotiation around the use

of the Hummingbirds. In this study, technical shortcomings such as the frequent need to change batteries resulted in negotiations. Also, the shared ownership and responsibility was evident in the case when a ski instructor decided to bring his Hummingbirds along even when it was malfunctioning and would be of no use to themselves but of use to the group. This implies that the ski instructors saw the group of Hummingbirds as one unit. Similar results have been shown in the study of stationary technology.

To summarize, differences between the mobile and the stationary setting are crucial to the use of communication technology. Differences in what the setting and the technology afford are what shape the negotiations of use of technology.

The focus of this study is on a particular group of users – ski instructors – that use this particular type of technology in a particular situation – a ski trip. The ski instructors' way of negotiating through talk and action the use of the new artifact that they have been given, is likely to have a lot in common with the way other novice users, engaged in a different mobile activity, begin to use new, mobile technology.

In the next chapter, a completely different situation is presented; a well-known and widely adopted technology such as the mobile phone is studied.

Chapter 8: Mobile Phones in Local Interaction[1]

It is early Saturday night, in downtown Göteborg. Four girls, about 13-14 years old, are sitting on the tram. They are sitting two and two, facing each other. A phone that girl A is holding rings and she answers. She says: "Yes, hold on", and gives the phone to girl B, who is sitting to her right. B talks for a couple of minutes with the person in the other end, girl E. B says to the other girls, while holding the phone a little bit from her head:

    B: she says it's more fun at the other place

    C gets upset and reaches over to get the phone. C starts talking to E:

    C: what do you mean by saying that? You shouldn't say that. Now everyone is looking at the floor. You shouldn't say that.

    After a short conversation, C ends the conversation by saying "bye, kiss, kiss". She hands the phone over to B again, who continues talking to E.

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[1] This chapter builds to a large extent on the paper Weilenmann, A., and C. Larsson (2001): Local Use and Sharing of Mobile Phones. In B. Brown, N. Green and R. Harper (eds) *Wireless World: Social and Interactional Aspects of the Mobile Age.* Godalming and Hiedleburg: Springer-Verlag, pp. 99-115.

Introduction

> "Here's an object introduced into the world 75 years ago. And it's a technical thing
> which has a variety of aspects to it. It works only with voices, and because of
> economic considerations people share it, so that there are not yet things where you
> can call up a particular person and get them, or get nothing. Now what happens is,
> like any other natural object, a culture secretes itself onto it in well-shaped ways. It
> turns this technical apparatus which allows for conversation, into something in
> which the ways that conversation works are more or less brought to bear. So there
> evolves from the introduction of the telephone a collection of rules about its use
> [...]" (Sacks, 1992vii:548)

As researchers interested in the use of mobile phones, everyday activities
provides us with a rich resource to observe phone usage. We often see people
using their phones on the bus, in parks, cafés, on bikes, in the streets, in line
for the cash machine, in shops – nearly everywhere. This public use of the
mobile phone provides us with an invaluable resource for looking at the
everyday, actual use of this technology.

As has been discussed earlier in this thesis, the social and interactional
aspects of mobile phone use have only recently become a topic of interest.
There is work looking at how mobile phones affect the urban society
(Kopomaa, 2000), how families and their teenagers coordinate their lives
together using mobile phones and how the ownership and payment structure
works within these families (Ling, 1999a,b; Ling and Yttri, 2002), the use of
mobile phones in relation to the other media (Koskinen, 1999; Coogan and
Kangas, 2000), and how mobile phones are used by mobile professionals as
one of several available resources for mobile work (Wiberg and Ljungberg,
2000).

These studies all contribute to understanding the use of the mobile phone.
In this chapter, however, we will focus on a relatively neglected aspect of
mobile phone use. That is, we will focus on the *local interaction* of mobile
phones, the ways in which phones are used and shared in the local situation
of use. From field studies of public use of mobile phones among teenagers in
Sweden, we report on how the mobile phone has come to be used as a tool
for local social interaction, rather than merely as a device for communication
with remote others. The collaborative nature of mobile phone use is very
evident from our observations. Mobile phones are often *shared* between
friends, in various ways and for various purposes. We examine how this
sharing is accomplished. Finally, we discuss how this type of empirical field
data can be of use when designing new mobile technology and services for
young people.

Related work

Mobile phones are often used in public spaces, and many of the observations we collected for this chapter come from urban situations. Unfortunately, most of this work is based on interview and surveys rather than looking at the actual use in a natural setting.

Kopomaa's (2000) book 'The city in your pocket: Birth of the mobile information society', is of particular interest in how it describes how this "new everyday appliance" has impacted on urban life. He describes how the social life in the cities has changed when practices for mobile phone use in public develop. Kopomaa gets most of his data from interviews, although these are supplemented with photos taken in public of people observed talking on the phone. Kopomaa's book, therefore, focuses almost exclusively on using phones for "phoning", i.e. making and or receiving phone calls, and the book neglects (although it does reference) other phone practices. For instance, he does not report to have made any observations on SMS-messaging, the practices of which he discusses in the book.

More specifically with regard to teenagers, this segment has received particular attention in the Scandinavian countries. For instance, Koskinen (1999) work is concerned with teenagers' use of SMS and other "asynchronous messaging with mobile systems" as well as with the convergence between mobile phones and other media. Research about Finnish teenagers' use of mobile phones and particularly their SMS-habits has been studied by collecting messages and interviewing teenagers (Kasesniemi and Rautiainen, 2002). In Norway, Ling and his colleagues have done many interviews and surveys with teenagers and their families to get the picture of use, ownership, and conception of mobile telephony (Ling, 1998, 1999a,b; Ling and Yttri, 2002). A more quantitative study focus on identity, gender and class issues related to mobile phone use among teenagers (Skog, 2002). There is also a Swedish study of teenage behavior focusing on identifying mobile internet services for young females[1]. These studies all show the great immersion of mobile phones among teenagers, and point to the importance of this device in the life of this age group.

Data collection

This chapter is based on fieldwork performed in central Göteborg, Sweden. We have focused on inner city public use of mobile phones among teenagers.

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[1] Christina Eriksson and Frida Norin (2000) "Female Application for the M-generation", unpublished master's thesis from Royal Institute of Technology, (KTH) Stockholm.

So far there are no comparisons made with teenagers' use of mobile phones in other cities, regions or countries. The fieldwork has been carried out in a wide range of places and situations, such as cafés, public transport (bus, tram and train), an amusement park, shopping malls, etc. In all these places, teenagers can often be seen passing time or "hanging out". All these places are public. The reason behind focusing on public use was originally methodological: we wanted to be taken for ordinary individuals, and not as researchers focusing on naturally occurring interaction. This would not have been possible (or at least very difficult), had we chosen to study teenagers' use of mobile phones in a private setting.

Being an anonymous observer in a public space has interesting methodological implications. When looking at the local social impact of the telephone use, the researcher only has access to the same information that the other participants have. For instance, if we are sitting on a bus and someone gets a phone call, we are in a similar position as other people on the bus, in reacting to the phone call. The ongoing interaction is as observable to us as it is to any other person currently present. This also means that we can only gather data that the members themselves actually make available; we felt that was good for ethical reasons. If someone talking on the phone did not want anyone in the surroundings to hear, we assumed they would simply talk quieter, making it impossible for us to hear, or choose not to have the conversation at all[1]. Our field study work was designed to be open ended. We generally wanted to address the question: "What do teenagers do with mobile telephones?" We did not want to make too many prior assumptions about the use, and by that miss out on what was really going on. Indeed, as we will discuss later in this chapter, by using this naturalistic technique we uncovered data on a phenomena so far neglected in the literature – the local sharing of mobile phones.

When doing fieldwork on public transport, we would generally sit on a bus or tram and observe the use and handling of phones. In cafés, we would sit at a café table like other café visitors. In the other environments, the amusement park, the shops, on town, in all these places we tried to do what people in these places generally were doing[2]. We did fieldwork during different times of the day and week, which means that the data encompasses late Saturday night, as well as early Monday morning, and everything in between.

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[1] Another note on the ethics of this study: in reporting our observations, all the material has been anonymized. We do not use any names that we have heard. We only describe the teenagers with an approximate age, from our estimations. Further, the place and time in which we made the observations are described in a general manner only, which should make it difficult to identify any single person.

[2] With the exception that we were making notes.

The observations were documented in field notes. In these notes, we made detailed descriptions of all observable events including teenagers handling their mobile phones in any way. For most of the observations, we worked as a team of two observers in the field at the same time. This had several benefits. First, it made it possible to observe more details of the ongoing interaction. Since we had to collect all our material in notes rather than recordings[1], two persons' observations could give a more detailed picture. Further, when analyzing the data, it was an advantage that we both had observed the instances, since the only material was documented in notes. We believe that this gave more a true recollection of the situation, and thus a more true analysis[2].

The field observations were then analyzed, looking for certain themes in the data, themes that seemed to have relevance for the teenagers themselves, rather than just for us as researchers. This chapter focuses on how teenagers do things together with their mobile phones, which means that many of our observations of solitary use are not discussed here. In the presentation of our observations the teenagers are named A, B, C, etc., in the order they appear in the description. The mobile phones are numbered 1, 2, 3, etc. in the same manner. Approximate times of the day are given, as well as a general description of the place in which the observation was made. The translations from Swedish have been made by the authors.

Results

The mobile phone is often described as a personal phone. In research as well as in the design discourse, there seems to be an underlying assumption that mobile phones are used by individuals for remote communication purposes. In this chapter, we hope to show how the mobile phone has become something more; it has become a tool for collaborative interaction in the local environment. Among the teenagers we have studied, the phones are not just treated as personal, and the calls and other communication are not treated as private. Rather, there is much work going on to render the communication 'public', enabling several people to take part in it. The remote communication, i.e. the phone calls they receive or make, as well as the SMS-messages they receive or send, are accounted for in the ongoing local interaction. Teenagers thus share the communication they take part in with their co-present friends. Not only the communication but also the phone itself is often shared. These findings question the notion of the mobile phone

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[1] Originally, we were interested in collecting both audio and video recorded data, but due to technical and ethical difficulties no such recordings were made.
[2] We recognize that methods relying on recollection can be questionable; cf. chapter 4.

as merely a personal phone used for remote communication. In this section we examine the ways in which phones are shared within the local environment.

SHARING OF MOBILE PHONES

We will begin by looking at *minimal forms of sharing*; how the content or information on the phone is made accessible to others in various ways, without sharing the phone itself. In the remainder of the chapter then, we will deal with a more *'hands-on' sharing*, where the phone itself is shared and handled by more than one person.

Minimal forms of sharing

In this section, we examine examples of a minimal form of sharing of mobile phones. What is shared in these instances is only information on the phone, in this case SMS-messages. There is no physical form of sharing of the phones, i.e. the phone remains in the hands of one person. The two strategies for minimal forms of sharing SMS-messages presented are (i) sharing by reading the message aloud, and (ii) sharing by showing the display to others. Both strategies are ways to let friends (and perhaps others in the surroundings) take part of or part in personal communication; ways to render private information displayed on a very small screen accessible to others. These strategies seem to occur when teenagers try to engage others in the SMS-messaging activities they currently are involved in.

   In the first excerpt from the field notes, a girl is sharing her SMS-message with her friends, while writing it. She first shows the display to her friends, and then reads aloud from her message. This one girl is responsible for all the physical interaction with the phone, but how she relates to her friends while using the phone is important for understanding what is going on:

Excerpt 1: Tram, evening

Three girls are sitting on a tram. One girl (A) is writing an SMS-message. A turns to B, who is sitting next to her, gives B a light nudge, and says "hey". She shows the display to B. A deletes a few letters, and then continues to write the message. She says with a whiny voice:
A: I don't wanna send this
A then begins to read aloud parts of her message:
A: "I want to have a home party. I'm leaving soon you know."
Presumably she now sends the message. She then puts her phone in her purse. Shortly after this, her phone rings. She exclaims "NO". She picks up her phone, and without looking on the display, gives the phone to her friend, B, and says:
A: please, can you get it?
B pushes the phone away, refusing to answer it. A answers the call. A talks to someone about the home party. She ends the phone call after a short conversation.

A: [to the others] I hate (him)! Shit! [sighs]
B: what did he say?
A: nothing! [she turns toward the window, crosses her arms and sighs]

This case basically has two parts: the first part is where girl A is writing her SMS-message, and the second part begins when the phone rings in her purse.

In the first part, the girl is trying to involve her two[1] friends in the production of an SMS-message. What could be a very solitary activity, writing a text message displayed on a very small screen, becomes a group activity. A shares her message by first actually showing the text (or the part of the text currently visible on the screen) to her friend B. This is done quite subtly, by a light nudge with the elbow and displaying the screen, thus indicating she wants B to read it. In this case, B does not seem to be very interested in the message; this is actually a point where B could take A's phone in her hand, to be able to read the whole message and involve herself in its production. For some reason, B does not do so. Shortly after this, A begins another strategy to let/make others know about the content of the phone; she reads aloud from her message. This could be because she wants more involvement from the others, and could not get it by simply showing the message. Reading aloud from the screen is thus a way to render the message on her screen 'publicly' accessible (Heath and Luff, 2000:67). In the second part of this excerpt, A's phone rings shortly after she has sent the message. A now wants to involve her friend B in this phone call; A asks B to answer the phone, but B does not accept. A answers herself. After the conversation on the phone, she comments the call to the others. Talking about the content of the call or commenting on the caller, is very often observed among teenagers.

In the next excerpt, we see another short example of the strategy of sharing content by showing the display to others:

Excerpt 2: Café

A girl comes back to her table after (presumably) having gone to the rest rooms. She is holding a blue phone in her hand. She gives B a nudge with her elbow, shows her the display, and then puts the phone on the table.

From mere observations it is impossible to say whether the content A is showing consists of an SMS-message or some other information on the phone. Regardless of content, the strategy is the same as in the example above where the content shared was an SMS-message under production. In this case also the strategy for letting others take part of the message, is to show the screen, and this is done by the elbow nudge (as in excerpt 1 above).

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[1] She was riding on the tram with two girls, B and C. B is the only one described in the excerpt; she was sitting next to A on the tram, and was consequently closer to the phone.

The phone is then put on the café table, maybe as a way to demonstrate that further interaction with the phone is possible from B's part.

In these two excerpts we have seen two different strategies for minimal forms of sharing content on the phone. The first was reading aloud from the message, and the second to show the display with the message. Both strategies are ways to try to involve co-present friends in the remote communication one is engaged in. While the content of the phones have been shared, the phones themselves have not.

Taking turns

The two examples discussed so far both involved one person having a phone and sharing the content of it in various ways. However, this was a minimal form of sharing; there were no physical sharing or exchange of the phones themselves. In the next excerpt from our field observations, the sharing of content is done through several people actually handling the phone. This is a different form of sharing which is more 'hands-on'.

In the first sequence, several teenagers share one phone call trough taking turns talking holding the phone and talking to the caller.

Excerpt 3: Saturday evening, tram

Four girls, about 13-14 years old, are sitting on the tram. They are sitting two and two, facing each other. A phone that girl A is holding rings and she answers. She says: "Yes, hold on", and gives the phone to B, who is sitting to her right. B talks for a couple of minutes with the person in the other end, E. B says to the other girls, while holding the phone a little bit from her head:
B: she says it's more fun at the other place
C gets upset and reaches over to get the phone. C starts talking to E:
C: what do you mean by saying that? You shouldn't say that. Now everyone is looking at the floor. You shouldn't say that.
After a short conversation, C ends the conversation by saying "bye, kiss, kiss". She hands the phone over to B again, who continues talking to E.

This excerpt begins by A receiving a phone call that seems to be intended for someone else, namely B. B thus takes the phone. After talking to the caller for a while, B seems to want the others to be involved in the conversation; this is done by sharing parts of the content of the conversations to the others ("she says it's more fun at the other place"). This is similar to the strategy of reading aloud from a message (cf. excerpt 1), in that it is a way to try to involve others in the remote communication. Apparently, from C's reaction, this is something that needs to be acted upon; C reaches over to get the phone. C then becomes the third person to be involved in this conversation by actually handling the phone itself.

From the observable actions described above, it is not possible to say who the owner of the phone is. It could be A, who is holding the phone when it rings. In this case it is noteworthy that the caller, E, knows whom to call when she wants to get a hold of B. We have seen other such cases, where the caller by calling one persons phone, gets to talk to several people, rather than just one. It could also be that the phone belongs to B; it is B that the caller gets to talk to. And it just happens that A at the moment is holding B's phone and therefore answers it when it rings.

In any of these two possible cases, the uses of the phone show us how the phone is shared within a group. We can see how several people take part in one phone conversation. This is an interesting type of multi-party talk, where one person (the caller) has limited access to the other participants in the conversation (those in the receiving end). It follows that the group in the receiving end only have access to the phone conversation through the person who is currently talking on the phone. What is notable is how little negotiation work these young girls do in order to know how the phone should go around in the group. The phone moves from one hand into another in what could be called a *turn-taking system of mobile phones*. Using this analogy from conversation analysis it is interesting to examine how and when others are brought into the conversation. How is the next user of the phone selected? What does C, in the above case, do in order to get the phone in her hand and begin talking to E? However, one suggestion could be that B by holding the phone away from her head and talking to the others, makes it possible for someone else to self-select as taking the next turn using the phone. To pursue an analysis of this, there clearly has to be more detailed material, i.e. audio and video recordings. (This point was discussed in chapter 4.)

Note also that girl C is trying to convey to E, the caller, the mood of the whole group. She does this by her metaphorical "looking into the floor". Whether they are really looking at the floor or not, whether they are sad or not, what is interesting is that C makes the whole group take part in the conversation. It is not only C that gets upset because of what E has suggested; it is the entire group.

From this example, it seems clear that the notion of the phone as merely a private resource for communication does not apply among teenagers. In this case the phone is shared to enable a whole group to talk to a remote person. Instead of one person talking and 'shielding' her/himself from the group while doing it, everyone present involves themselves, and are allowed to involve themselves, in the ongoing conversation.

Borrowing and lending of phones

Several times when doing field observations, we had to reconsider our initial ideas about to whom the phones belonged. The mobile phones passed through so many hands, that we had to stop and ask ourselves "whose line is this anyway?". Initially, we assumed the first person observed to be handling the phone to be the owner of the phone. It turned out to be a lot more complex. Many teenagers handle each other's phones, using them for various purposes, and it is sometimes impossible to understand from observations to whom the phone actually belongs. This borrowing and lending of phones seems natural to the teenagers themselves. These observations suggest that the mobile phone is a *collaborative resource* for teenagers, rather than just a personal phone. Below are a few examples of how teenagers borrow each others' phones for calling, answer their friends' phones when ringing, and even carry each others' phones.

We begin with an example where one girl uses her friend's phone for calling although it later turns out that she has her own phone:

Excerpt 4: Café, Thursday evening

Two girls are sitting at a small café table, facing each other. A receives a phone call. She answers. She talks for a while before ending the conversation. She holds the phone in her hand, and shows the display to B. B takes the telephone and calls someone on it. She makes a very brief conversation. She gives the phone back to A. They light two cigarettes.

B now takes a phone out of her purse. This phone is ringing, playing the song 'Come on baby light my fire'. After a short conversation she puts the phone back in her purse again.

A uses the same strategy here as described above for sharing of content – showing the display to her friend. This seems to prompt B to take the phone in her hand. Perhaps A was showing a phone number to B, so as to encourage her to call someone. In any case, B uses A's phone to make a phone call. We could not hear the conversation between the two girls in this case, thus we do not know if B received a verbal permission to use the phone. The phone call B makes is very brief. One reason for this might be because the phone call is costing A money and B therefore knows to be polite in keeping it short. The economic aspects of phone use are likely to be an important factor in the teenagers borrowing and lending of the phones.

Surprisingly though, in the above example, it turns out that B actually has a mobile phone of her own. This becomes very evident when it rings. So why did B use A's phone to call and not her own? This could be because B was using a pay card on her phone and the card was empty, making it possible to use the phone for incoming calls only. It could also be simply because A's

phone were at hand; it was more convenient to use that phone. However, this does not explain the economic decision to use let B call from B's phone. If it not were that the phone call B made from A's phone, was considered more related to A, and therefore she should pay for it.

In another similar example, one girl is using someone else's phone for calling although she has her own phone. What distinguishes these examples is that the girl above has quite a lot of control over the lending of her phone, since the person to whom she is lending her phone is sitting next to her, where as in the following example this is different.

Excerpt 5: Tram, Friday at noon

A dozen high school teenagers get on the tram at a stop very near a high school. One girl (A) is holding a pink small telephone in her hand when she is getting on the tram. She is just finished talking on it and is now pushing the buttons and looking at it. When she has gotten on the tram she walks over to another one of the girls (B) who also just got on, and gives the phone to her. B says "Thank you", takes a quick look on the display and puts the pink phone in her bag.

A walks over to stand and talk with some other people. She now takes a green phone out of the front pocket of her pants. She makes a phone call from this phone. After a short conversation she finishes, and puts the phone back in her pocket. She tells the others that she is going to meet a person later.

B has let A use her phone. When they enter the tram they are apart, which means that B cannot see what A is doing with the phone. In fact, B cannot be sure that A gets on the tram at all. This implies a trust in her friend. During the tram ride A and B are standing in different groups. When A is finished using B's phone she walks over to return it. It now turns out that A actually has a phone of her own, or at least another phone available to use: in her pocket. In this case, as in excerpt 4, we did not get access to the communication between the borrower and the lender of the phone prior to the sharing. In both of these cases, the girls use their own phone directly after borrowing a phone. This strikes the observer as odd, but apparently it is not treated as unusual among teenagers.

In the next example, two girls are involved in the sharing of phones. They are at a café, but not sitting together. The girl currently in possession of the phone has to take action when it rings:

Excerpt 6: Café, noon

A girl sitting at a table in the one far end of the café has a phone that is ringing quite loud. The girl (A) stands up and begins running across the café, while holding the ringing phone in her hand. She runs to the other very far end of the room, ten tables away. Four ring signals have now been heard. She gives the phone to a girl (B) sitting at a table. B answers the phone. A walks back to her table. B

> talks for a while, then puts on her coat and leaves the café together with her friend, and the phone. A remains seated in the café.

This girl's running with the phone ringing confused us at first, because we had seldom observed teenagers leaving the ongoing event to answer a phone call. When we saw her giving the phone to another girl at the café, we understood that she did not answer because she did not take this call to be intended for her.

In the excerpt below, three girls are interacting with two phones. Note how one of the girls demonstrates her thanks when receiving the phone:

Excerpt 7: Café, Wednesday afternoon

> C holds a small red phone (1) in her hand; she pushes the buttons and looks at it. She puts in on the table after a while.
> B takes another phone (2) from her purse, and gives it to A who hugs her. A makes a short phone call from phone 2. She gives it back to B who takes a quick look at the display.
> B now gives phone 2 to C, who makes a phone call from it.
> While C is talking, phone 1 rings. A quickly answers. After a short conversation, she puts the phone back on the table.

In this quite complex sharing of the phones, we assume that C is the owner of phone 1, B is the owner of phone 2, while A does not seem to have one at the moment. A therefore borrows phone 2 when she needs to make a phone call. C also borrows this phone to make a phone call, although she apparently had a phone of her own. The reasons for borrowing a phone while having one, might be, along with the argument in connection to excerpt 4, because she did not have "enough money on her phone", or because the phone call was somehow related to B, and she should therefore be the one paying for it.

At the end of the excerpt, the phone belonging to girl C, who is currently calling from her friend's phone, rings. Since C is busy talking when her phone rings, A answers. It is interesting that her answering is very quick, and she does not seem to get permission to get the call. There might be a previous agreement that A is allowed to answer C's phone, or maybe C subtly let A know that she could take it. Also, the caller identification function might be of relevance here. Perhaps A saw who was calling (or from whose phone someone was calling!) and thought that it was appropriate for her to answer.

Again, these examples of how the mobile phones are borrowed and lent within groups of friends show how the phone is not just a personal device, carried around and used by one person for that person's private purposes. Rather, it seems that the phone has become a collaborative resource among teenagers. If someone does not have access to a phone, that person can use

someone else's phone. It seems that there is much trust involved here. They trust each other to borrow their phones, even when they are not in the same place, and therefore unable to see what the phones are used for. Showing someone the trust it means to let her or him use one's phone might be a way to display friendship; you don't let just anyone use your phone.

Sharing with unknown others

In all the above examples, the sharing of mobile phones, both concerning content and the actual phone, has involved teenagers who are friends or at least acquaintances that currently hang out together. We have seen how the phones are shared, wandering from friend to friend in very intrinsic ways. As a contrast to this is the observation below, where the phones are handled by teenagers who seem to be unacquainted up until the described interaction.

Excerpt 8: Liseberg amusement park, Friday night

Two girls, about fifteen years old, are sitting on a bench. Next to the girls are a bunch of guys about the same age. Two boys approach the two girls.
Boy A: are you Swedish?
Girl A: yes
They talk about their origin for a while. He insists on getting her phone number. During the entire conversation, he is holding his mobile phone in his hand. He gives the phone to the girl, and she enters something using the buttons (probably a phone number). Right after this, the other girl enters something on the phone belonging to the other boy.
BA: how old are you?
GA: fifteen
BA: okay
The conversation ends with the first boy asking the girl:
B: is it okay if I call you at three o'clock tomorrow?
G: yes
And the two boys walk back to their other friends, without saying goodbye to the girls.

During this whole event the participants have their phones in hand, visible to each other. The mobile phones are here shared for social purposes, to make contact. The two boys use their phones as tools for getting acquainted (or flirting, it may seem) with other teenagers. For these boys, it is almost as if having a mobile phone in hand is an excuse for approaching the girls.

The example above also nicely demonstrates the ways in which the phones are used for social interaction in the local context. In this case no communication via the phone is involved. The phones are used for exchanging phone numbers with the group. Their meeting might lead to calling later (as one of the boys suggests), but at this moment all they do with their phones is going on right there, in the local milieu. Thus the phones are

used for getting things accomplished in the local context, rather than calling non-present others.

Discussion

Our empirical studies of everyday use of mobile phones have examined the ways in which the mobile phones are brought into play when teenagers do things together. In this section these findings are briefly discussed, as well as conclusions about what they might imply for design of mobile phones. First, however, we discuss some of the methodological issues raised in this study. This is also expanded upon in the final chapter of the thesis.

A NOTE ON THE METHOD

The material used in this study was collected through ethnographic fieldwork, and documented in field notes. This was sometimes a shortcoming. When analyzing the data, many times we lacked some crucial piece of information, which we could not remember, had not written down, or simply had missed. For instance, sometimes we wanted to know how and where the phone was placed on the table after using it, but had no notes of this. In order to do a more detailed and comprehensive study of how the sharing was carried out, we would have needed video and audio recordings. For instance, in order to develop the notion of the turn taking of phones within a group, it would be necessary to analyze the conversation within the group.

However, it is important to remember that it would have been difficult if not impossible to get audio and video recordings of the natural occurring action described here. Studying the use of such a highly mobile technology as the mobile phone, poses difficulty to the use of audio and video based analysis. It would perhaps have been possible in the cases where people were a little less mobile, such as the cafés, where we could have recorded a certain table, for instance. In other locations, e.g. the amusement park, we would have needed several cameras and microphones in quite a lot of places in order to collect as much material as we have done through observations. One possible solution would be to use mobile recording equipment instead of fixed, where the people observed can be followed around and recorded. This clearly raises many ethical concerns, at least when studying people in public settings. Having mobile equipment would imply that no specific place is used for collecting data, which makes it more difficult to inform people of where they might be recorded. Until these issues have been satisfyingly resolved, there is much interesting and useful data to collect through ethnographic

observations. In relation to this, we want to stress the benefits of being two people in the field at the same time. This made it possible to collect and note more details of the interaction. We believe that that we got considerable better material from doing fieldwork together.

Some of the issues could have been investigated further by using some sort of interview technique as a compliment. Certain things are not possible to get at in a field study where no questions are asked. For instance, it could be useful to ask for their own ideas about why they use their friends' phones when they have their own. However, these questions would have been particularly interesting to ask from the very same people we had observed, in connection to the particular instances in which the actual sharing took place. In the future, we are likely to see 'traditional' methods for data collection develop to meet to the issues raised when studying the everyday use of mobile technologies (cf. chapter 4).

DESIGNING FOR SHARING AND LOCAL USE

This chapter has described the local use and sharing of mobile phones. We have seen how the mobile phone has taken an important part in the local social interaction among teenagers. Teenagers do other things with their phones than just one person calling another, remotely located person. When teenagers spend time together, the remote communication they take part in, i.e. the phone calls they receive or make as well as the SMS-messages, is rendered public in various ways, as described in this chapter. This is what we call strategies for sharing of content. The mobile phone itself is also shared between friends, borrowing and lending each other's phones. There was even an instance of sharing between unknown others, with the purpose of making contact.

The strategies for sharing presented here can be summarized briefly as being of two types: minimal forms of sharing and 'hands-on' sharing. The *minimal form of sharing* of content, mainly SMS-messages, was (i) sharing by reading the message aloud, and (ii) sharing by showing the display to others. Both strategies are ways to let friends (and perhaps others in the surroundings) take part of or part in personal communication; ways to render private information displayed on a very small screen accessible to others. The *'hands-on' sharing* meant that the phone itself was shared between two or several teenagers. The hands-on sharing is made possible by the ecological flexibility of the phones; they are small, and easy to move around, thus enabling several people to use it as a collaborative resource.[1] This allowed for several teenagers to take turns in a phone conversation, pass around phones to share SMS-messages, etc.

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[1] To this extent, the mobile phone shares some (but definitely not all) characteristics with the various paper documents studied by Luff *et al.* (1992).

The micro-mobile use of the mobile phone has many implications to a device originally introduced for remote communication. As pointed out by Luff and Heath (1998), micro-mobility is a type of mobility not normally associated with new technologies. For those interested in designing new mobile phones and services, it might be useful to consider that phones are used within the local domain as well. The ways in which teenagers share the phones and their content today, could be drawn upon to add features or services that supports this sharing. We will discuss a few possibilities here, based on our findings.

The sharing of mobile phones observed in this study raises questions about the notion of the mobile phone as a *personal* device, belonging to and being used by one individual[1]. This notion of a personal phone often goes hand in hand with it being perceived as a *private* phone. With this follows the issue of the handling of private talk in public settings, something that occupies researchers (e.g. Persson, 2000) as well as the public. Of course, the mobile phone is personal and private in many ways, and is often used like that. We do not want to claim that these issues do not exist, nor that they not are interesting to study. However, we hope to have shown with this study that the mobile phone can be something else than personal and private. Among the teenagers we have studied, the phones are not just treated as personal, and the calls and SMS-messages are not treated as private. Rather, there is much work going on to render them *not* personal and *not* private. Understanding the ways in which this work is done, and what it involves, could be useful to consider when designing mobile phones. The mobile phones of today are designed to be used by one single person at a time. People using the phones for collaborative purposes have to work around this. One approach could be to make the phones more flexible, supporting the private, individual use, as well as the collaborative, group-use described in this chapter.

The extensive sharing of mobile phones has in a sense replaced the use of the public telephone provided by society. If you are without a phone, or without enough money on your phone card, or other reasons for being 'off-line', you can use someone else's phone. We have seen examples of how mobile phone owners very willingly, it seemed, lend their phones to those without phones. In the cases described in this chapter, the mobile phone is a personal telephone made public, with the important difference: it is made available for selected people. The phones are shared between friends, or people who have (or want to have, perhaps) some relation to each other. This could probably be studied effectively by walking up to a stranger on the street and asking to use the person's mobile phone. Unless there were very

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[1] This notion is sometimes explicit in the literature about mobile phones. For instance, one writer calls it the mobile PP – personal phone (Roos, 1993).

good reasons, e.g. an emergency, this would probably strike people as odd behavior.

One of the possible explanations to why phones are shared only with people one is acquainted with could be economical. When using someone else's phone for calling out, the owner is actually doing the caller a favor costing the owner money. A nice solution was reported to us by a young girl, who said that some teenagers who do not have phones buy prepaid phone cards which they can use on their friends' phones. The teenagers we studied did not seem to have great concerns about economy when lending and borrowing phones. Still, there could be ways of making the methods of payment more sophisticated, enabling for someone else than the owner of the phone to pay for calls.

Another issue that the results from this study raises is the way teenagers spend time in groups, and how this is shown in their use of the mobile phone. In particular, our observations show how teenagers sometimes call someone's mobile phone and end up talking to someone else in the group. There seem to be the case that sometimes they call a person up when looking for someone else, e.g. when A wants to talk to B and knows that B does not have a mobile phone, A calls to C's phone, assuming that they spend time together. The call is thus directed to a phone in that group, with the aim of getting hold of someone who might be a part of the group. This could be compared to calling a person's house, i.e. a landline, looking for someone who does not live in that house but who might be there. There could be interesting technological solutions to this. Instead of guessing or having to know in advance who currently spends time with whom, there could be other ways of getting this information. Various awareness services could be built in to the phones. This would of course raise some privacy concerns, which would have to be solved.

We believe that the mobile phone industry could learn from an understanding of the actual everyday use of the phones and services they are designing. It does seem that the industry is beginning to catch on to the young generation's use. Recently, there have been a number of new phones and services especially oriented towards young people. The mobile phone companies Nokia and Ericsson have both released mobile phones marketed in Sweden as 'teenage phones'. The industry focuses on developing further those services which seems popular. Different possibilities of using SMS are explored, for instance multiparty SMS and MMS. It remains to be seen how this will be accepted among teenagers.

Chapter 9: Location and Availability in Mobile Conversations[1]

Nicky is busy trying on clothes in a fitting room, when her mobile phone suddenly rings…

Nicky:	jag tycker den va snygg a hej	I think that was nice yeah hi
Caller:	ha?	what?
N:	hej	hi
C:	hej hej	hi hi
N:	men jag kan inte prata nu (.) för	but I can't talk now (.) cause
	[jag e:: i en prov+	[I'm:: in a fitting+
C:	[nähä va ska jag göra åt det dåh	[oh yeah what should I do about that then
N:	e:hehehe:	e:hehehe:
C:	va gör du då?	what are you doing then?
	(0.3)	(0.3)
N:	jag si+ ja står i en provhytt å provar kläder	I'm si+ I'm standing in a fitting room and trying on clothes
C:	jaha:::	oh yeah:::
N:	m	m
C:	jaha:::	oh yeah:::
N:	ja!	yes!
C:	ja! (.) OCH?	yes (.) AND?
N:	heh jag ringer dig sen	heh I'm calling you later
C:	nä det gör du inte alls jag är inte hemma h	no you don't at all I'm not home h

N:	nähe aja jag	oh yeah oh well I'm
	[ringer dig imorron då	[calling you tomorrow then
C:	[du får ringa till mobilen då	[you'll have to call the mobile then
N:	ja	yes
C:	ja	yes
N:	ja	yes
C:	hej	hi
N:	hej	hi

Introduction

"You can read the world out of a telephone conversation." (Sacks, 1992)

"[O]n each occasion in conversation on which a formulation of location is used, attention is exhibited to the particulars of the occasion. In selecting a 'right' formulation, attention is exhibited to 'where-we-know-we-are', to 'who-we-know-we-are', to 'what-we-are-doing-at-this-point-in-conversation'. A 'right' formulation exhibits, in the very fact of its production, that it is some 'this conversation, at this place, with these members, at this point in its course' which has been analyzed to select that term; it exhibits, in the very fact of its production, that it is some particular 'this situation' which is producing it." (Schegloff, 1971)

At the time of Sacks and Schegloff's investigations of the particulars and peculiarities of telephone conversations, a telephone was something fixed to a particular location. When calling someone you could have a fairly good idea of where that person was located, which meant you could draw some conclusions about the activities in which they might be engaged. Thirty years later, with the introduction of the mobile phone, you can call someone up and reach her or him in situations and locations you cannot predict – even, as the title of this chapter suggests, you can call someone in a fitting room. Because of the unpredictability of where the called is in mobile phone conversations, the assumption is that conversationalists often need to establish a mutual understanding of each other's location, as well as their availability for having a conversation.

The main issue of this chapter is to begin to investigate the ways in which participants in a mobile phone conversation orient to each other's location, activities and availability. This study will present the analysis of recordings of naturally occurring mobile phone conversations, looking at the issue of expressing location, or formulating place, in the words of Schegloff, over the mobile phone. While there is a widespread notion that mobile phone conversations are opened with "where are you", is it really true that the first thing that conversationalists do in a conversation is establish location? And if this is so, how is this done? Somewhat surprisingly, in the mobile phone conversations considered in this chapter, 'what are you doing' is the most

frequent opening question. This chapter will examine in detail this question, focusing on what can be accomplished with such a question. Also, it is discussed whether these initial observations on location work in mobile conversation can have anything to say about the ways in which the use of the mobile phone potentially transforms what it is to be in a place.

The chapter is outlined as follows. First, there is a presentation of conversation analysis and the analysis of fixed telephone conversations, along with an introduction of studies of mobile phone usage. Then follows the analysis, where I present and discuss fragments from the mobile phone recordings. The chapter ends with a discussion on location work in mobile phone conversations as well as some ideas on how to continue this line of research.

Related work

This chapter is based on work which originates in two fields of research. The first is conversation analysis (CA), the study of naturally occurring conversation originating in the work of Sacks and his colleagues. In particular we will consider CA work relating to telephone calls. The second body of work is the growing number of studies of the use of mobile telephones. In this section, these two fields of research will be presented.

TELEPHONE CONVERSATIONS AND CONVERSATION ANALYSIS

From the very beginning, conversation analysis has been closely linked to the analysis of telephone conversations. Sacks began his now famous Lectures on Conversation with looking at the openings in telephone calls to a suicide prevention center. One practical reason why telephone conversations were the focus for early research in this field was that telephone calls were particularly suitable for conversation analysis methods. By making audio recordings of both ends of phone conversations the researcher would get access to much of the same interactional resources as the participants, since they also are only connected through audio rather than using other interactional resources. Most important to this is that, on the phone, participants have no visual access to each other.

The phone call has thus been in focus since the very beginning of the analysis of conversations. In particular in conversation analytic work there has been considerable attention given to the *opening sequences* of phone conversations. Schegloff's PhD thesis, for example, consisted of analysis of the sequencing of conversational openings; its focus was the first five seconds of telephone conversations (Schegloff, 1967).

In Schegloff's paper Identification and Recognition in Phone Conversation Openings (1979), he deals with the issue of how participants identify and display recognition of each other. One important finding is that in his data, the answerer (A) often do not self-identify explicitly by name rather they rely on the caller (C) to recognize him or her by a 'voice sample'. This can look something like this, as seen in an instance taken from Schegloff's paper (*ibid.*:35):

> A: Hello
> C: Hi
> A: Hi

Schegloff argues that the first greeting (Hello) is an answer to the *summons* – the ringing of the telephone. The answerer's second greeting then (Hi), is seen as a claim that the answerer has recognized the caller (*ibid.*:35).[1] One important point to make is that conversation analysis originally looked primarily on North American data. This means that the rules identified were based on a somewhat limited and homogenous group of speakers. Especially in the case with identification and recognition, it is obvious to readers from other parts of the world that this pattern seems to differ from how Schegloff describes it. As the data collected for the present study was by Swedish conversationalists, studies of Swedish phone calls are of particular interest. In Lindström's paper Identification and Recognition in Swedish Telephone Conversation Openings (1994) it is argued that Swedes seem to orient to the same issues as Americans in the opening section. However, the main difference is that self-identification by name is the most common way of answering the phone in her data (*ibid.*:238). As we saw above, this differs from what Schegloff claims about American phone calls. In the American phone calls the callers seldom self-identify, rather they rely on the other part to recognize them[2].

Here is an opening sequence from Lindström's Swedish data, where the answerer (A) offers a greeting and then self-identifies, the caller (C) also provides a greeting and self-identifies, and the answerer then provides a second greeting, which according to Lindström works as "claim that recognition has been achieved" (*ibid.*:238).

> A: Hej de e He:nri:k   Hi 't's Henrik
> C: Ja hej de va mormo:r?   Yes hi 't was (maternal) grandmother?
> A: ->Hej,   ->Hi,

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[1] There are of course other aspects to this interaction discussed in his paper, but for the purpose of the present study, this is the main argument.
[2] With the exception of business calls where this can be different; the answerer often provides a name or company name.

Lindström found that in the cases where the caller did not identify by name, the caller and the called had a close relationship, e.g. husband and wife or mother and child. Leaving out the explicit identification in the first turn by the caller, was thus a way of "doing being intimate", Lindström argues. Another noteworthy thing is that Lindström finds that the question "How are you?" in the opening section is very rare in the Swedish data, whereas this is very common in American sequences (*ibid.*:238). Lindström also points out that Swedish phone identification sequences have a lot in common with the Dutch, which has been investigated by Houtkoop-Steenstra (1991). In both Dutch and Swedish, speakers overwhelmingly identify themselves by name.

Opening up to the rest of the conversation

Schegloff identifies nine ways in which the second turns in the phone call (the caller's first turn) are constructed in his data. Of specific relevance for the present study is the second turn formulated as a "question or noticing concerning answerer's state". For instance, this can look like this:

    A: Hello
    C: Hi can you talk

or

    A: Hello
    C: Hello. You're home.

This deals with issues of availability for having a conversation, as well as recognizing where the answerer is located. Of course, in the second case above, the fact that the caller knows that she or he is calling to a residence home, a landline phone, is obvious. If someone answers this call at all, the caller can be certain that the called is home, where the phone is located[1]. This is obviously different in the case with mobile phone calls.

Having taken a closer look at the openings of the conversations, it is now time to move on to what happens after that point in the conversation. In the words of Sacks: "how beginnings work to get from beginnings to something else" (Sacks 1992vol2: 15).

Button and Casey (1984) report on a phenomenon relevant when considering how availability is established in telephone conversations. They show how questions about what the co-participants are doing, thus an

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[1] An exception is when the home phone has been redirected to another phone, which now a days could be a mobile phone. In these cases, there is often an audible click, and a slight change in the ring signal, which can reveal that the call is being redirected, and the caller can then, if aware of this, assume that the called person is somewhere else than on the location of the landline phone called to.

"inquiry into immediately current events", what they call *topic initial elicitors*, occur after the identification and recognition section. They argue that the fact that these topic initial elicitors "make a display of availability for further talk but without, themselves, introducing topic material provides the opportunity for, as a preferred next activity, a newsworthy event reported in a next turn" (*ibid.*:172).

Taking a yet wider perspective on the telephone conversation, another study by Button (1991) deals with how a conversation is organized as part of a series of conversations. He found that *arrangements* may be oriented to as a "special status topic", which is specifically used to place the conversation on a closing track" (*ibid.*:251). One way of doing this is through "projecting future activities", for instance, talking about whom should call a third person and make arrangements, etc.

Another study by Schegloff is also relevant for the present study, although it is not explicitly focusing on phone conversations. Schegloff (1971) has studied how people formulate place in conversations. He wanted to know why a certain place term is selected, rather than another. He argues that "the selection of a location formulation requires of a speaker (and will exhibit for a hearer) an analysis of his own location and the location of his co-conversationalist(s), and of the object whose location is being formulated (if that object is not one of the co-conversationalists)." (*ibid.*:100). Also, as Schegloff points out, one of the things speakers have to attend to in conversation is 'where-we-know-we-are'. The interactional work needed in order to establish the 'where-we-know-we-are' in a conversation can be assumed to differ in talk where the participants are dislocated and communicating through a mobile device, as opposed to when participants are co-located (as in face-to-face interaction) or using stationary landline telephones.

MOBILE PHONE STUDIES

The previous section has dealt with a well-established field, conversation analysis of telephone conversations. A lot of work has been done within this field. When it comes to *mobile* telephone conversations, it gets more difficult. To my knowledge, there are very few (published) conversation analytic or conversation analytically inspired approaches to mobile phone conversations. Apart from the newness of mobile telephone technology, one of the reasons why this is so, is likely to be because it is relatively difficult to get recordings of mobile phone conversations. In general, it is more difficult to gather naturally occurring data about the use of mobile telephones.

One of the few available studies of mobile phone use based on recordings of such conversations, has been made by Laurier (1999). He investigates the ways in which mobile office workers talk about location when traveling by

car. He seeks to explore "why people say where they are during mobile phone calls". His argument is that this is a question of location used to establish a mutual context in communication, between participants who are dislocated. The formulation of location in mobile phone conversation is tied to the business that needs to be done between the two people, and the place descriptions are thus doing a lot more than just formulating place. Several of Laurier's findings will be discussed when looking at the data in this chapter, as he deals with similar issues and his arguments can shed light on what is going on in the conversations.

Other authors also expand upon the "Where are you?" question. In discussing monitoring and accountability in mobile phone relations, Green (2001) argues that this question provides a means of "[m]onitoring of location and activities in this instance [which] serves both to cement personal or intimate relationships, but also to make an individual's activities transparent, visible and accountable to both co-present and tele-present others" (*ibid.*:32). In some relations it would be difficult to refuse to provide an answer to where one is at the moment.

Many authors claim that the mobile phone privatizes public space, as it enables people to have private conversations in public places. For instance, in discussing mobile phone culture in Finland, Puro (2002) maintains that: "as someone talks on the phone, one is in her or his own private space. Talking on the mobile phone in the presence of others lends itself to a certain social absence where there is little room for other social contacts. The speaker may be physically present, but his or her mental orientation is towards someone who is unseen (Puro, 2002:23).

However, previous field studies of mobile phone use show how in some situations, conversationalists include co-located others in the mobile phone communication, rather than withdrawing to have private conversations. One example of this is related earlier in this thesis (chapter 8). This study shows an instance where four girls all take part of a mobile phone call received by one of them, and how they also relate to the caller what is going on in the group at their end. From this field study it seems clear that the young people studied do not exclude their co-present friends when talking on the mobile phone, they remain attentive to the ongoing event as well as that on the phone.

Murtagh presents another ethnomethodologically inspired field study of public use of mobile phones (2001). He shows how non-vocal responses and body movements are used to regulate mobile phone use in public space. Drawing on Goffman's notion of civil inattention, Murtagh suggests that looking away while receiving a phone call could be a strategy for avoiding the potential embarrassment of having a private conversation in public.

A more theoretical approach to the mobile phone is provided by Cooper (2001), in examining how theoretical concepts from sociology can be used to

understand the use of mobile phones. In doing so, he emphasizes the need for such theoretical development to be tied to empirical research: "theoretical work carried out in isolation from the study of the practicalities of situated mobile use can easily go astray" (*ibid.*:19). For instance, the private/public distinction is a theoretical one, which is only one way of thinking about the significance of the mobile phone in some settings. Cooper suggests instead that the mobile phone should be thought of as an 'indiscrete technology', because "it has the capacity to blur distinctions between ostensibly discrete domains and categories, or more precisely to take its place among a number of social and technical developments that have this capacity: not only public and private, but remote and distant, work and leisure, to name but a few." (*ibid.*:24). What is particularly interesting with his argument is how it shows the need for theoretical investigations of mobile technologies to be empirically grounded.

As the present study deals with data from a young teenage girl, it can be relevant to emphasize that young people in many countries are now heavy users of mobile phones. Several studies focus specifically on young people's phone usage. The study presented in chapter 8 of this thesis shows how teenagers use mobile phones collaboratively, in local interaction, and not just for communicating with dislocated others. Similar results are presented in another study of mobile phone use among teenagers (Taylor and Harper, 2002). Here the sending and sharing of text messages and other phone mediated practices are considered as gift giving rituals, which have impact on the ways in which young people conceive of mobile phones.

In Japan, mobile phones are commonly used for many purposes other than calling, as the mobile phone operators offer a large number of features and services, among them the NTT DoCoMo's I-mode services, and Japanese teenagers are said to be the driving force in much of the use of mobile phones (Madoka *et al.*, 2001). In sum, many studies show the great immersion of mobile phones among teenagers, and point to the importance of this device in the life of this age group.

Data collection

The material presented here consists of naturally occurring mobile phone conversations. Both ends of the conversations have been recorded, making it possible to see how the participants orient to each other's location, activities and availability. Making recordings of mobile phone calls it not easily done. There are both technical and ethical problems which need to be resolved. In this section, I will shortly relate how I attended to these difficulties.

A special recording device was built in order to make initial data collection. One person was recruited to have her calls recorded – an 18-year-old girl, living in a small suburb to Göteborg, Sweden's second largest city. She attends the last year in the local high school (*gymnasium*), where her studies are specializing in the media. As part of this media program she is involved in making local television, an activity which involves considerable organization and coordination, for which she often uses her mobile phone.

For this study I made sure that the informant would feel that she was in control over what was recorded. I would only get the conversations she agreed on letting me have. The data was recorded on a minidisk recorder, over which the informant had control. That way, she had the possibility of deciding which phone conversations to give to the researcher. After having recorded a conversation, she herself could delete it if she did not feel she wanted it to be used for the study. She was told to let her friends know that she would be part of this study, so that those who did not want to be recorded could say so. A few of her friends then chose not to be recorded. All names of persons and places appearing in the conversations have been changed.

A few technical aspects are relevant to know, as they effect what sort of data was collected. The informant had to use a headset when talking. She did not normally use a headset, which means that this was somewhat unnatural for her. Also, she had to carry with her the minidisk recorder in her purse or pocket. Every time someone called in or she was about to make a call, she had to push the record button. This meant that it took extra time to answer the phone. These things may have affected the opening sections in the conversations. Of course, it would be ideal to have a voice activated recording, so that the informant could use the phone more naturally. Or even better, to have all the traffic from and to her number automatically recorded via the operator. With current technology I was restricted to this clumsy set up, although in the future, I hope to be able to find a better means of making recordings.

When discussing the results it is important to keep in mind that this is a limited set of data, and as such this analysis should be seen as an initial investigation into which questions are of relevance when studying mobile conversations, rather than as a final analysis. However, in taking a conversation analytic stance, I emphasize the interest in particularistic features of specific naturally occurring conversations, rather than attempting strongly generalizable results.

Analysis

The main focus of the analysis was to investigate the ways in which location features in mobile phone conversations. In particular there was an interest in investigating the notion that mobile phone conversations are opened with "Where are you?", and that location is something inevitably and explicitly discussed in mobile phone conversations. In the instances I have looked at, "What are you doing?" is the most frequent opening question, after the greeting and identification sequences. In this section, I will show examples of how this question comes about, how it is treated in the interaction, and what sort of work it seems to be doing.

However, I will begin by taking a quick look at the ways in which the conversations are opened: how are identification and recognition carried out over the mobile phone? Then, I will continue to investigate what happens after this opening section; how the participants move from this part of the conversation to the topic.

In the analysis, the person who has the recording device on her phone is called Nicky. The caller is abbreviated C, and the answerer as A. The translations from Swedish to English have been made by the author, and with focus on content rather than on correct English. For details about the transcription notation, see Appendix.

IDENTIFICATION AND RECOGNITION

In some of the instances of the mobile phone calls, the identification and recognition sequences are similar to the ways in which Lindström (1994) describes Swedish landline phone conversations openings. Below are two examples from the mobile phone data.

Excerpt 1

```
A:  a de e Nicky          yeah it's Nicky
C:  hej Nicky de e Fred   hi it's Fred
A:  he:j                  hi:
```

Excerpt 2

```
A:  a de e Nicky   yeah it's Nicky
C:  he:j           hi:
A:  he:j           hi:
```

In excerpt 1, the caller answers with her name, thus explicitly identifying herself. The caller greets her and identifies himself by name. The "hi:" in the

second turn by A, can then be seen as recognition of the caller. In excerpt 2, the caller does not identify himself. It seems here that caller is relying on that the answerer recognizes the voice, as previous studies have found (Sacks, 1992; Schegloff, 1979). This seems to be unproblematic; that Nicky recognizes the caller is evident in her "hi:", as in the argument for excerpt 1. In these two examples, there seems that nothing much is going on that makes mobile conversations differ from stationary ones. However, in other instances, there is evident that there is something going on where the answerer is located, which affects the opening section.

It is important to remember that features of technology have impact on how identification and recognition is dealt with in telephone conversations. The mobile phone (often) makes it possible to see the phone number of the person calling, or the name of the person, if this had been registered in the address book. Also, some phones have the possibility of choosing ring signals specific to a group of people, or just one person. Thereby it is possible to have a unique ring signal for e.g. ones best friend or ones husband, and be able to tell already from the summons, the ring signal, who is calling. In some of the instances collected for this chapter, it is likely that technology features such as caller ID and ring signals play a part in the opening sections, as we will see later.

However, it is what happens after the opening sequence, when the first topic is introduced, that is more interesting, as it bears upon the mobility and unpredictability of the participants' location and availability. The remainder of the analysis deals with what happens after the identification and recognition has been done.

CHECKING AVAILABILITY USING A PRE-TOPIC INITIATOR

In the following two excerpts, the caller uses a similar strategy to initiate the topic; after the greeting sequence, and before getting to the reason-for-the-call, the caller says "you". For non-Swedish speakers this might seem like a peculiar use of the word; it might be that it is specific for Swedish conversations.

In both instances where the use of "you" occurs, it is apparent that other things are going on where the called is, and it might be that the caller is orienting to the answerer's potential unavailability through using a strategy which allows for the answerer to end the conversation.

Excerpt 3

```
((Ring))
((Voices are heard in the background))
A:   a de e Nicky              yeah it's Nicky
C:   hej Nicky de e Fred       hi Nicky it's Fred
```

A:	hej	hi
C:	du::	you::
A:	a:	yeah:
C:	de: e möte idag de vet du va?	there's a meeting today you know that right?
A:	ja:::: du har sagt det fem gånger	yes:::: you've said that five times

In the opening of this conversation, presumably, the caller can hear the voices in the background, and therefore draw the conclusion that the answerer is in a group of people, or in a place where others might compete with him for her attention. Therefore he might be anxious to know her availability and interest in having a conversation with him. What comes after the greeting could then perhaps be a way of checking the answerer's availability. After the identification and greetings the caller says "you:::", in a prolonged manner. Although there is not a question intonation, the "you" gets a "yeah". This seems to be a "yeah, continue". The caller goes on with the topic, the reason for the call, which is to check whether Nicky knows about the meeting later today. I want to suggest that "you" here works as a sort of topic initiator, thus a way of moving into the topic, in the words of Button and Casey (1984) "make a display of availability for further talk but without, themselves, introducing topic material provides the opportunity for, as a preferred next activity, a newsworthy event reported in a next turn" (*ibid.*:172). Also, it is noteworthy that her reply "you've said that five times" indicates that they have been talking previously about the same topic. There is actually a phone conversation earlier on the same tape, probably from the same day, where they talk about this meeting. It is therefore possible to see this conversation not just in itself, but as a part of a series of conversations between the same people.

In the next excerpt, excerpt 4, there is a similar pattern going on. The caller does the "you", which gets a yeah, and the caller then presents the topic.

Excerpt 4

((Ring signal – the Simpson's tune))

A:	jajaja käft (0.3) ee::	yes yes yes shut up (0.3) ee::

((answers phone))

A:	hej!	hi!
C:	he:j	hi:
A:	ee: hej (.) ja?	ee: hi (.) yes?
C:	hej (.) du:?	hi (.) you:?
A:	a	yeah
C:	eh: kan du få med dig Pete idag	eh: can you get Pete with you today

In this excerpt, Nicky has problems with the phone before answering. After pushing the record button on the minidisk, it takes her some time to answer the phone. Meanwhile, the Simpson's tune is heard. It is possible to choose a

ring signal specific to certain persons. This might be the reason why no identification using names occur here. However, it might be that it can be embarrassing to have a less conventional ring signal in some situations. I am not sure what is going on here, whether her "yes yes yes shut up" is designed for the co-present or perhaps even for the researcher listening to the tape. When she finally answers, she does this in an exclamatory way. Her second turn is interesting. She makes a funny noise "ee:" before her second greeting, and then a "yes". Perhaps this rather strange turn makes the caller assume that there is something else going on where the called is.

Before getting to the reason for the call, which is to ask Nicky if she can get a third person to come to a meeting, he initiates this topic with a "you?" asked with a question intonation. As in the above fragment, this could be a way of getting down to business.

The difference between these to examples of the use of "you" is that the first one is prolonged, whereas the second is quicker and demanding. However, they are both responded with a "yeah", and continued with the topic, suggesting that they are doing the same work – initiating the topic without providing any information about the topic itself. Also, the fact that in both these situations it is possible to hear other people in the background, it could be argued that this strategy is used to give the answerer the chance of getting out of the conversation, before getting to the reason for the call. It might be then that the "you" is a way to check the answerer's availability. More data is needed to investigate whether this is so, it would also be interesting to compare with the use of "you" in fixed telephone conversations.

"WHAT ARE YOU DOING?" – ACTIVITY AND AVAILABILITY

Moving on to a different way of checking availability, we will look at an excerpt where the caller asks what the called is doing. By asking this, the caller gets both the activity and availability status of the answerer. In this case, it turns out that the boy Nicky is calling is in the middle of a class.

Excerpt 5

C:	hej![1]	hi!
A:	he::j	hi::
	(.)	(.)
C:	vad gör du	what are you doing
A:	jag har lektion: men det är ingen fara hhh	I'm having a class: but it's no problem hhh
C:	okej h:	okay h:

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[1] It is unclear here why the caller utters the first turn, the initial "hi". I am not sure whether there had been some interaction prior to this; this is all that is available on the tape.

	(.)	(.)
A:	ha::	well::
C:	du	you
A:	ja:	yes:
C:	ikväll	tonight
A:	ja:	yes:
C:	nä:::r eh::blublub får vi nån mat?	whe:::n eh:: blublub do we get anything to eat?
A:	nej	no
C:	inte?	we don't?
A:	nej	no
C:	hepp (.) då får jag äta nu då	okay then (.) then I'll have to eat now then

Here we can see how the caller is informed that she has called someone who is in class at the moment. However, the answerer claims that his being in class is not a problem, thus displaying availability. He does this in one turn "I'm in class but it's no problem". It is interesting that on the question "what are you doing?" he does not just answer that he is in class, he also says that it is not a problem. Probably this is because many of us would actually see this as an activity where one is (or should be) unavailable for talking on the phone[1], and he therefore needs to state that he is not one of these people. Presumably, it could be a problem for other people in his immediate surroundings, e.g. the teacher. Perhaps this is also a way then to "be cool", to show that he can do as he pleases.

The way that the conversation unrolls after he has said where he is, is peculiar. There is a long sequence with one word turns before she initiates the topic. This can be because she does not really have a topic, and comes up with one as the call develops. It could also be because she is orienting to him being in class, she might find this more problematic that he pretends to do. Therefore in initiating the topic step by step in short turns, she gives him the possibility of saying that he cannot talk. This argument is supported by the fact that she is hesitating and rephrasing her question about whether they will get anything to eat. She is perhaps searching for a way to formulate herself so that he does not have to give a lengthy answer, given the presumed inappropriateness of having a mobile phone conversation in class.

This excerpt also provides some insight into the larger issue of whether the introduction of the mobile phone and with that the possibility of being called anywhere, changes the notion of what it means to be in a place. A classroom traditionally is a place for activities related to learning. The mobile phone in this environment could be seen as competing for attention with this activity. That this is seen as a risk by some is evident in the many schools which prohibit mobile phone use during class, the school Nicky goes to being one of them. In this conversation, Nicky and the person in the classroom struggle with what it means to be in a class room, and what sort of

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[1] It is forbidden in this school to use the mobile phone during class.

activities are appropriate in such a place. On the one hand, the called says that it is not problem for him to have a conversation during class, on the other hand, the conversation enrolls in a way which seems sensitive to place and situation.

"WHAT ARE YOU DOING?" – A QUESTION ABOUT LOCATION?

In excerpt 6, "what are you doing?" is asked by the caller right after the identification and recognition part of the opening. Here, the question gets a location, rather than an activity.

Excerpt 6

A:	a de e Nicky	yeah it's Nicky
C:	he:j	hi:
A:	he:j	hi:
C:	vad gör du?	what are you doing?
A:	e:: ja e i skolan nu	eh:: I'm in school now
C:	osch: h:	osch: h:
C:	>va bra< jag kommer jag tar fyrtitretåget för de har blivit nå strul i morse då va	>great< I'm coming I'm taking the forty-three train because there was some trouble this morning then
A:	mhm	mhm
C:	men du har ju minidiscen kan inte du börja lägga in det ljudet	but you have the minidisc can't you begin to do that sound

The question "What are you doing?" is responded with a location; Nicky answers that she is in school[1].

In this excerpt, the caller treats the "what are you doing" as a question for where she is, rather then what she is doing, and it seems that this is how the caller meant it to be treated, as is evident in "great". There is not a follow-up question like "but what are you doing in school?", which would have suggested that he was actually interested in what she was doing. Also, that she is correct in answering with where she is evident taken that the caller then asks her to do something that she needs to be in school to be able to do (i.e. work on the sound with the minidisk). Therefore the "great" when the caller hears that she is where he hoped she would be, so that she could start doing the work before he gets there.

It seems then that her formulation of place, that she is in school, is relevant for the work that they are mutually engaged in at school. This idea is in line with Laurier's (1999) findings. He argues that the formulation of location in mobile phone conversation is tied to the business that needs to

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[1] Note that this differs from the previous excerpt, where the answerer was in class. In Swedish at least, to be in school does not necessarily imply that one is in class; to be in school is to be somewhere on the school premises.

be done between the two people, and the place descriptions are thus doing a lot more than just formulating place.

Also, the caller explains that he is on his way, as well as the reason for being late, that "there was some trouble this morning". As Laurier (1999) has pointed out, "each actual occasion of lateness requires careful accounting for". When the caller says that he will be on the "forty-three train" he is orienting to "who we know we are" (Schegloff, 1971) – he shows that he sees her as a person for whom the "forty-three train" is relevant. She knows what this can be taken to mean in terms of his arrival (cf. excerpt 8).

GETTING OUT OF A CONVERSATION

In the next excerpt, Nicky gets a phone call in which she has trouble getting the caller to accept that she is unavailable for having a conversation. She is in a fitting room talking to someone else, when she answers the phone:

Excerpt 7

A:	jag tycker den va snygg a hej	I think that was nice yeah hi
	((sound of door closing))	
C:	ha?	what?
A:	hej	hi
C:	hej hej	hi hi
A:	men jag kan inte prata nu (.) för	but I can't talk now (.) cause
	[jag e:: i en prov+	[I'm:: in a fitting+
C:	[nähä va ska jag göra åt det dåh	[oh yeah what should I do about that then
A:	e:hehehe:	e:hehehe:
C:	va gör du då?	what are you doing then?
	(0.3)	(0.3)
A:	jag si+ ja står i en provhytt å provar	I'm si+ I'm standing in a fitting room and trying
	kläder	on clothes
C:	jaha:::	oh yeah:::
A:	m	m
C:	jaha:::	oh yeah:::
A:	ja!	yes!
C:	ja! (.) OCH?	yes (.) AND?
A:	heh jag ringer dig sen	heh I'm calling you later
C:	nä det gör du inte alls jag är inte	no you don't at all I'm not home h
	hemma h	
A:	nähe aja jag	oh yeah oh well I'm
	[ringer dig imorron då	[calling you tomorrow then
C:	[du får ringa till mobilen då	[you'll have to call the mobile then
A:	ja	yes
C:	ja	yes
A:	ja	yes
C:	hej	hi
A:	hej	hi

One interesting thing with the opening in this excerpt is that the answerer's first turn seems to have multiple recipients. Nicky seems to orient herself to more than one listener. The utterance "I think that was nice yeah hi", has two parts. The first ("I think that was nice") presumably is meant for the other(s) present with her in the fitting room or in the shop. The second part ("yeah hi") is presumably meant for the caller. However, it might be more complex than this. The fact that the caller can hear the entire first turn makes it possible for the caller to use this as a resource. In hearing "I think that was nice", the caller can draw some conclusions about the location and activity in which the called is engaged. It might also be that *the utterance is designed to give the caller this background information.* This could then be a way of showing that she is already engaged in a conversation with someone co-present, meaning that she is busy. Also, if she wants to get the conversation on a closing track from the beginning, letting the caller hear this piece of talk could be a strategy of displaying her unavailability.

After the greeting sequence, the answerer's first thing to say is that she "can't talk now". She thus tries to initiate a closing of the conversation in the beginning of the conversation. In line with the argument in Button, she is trying to "place the conversation on a closing track" (1991:251) by saying that she will call him later, thus making arrangements for the future. Button identified this specific topic as being one used to begin the closing of a conversation. However, the caller is not cooperative in this matter. It takes Nicky quite a few turns after having initiated the closing, before she can actually get out of the conversation, and end the call. She says explicitly that she is unavailable for having a conversation – "I can't talk now" and begins her explanation to why she cannot do this "I'm in a fitting room". The caller does not seem to hear her explanation; just that she cannot talk right now. The question "what are you doing then?" seems to imply that he wants a good explanation for why she cannot talk to him right then. The second time she explains why she cannot talk; she does this by giving both location ("I'm standing in a fitting room"), and activity ("and trying on clothes").

She tries to end by promising to call him later. However, he takes her "I'll call you later" as "I'll call you *at home* later". It is difficult to say why this is so, but at least this discussion about when and where to call, postpones the ending of the conversation yet a little bit longer.

In the beginning of the call, Nicky seems amused by the fact that she is answering while being in a fitting room, but as the conversation develops and she has difficulties ending the conversation, she seems more and more annoyed. Although this caller might have been unusually unwilling to cooperate, it is interesting to see how *the called tries to get out of the conversation by saying what she is doing*, and how this is treated by the caller.

Also, in line with the argument of the case of the conversation in the classroom, this excerpt gives insights into the notion of what type of

activities belongs in a certain place. Nicky shows quite vividly that she does not consider a fitting room an appropriate place to talk. Therefore it could be argued that even though the mobile phone allows people to be reached in all locations on all occasions, people work to maintain a sense of what belongs where.

LOCATION, MOBILITY AND 'BEING LATE'

In the next excerpt, the caller volunteers to describe her location, although it has not been asked for and is not treated as particularly interesting by the answerer. Nicky gets a call from someone who is on a bus, and is late for a meeting they both are going to.

Excerpt 8

Ring ring	
Rin+	
A: a de e Nicky	yeah it's Nicky
C: hej de e Sandra	hi it's Sandra
A: hej	hi
C: du ska på mötet eller?	you're going to the meeting or?
A: va sa du	what did you say
C: du ska på mötet?	you're going to the meeting?
A: jag ska på mötet ja	I'm going to the meeting yes
C: a jag kommer väl jag kommer en kvart tjugo minuter sent bara så börja utan mig	yeah I'm coming I'm coming a quarter twenty minutes late just so start without me
A: okej a men de e lugnt	okay yeah but that's cool
C: jag sitter på bu+ jag sitter på bussen nu ja e alldeles framme vid Backaplan snart så att	I'm sitting on the bu+ I'm sitting on the bus now I'm almost at Backaplan soon so that
A: okej (.) de e lugnt	Okay (.) that's cool
C: bra	good
A: ah hehej	ah h: hi
C: he:j	hi:
((Ends conversation))	
Nicky ((to herself or co-present)):	
men fan jag kan inte ta det kortet	but shit I can't take that card

The reason for this call is that Sandra is running late for the meeting. The caller gets to the point very quickly, right after the greeting and identification has been done. There is no pre-topic work going on here, as in the other excerpts. This might be because the caller feels that this is an urgent topic, and does not want to risk not being able to deliver the message should the answerer claim to be unavailable.

When Sandra says that she will be a quarter to twenty minutes late, Nicky seems to want to end the topic already. She says "that's cool", but Sandra continues to explain where she is. It is interesting that she continues,

although Nicky has already indicated that it is okay. The caller goes on to give her location, that she is soon at Backaplan. Her location can be used by Nicky to understand the estimated time of Sandra's arrival to the meeting. Her location is thus relevant for the future activity, and this might be why it is provided even though it already has been said that her late arrival is not a problem. In fact, the words "so that" indicates that her location should be taken as meaning something in terms of her arrival; something like "I'm almost at Backaplan soon *so that* means I'll be there in X minutes".

Laurier (1999), in discussing accounts for running late, argues that one reason for providing more information to the answerer, can be to give the answerer an account to then relate to other persons going to the meeting one is running late for. This might also be part of the reason why Sandra goes on to make a second statement about her location; to give Nicky some information the she can use when saying that Sandra is late for the meeting. In this way, Sandra provides her location to Nicky although she has already indicated that it is okay that she is late. Actually, in the closing goodbye, Nicky laughs subtly, which might indicate that she found it amusing or irrelevant that Nicky was providing her location, or even calling at all to say that she was late.

One explanation to why Nicky does not display an interest in discussing further where the caller is, and what time she can be estimated to arrive, might be because Nicky is occupied doing something else when she gets the phone call. We are actually given more information in this fragment than what is in the actual phone conversation. Nicky forgets to switch off the recording machine, and it becomes evident from what she says after having ended the phone conversation, that she is standing in the line to the cash machine. Therefore, presumably, she wants to end the call before it is her turn, in order to be able to use the cash machine easier. This information is available to us, but not to the caller.

The mobile phone provides a tool to do just this sort of micro-coordination (Ling and Yttri, 2002); calling and saying that one is late for a meeting. The possibility of making a call if one is late, might also lead to a *demand* to call and say if one is late.

Conclusion

The data presented in this study is limited, and before investigating a larger set of data, from several participants, it is impossible to make more than initial observations about the character of mobile phone conversations. However, I hope to have provided a few initial observations about what sort

of issues seem to be attended to in mobile phone conversations, and consequently what issues are to be studied in the future.

The main issue of this chapter was to begin to investigate the ways in which participants in a mobile phone conversation orient to each other's location, activities and availability. Caller and answerer's location, as well as their availability for having a telephone conversation, is more complicated now that the telephone no longer is fixed to a predictable location. As always, it is rewarding to look at the talk to see how these things are being done as practical ongoing accomplishments.

One of the characteristics of mobile phone conversations is that the participants cannot beforehand know where the other party is or what she or he is doing. One can be 'forced' to answering in the middle of an activity which it is impossible or difficult to continue at the same time as having a mobile phone conversation. This can be compared to standing in line for the cash machine, as in one of the examples in this chapter, where the actual physical activity of standing in line does not get more complicated because of a phone call.[1] The caller then has to find out about the called's availability for having a conversation. In some cases, this involves finding out about the location of the answerer, as certain places are considered more or less appropriate for having mobile phone conversations. We have seen a few examples of how this is done, and what resources the caller has for knowing if the called is available for conversation. The caller can draw some conclusions about the location and activity in which the called is engaged from the background information. We have seen that the mobile phone users seem to use background noise, voices etc. Also, in one instance, where the called was in a situation where it could be presumed he was not available for conversation (although he claimed he was) it seemed that the caller attended to this by giving the caller a possibility of ending the conversation. In another instance, the caller answered the phone while still talking to someone else. This might be a strategy to give the caller background information of the activity of the caller, and show that she was really not available for having a conversation. In some conversations where there seemed to be things going on where the called was located, the caller attended to this by initiating the topic with "you". This might be a strategy to give the called a chance to end the conversation.

Further, we have seen one example of how the called tried to get out of a conversation by talking about a future phone call. Making arrangements like this can be a way of placing the conversation on a closing track (Button, 1991:251). One way of doing this is through "projecting future activities", e.g. talking about whom should call a third person and make arrangements.

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[1] Of course, there might be other constraints for having a conversation in this location, e.g. if one does not want to have a conversation with others overhearing it.

Location was particularly relevant if it could give any information about a future meeting. When there is a meeting or a place both callers are going to and one party is late, location seems to be attended to as an issue of what this means in terms of getting to the place where the meeting is.

The data presented in this chapter also provide some initial ideas on the larger issue of whether the introduction of the mobile phone, and with that the possibility of being called anywhere, changes the notion of what it means to be in a place. For instance, when Nicky happens to call someone who is in a classroom, he says that it is not problem for him to have a conversation during class, but still the conversation enrolls in a way which seems sensitive to place and situation. Also, when Nicky received a call while trying on clothes in a fitting room, she shows quite vividly that she does not consider a fitting room an appropriate place to talk. It could be the case that even though the mobile phone allows people to be reached in all locations on all occasions, people work to maintain a sense of what belongs where. Thus, certain places are still tied to certain social activities (cf. Crabtree, 2000a). To be able to understand how the notion of 'place' changes with the mobile phone, we need to analyze more naturally occurring mobile conversations.

The convention to answer through self-identifying by name still seems to be attended to in mobile phone conversations. Regarding the identification and recognition, mobile phones have a few interesting features which might affect the way in which this is done. One of these features is the caller identification function. This means that numbers can be preprogrammed into the phone, so that when someone calls, the name of the person appears on the display. In the data analyzed for this chapter, there were no cases where the answerer explicitly attended to this by saying the name of the person who called. However, it is possible that in the cases where the caller did not state his or her name, the answerer could see the name on the display and the absence of a name was therefore unproblematic.

Also, some phones have the possibility of choosing ring signals specific to a group of people, or just one person. Thereby it is possible to have a unique ring signal for e.g. one's best friend or one's husband. This means that it is possible already from the summons, the ring signal, to know who is calling. In a sense, then, the first turn is already made by the technology, which provides an identification of the person calling. However, as previous studies of mobile phone use reveal (chapter 8) it is not always the person owning the telephone who uses it, so this way of identifying the caller might prove to be unsuccessful.

Another side of the technology is that it is possible to see phone calls that one has missed. Knowledge about who has tried to reach you previously that day, for instance, might be brought into play when answering the phone and identifying the person in the other end.

It is important to remember that mobile phone conversations can be just one form of communication between the conversationalists. The individuals who Nicky, the person we follow in this chapter, speaks with are people that she spends time with, goes to school with, and thus interacts with in many other ways than over the mobile phone. In the words of Laurier (1999) "they are speaking to one another because they do this day in, day out to co-ordinate their day's activities". He makes the interesting suggestion that this constant contact blurs the distinction between caller and called, in that it is not necessarily the caller that has to provide the reason for calling. As we have seen in this chapter, in many of the conversations the topic is introduced in a manner which has us guessing that the speakers have talked about this previously. Topics are in a sense open for conversation, on the floor, and can therefore without much introduction be continued.

Therefore, one limitation with this way of collecting data is that we miss out on the chain of communication. It is not possible to see where a specific phone conversation is placed in relation to other communication, such as text messages, landline telephone conversations or face-to-face conversations. Thereby we sometimes miss out on how the conversations form part of a series (Button, 1991). Also, since the participant in this study was told to only give away the mobile phone conversations she felt comfortable with, this means that she probably had conversations which were not recorded.

For this particular study, I wanted to have access only to the data available on the tape, to use a conversation analytic approach. This was to make it more similar to conversation analysis studies of landline phone conversation. This meant that no interviews were carried out with the person recorded. I could have asked her about the particular conversations, and have her opinion about what was going in. A possible and interesting next step would be to include other types of data. For instance, to interview people and talk to them about how they handle availability could be useful, as well as to use findings from fieldwork. When studying mobile phone use in public places it is possible to get only one end of the phone conversations, but in this there is still a lot of information to obtain about how people formulate place as well. In this chapter, I have in a sense actually used some small ethnographic data in the analysis, and that was the information that was recorded on the tape but was not part of the actual conversations. This provided more information about what was going on before and after the conversations, and what issues the participants where dealing with. An example of this was when it became evident from the tape that the answerer was standing in line to use the cash machine. Without this information about the location, activity, and presumed unavailability of answerer, the analysis would not have been the same; it is therefore worth investigating how to combine methods for studying these issues in the future.

Chapter 10: Conclusions

The aim of this work is to provide insights into the nature of mobility. The thesis has presented five studies of the ways in which mobile technologies feature in very different settings, ranging from practically stationary work to truly mobile activities: the technology-intense work in a traffic information central, workers cleaning the runways from snow at a large airport, a group of ski instructors using a mobile awareness device, mobile phone use among young people in public places, and recordings of real mobile phone conversations.

The findings presented in the thesis have shown the highly collaborative nature of mobility, and thereby questions some earlier assumptions about mobile technology being private and personal. Results are presented which point to the various ways in which mobile technology is shared, and also how those using the technology get a sense of shared ownership of the technology.

This thesis also falsifies the assumption that mobile technology has provided us with access and communication possibilities anywhere anytime, in a smooth and effortless manner. The advent of mobile technology has not made people independent of place. This thesis has provided examples of how 'place' and 'the local' is important in the mobile world. It is evident in the following three ways: (i) A lot of work need to be done in order to negotiate a mutual understanding of the situation at hand. Context, including the part of it that is location, is not something which is easily provided; it is interactionally and continually negotiated. (ii) The local is often used as a

resource in the communication, both between co-located and distributed participants. Locally available information takes precedence for remotely accessed information. (iii) There is not one part in the communication that has the overall perspective; the localities of both parties are relevant. Different participants may have different perspectives, different viewpoints and possess their own local information. Coordination is then achieved through negotiations between different localities. Again, this is interactionally and continually organized. Amongst other things, these results have implications for how we understand the role of so-called centers of coordination.

Mobile technology as shared technology

The mobile phone is often portrayed as a personal and private communication tool. Today's mobile phones are designed to be used by one single user at a time to communicate with remote others. Several of the studies in this thesis have pointed to aspects of sharing and collaborative features. Two aspects of sharing can been identified: the sense of shared ownership and responsibility which mobile technology can invoke, although often being separate devices held by individuals, and sharing of mobile technologies to support interaction between co-located. These two aspects of sharing show the importance of not treating mobile technologies as necessarily private, when designing new technology.

SENSE OF SHARED OWNERSHIP

In the study of the snow crew at Arlanda airport, we could se examples of a group responsibility for the work and the machines used to do this work. They were to a large extent dependent on each other to do the work. The snow sweepers coordinated their work using highly local-dependent information, such as how much snow there was left to clear, how far apart from the rest of the group they were, etc. Local information was obtained simply by looking out the windshield. Together they took great responsibility for the machines and for leaving the runways clear. They kept an eye on the machine immediately in front of them, letting others know if there was a problem, and if so, how it could be adjusted. For instance, they would comment that the brush on a machine was not positioned correctly and therefore left some snow behind. In this way, the individual sweeper took responsibility not only for his own machine, but for the machine in front of him and the work of the entire group. The sweepers took great pride in

doing a good job; they talked about "black runways", meaning runways free from snow. In order to maintain these black runways they had to collaborate.

Interestingly enough, mobile technologies can invoke a sense of shared ownership among its users, in similar ways. In this thesis it was described how the ski instructors using the mobile awareness device (Hummingbird, chapter 7) developed a sense of shared ownership of these devices. This was observable in the interaction which the technical problems and shortcomings resulted in. For the ski instructors, it turned out to be a struggle to keep the devices functioning despite technical difficulties. It was clear that the most active users cared about the other Hummingbirds and the way these were handled by the other group members. Being a technology for group awareness, it was in everyone's interest that all the devices functioned. This lead the more active ski instructors to remind the less active ones of their Hummingbirds, to bring them along and to change batteries. Negotiations around how to handle breakdowns of technology were observed on a couple of instances, when a ski instructor's Hummingbird was defective, preventing its holder to see the others but still being visible to the rest of the group. In these cases, the group decided that the ski instructor in question should bring his Hummingbird along despite that it was of no use to him personally, but because the others could have use of the information, and thus it benefited the group. This indicates that this type of group awareness technology creates a shared sense of responsibility.

SHARING AS A RESOURCE FOR LOCAL INTERACTION

Mobile technologies and other artifacts are often used as a resource for local interaction. That artifacts are used in this way has been observed in several studies. For instance, medical records are oriented to in the communication between the patient and a doctor (Luff *et al.*, 1992), and maps are shared between tourists trying to find their way in a city they are unacquainted with (Brown and Chalmers, 2003). Also more 'high tech' artifacts are used in this way, as will be discussed below.

This was also the case with the maps used in the study of the Traffic Information Center. The maps were used as resources for the interaction in the room, when talking about places and things occurring out on the roads. The maps where shared in different ways, depending on their design. So for instance, there was one large screen which could be moved back and forth in the room. This map was also at moments augmented with pins representing events. Further, there were smaller 'handheld' maps, which could be circulated around, and were kept on shelves or desks. These maps were all used collaboratively, and were resources provided by the organization, rather than resources owned or provided by the individuals.

The organizationally provided resources for local interaction can be juxtaposed with the personally provided resources, e.g. mobile phones. Mobile phones are mostly bought and owned by individuals. The study presented in this thesis (chapter 8) shows how the mobile phone has become a tool for collaborative interaction in the local environment, rather than merely a private communication device. Among teenagers, the phones are not just treated as personal, and the calls and other communication are not always treated as private. Rather, there is much work going on to render the communication 'public', enabling several people to take part in it. The remote communication, i.e. the phone calls they receive or make, as well as the SMS-messages they receive or send, are accounted for in the ongoing local interaction. Teenagers thus share the communication they take part in with their co-present friends. Not only the communication but also the phone itself is often shared. This was observed to be done in two ways: minimal forms of sharing of content, mainly SMS-messages – sharing by reading the message aloud, and sharing by showing the display to others, and the other form was hands-on' sharing, when the phone itself is shared between two or several teenagers. The hands-on sharing is made possible by the ecological flexibility of the phones; they are small, and easy to move around, thus enabling several people to use it as a collaborative resource. Both strategies are ways to let friends (and perhaps others in the surroundings) take part of or part in personal communication; ways to render private information displayed on a very small screen accessible to others.

It was argued that the micro-mobility of the mobile phone has many implications for a device originally introduced for remote communication. Micro-mobility is a type of mobility not normally associated with new technologies (Luff and Heath, 1998), so for those interested in designing new mobile phones and services, it might be useful to consider that phones are used within the local domain as well. The ways in which teenagers share the phones and their content today, could be drawn upon to add features or services that supports this sharing. A few possibilities based on our findings were discussed previously, and will be briefly summarized here.

The sharing of mobile phones observed in this study raises questions about the notion of the mobile phone as a personal device, belonging to and being used by one individual. There is a lot of work going on to render the mobile phones as *not* personal and the communication as *not* private. Understanding the ways in which this work is done, and what it involves, could be useful to consider when designing mobile phones and services. The mobile phones of today are designed to be used by one single person at a time. People using the phones for collaborative purposes have to work around this. For those interested in designing and providing new mobile services and technology, one approach could be to make the phones more

flexible, supporting the private, individual use, as well as the collaborative, group-use described in this study.

Another issue that the results from this study raises is the way teenagers spend time in groups, and how this is shown in their use of the mobile phone. In particular, our observations show how teenagers sometimes call someone's mobile phone and end up talking to someone else in the group. Sometimes they call a person up when looking for someone else. The call is thus directed to a phone in that group, with the aim of getting hold of someone who might be a part of the group. When presenting design students with these findings, they suggested that phone calls could be redirected to the nearest available phone of a friend, if the intended recipient could not be reached for some reason.

These ideas have interesting links to the history of the stationary telephony. In the beginnings of the fixed line telephone, phone calls were directed to a switch. The call was then redirected to the person one wanted to get in contact with. So rather than calling to a person, a place was called. This system was then built into company switches, where it still today is possible to call a place and then ask for the particular person, rather than getting a hold of the person directly. With the mobile phone, it has been argued that we have been given a means of reaching a person directly, instead of calling a place first. The findings from the study of young people using their friends' phones, and the design suggestion using such findings in creative ways, show how the mobile phone can be used for more than just person-to-person communication.

Mobility and place

This thesis falsifies the assumption that mobile technology has provided us with access and communication possibilities anywhere anytime, in a smooth and effortless manner. The advent of mobile technology has not made people independent of place. The studies have provided examples of how 'place' and 'the local' is important in the mobile world. The following sections discuss this, based on the findings presented in the empirical chapters.

MOBILITY AND LOCAL INFORMATION

In interacting remotely, the local surroundings and local knowledge have bearing upon the interaction. This became evident, in ways somewhat related, in the studies of the Traffic Information Center and the snow sweepers at Arlanda. The fieldwork was carried out from two opposite perspectives: the operators inside the information center, and the mobile workers in the field.

It was observed in both studies that local information was highly relevant in the work. Both groups used the information they obtained from looking out the windows of their respective workplace. Locally available (sometimes visual) information takes precedence for remotely accessed information. The operators used the information about the weather as they observed it from the windows of their office in the communication with the crew and public calling in to the center. Similarly, the snow sweepers used local information in the field to make their own decisions on the ground, as well as when communicating with the control tower via radio. In this way, local knowledge plays an important part in remote interaction.

The coordination of snow clearing can be understood as an ongoing interactionally negotiated practice. The tower and the snow clearers occupy different viewpoints in the system depending on their task and the situation. There is not one single unit with control; the control is distributed over various people, and the decisions are consequently also distributed, although this goes against regulation. The snow sweepers and the tower have different perspectives in the system that the ground air traffic management comprises. Coordination is achieved through negotiations between different localities.

LOCATION, POSITIONING AND MOBILITY

> "Place is more than just a location—a spot on a map—and it is more than just a landscape. Place is inextricably linked to people and the things that happen in that location that are meaningful to them. Place, after all, is a social construct."
> (Salvesen[1])

Today there is much talk about making mobile technologies context-aware (e.g. Agre, 2001). One big part of this is to make the technology aware of its location. It is evident that this location is something more than just a spot on the map; it is also a place which has a number of conventions surrounding its use, and this is more difficult to make the technology aware of. Location awareness is not the same as place awareness. In order to provide useful location based services it should be examined what a place is and how people go about making it into such a place. How meaningful a position is, is also dependent on the practical activities in which one is involved. It is as part of these activities, that position becomes relevant.

Analysis of mobile phone recordings clearly gives at hand that a place is more than just a location (chapter 9). Place and activity are strongly related in the conversations. One of the problems behind the idea with context aware applications then, is the simplifications about what a location is. A context is not something which can easily be provided, it takes work to find

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[1] David Salvesen, Urban Land Institute, http://www.matr.net/article-4108.html accessed 10 December 2002

this context, and this is *continually* and interactionally organized. The context is seldom given; rather it is created in the interaction.

It could be debated whether mobile technologies challenge what it is to be in a location, when it is possible to be reached in spaces where it previously was not possible to be reached. For instance, to take the fitting room example from chapter 9, how is a space such as this to be seen, if it is no longer only a place to try on clothes, but now it is also a phone booth? In order to more fully understand how mobile technology challenges and potentially changes what it means to be in a space, we need to make further investigations of how ordinary people go about talking about space, and acting in space as part of their everyday affairs.

From the empirical studies in this thesis and the observation that place is more than just a location, systems or services providing or relying on position face four challenges which needs to be designed for: embodied positioning, speed, relative positioning, and intentions. These are described below.

Embodied positioning

For the snow sweepers, looking out the window and seeing where others are located provides them with embodied location awareness. It adds something to the representation on the screen. Rather than seeing a small dot representing self and others, they can see and feel their relation to the other vehicles and the surroundings. Brown and Chalmers (2003) provide data from a field study of tourists using maps, and show how tourists point and turn their bodies as a part of working out where they are going. This is an embodied sense of location (Jones in Brown, 2002. The SnowCard display provided the snow sweepers with an overview, a map, of the airport. Clearly, this bird's eye perspective is different from the perspective of the sweepers, seated in the large vehicles on the ground. Positioning of others from looking at a map is therefore obviously different from positioning someone in relation to one's own physical self.

The need for relative, embodied positioning was also an issue in the ski instructors' use of the Hummingbirds. They were unable to know where the others were located, they were only notified when someone were in the vicinity. In fact, it even turned out to be relevant to know not only in what direction they were located horizontally, but also vertically. The instructors lived in two store apartments with separate entrances, and the Hummingbirds displayed those as nearby who were on a floor above or below. One of the ideas behind the Hummingbird, was that it should support the initiation of face-to-face interaction, by letting the users know when their friends were in the vicinity, so that they could start looking for each other. The example with the Hummingbird presenting those in another apartment and on another floor as available for such interaction, clearly

shows how difficult it is to define when a distance is relevant to be presented as "close".

When presenting these findings to a group of design students, they suggested KompisKompassen (The BuddyCompass) – which does not only show that a friend is in the vicinity but in what direction, by providing an arrow pointing in the direction of the other person. This adds relative positioning to an awareness service in a neat way.

Speed and relative positioning

Movement has been used in this work to signify the physical movement of persons or artifacts, while mobility is the social interaction associated with this movement. It is not only the movement but also the social interaction related to this movement which has been the concern of the studies in this thesis.

Speed turned out to be important for those activities that were truly mobile, where the physical movement was an integral part of the interaction. In the case of the snow sweepers, speed was an important part of their work. They had a certain time to clean the runways, in order to not delay air traffic. One instance from the field shows how the front sweeper, who is responsible for reporting to the tower when every sweeper has left the runway, is concerned when one rookie sweeper is left behind. He does not discover that this sweeper is behind the rest of the group until he can turn around and look out the window. Not until the front sweeper noticed how far back the last sweeper is, speed is brought up in their conversation. He then sees the big gap between this last vehicle and the others, and this is when the problem presents itself to him. So what he discovers is not that the sweeper is driving slower than the others, rather it is the gap that is observable to him. Perhaps what was lacking was a sense of speed. Speed is also relative and it needs to be taken into account the speed of others, as is shown in the example with the snow sweeper being left behind.

The lack of taking into respect speed as a factor was also one of the explanations for why the ski instructors' had relatively little use of the Hummingbird during the actually skiing. Apart from being a problem with the distance the Hummingbirds worked on, it was also problematic when skiing and going quickly down the slopes. The instructors were in the vicinity of each other during such a short period of time, for the awareness information to be of little use, if at all the system had discovered that another Hummingbird was in proximity.

The speed in truly mobile activities is something considered in Hocman, a prototype allowing for motor bikers to share information as they pass each other by quickly. A rapid peer-to-peer discovery algorithm was developed in order for ad hoc networking to work despite the high speed of its users (Esbjörnsson *et al.*, 2002).

As these location-based services are brought into use, the information about location is provided with meaning in the interaction. The extent to which this is possible determines the success of these systems.

Intentions

One of the major problems with position-based systems presenting visual information about location, like the SnowCard system studied in this thesis, is that they do not provide information about intentions and next action. In the study of the snow sweepers at Arlanda, it was evident that information about the location of a vehicle is not enough. It is not possible from this system to ascribe intention to the small dots which represent the snow vehicles. This is negotiated over the radio through talk. The snow sweepers talked about where they were going next and what they were doing. So for instance, it was not possible to know in what directions other vehicles were heading. The direction of others could only be seen from the system if looking at the map for some time, seeing how the dots moved.

The underlying difficulty here is that position and activity are tightly interwoven. Analysis of mobile phone conversations show how it is not only enough to know the location of the person one is talking to, but also what he or she is up to. Contrary to popular belief, findings presented in this thesis suggest that callers do not so much ask where the answerer is, rather what she or he is doing. If location is relevant for the activity and in order to understand what the answerer is involved in, this is provided. The similar is valid for the snow sweepers; they are also interested in what others are doing rather than merely knowing their location.

The importance of talk

Verbal communication is a crucial aspect for interaction and coordination. This might not seem surprising, yet not much effort is put into refining and enabling technology for smooth verbal interaction. Several of the studies in this thesis have shown the importance of allowing for verbal communication, and the challenges involved when trying to replace this possibility with other technological solution.

In the study of the airport snow sweepers, a set of important factors in radio talk was identified, from detailed investigations of the radio talk-in-interaction between the snow crew and the tower. These are necessary to consider when designing alternatives, or additions, to talk, as the SnowCard does. Through talk, they repaired misunderstandings, talked about how the work should be done and how the radio should be used, and finally, they

negotiated the task at hand and talked about intentions and next actions. These things were all found to be of great importance for the work.

The study of the Traffic Information Center also shows the unique position of verbal communication on many levels of this practice. In designing intelligent traffic information systems, one has to consider the flexibility of human language. The information which the weather forecasts and maps provide is situated in the remote interaction between the workers in the control room and the mobile workers and public in the field. They had to rely on the information sources about the outside world. This is primarily done by talk. An example of this is the reports from the weather authorities, which earlier was delivered over the telephone but the direct contact had been replaced by a fax. This obviously took away the possibility for the TIC crew to discuss interpretations of the weather reports with the professional weather personnel, something they thought was important. What makes the work at the TIC especially interesting is that they are located in an office distant from the mobile people with whom they interact. This is a form of remote interaction, where much time and effort is put into trying to inform themselves of the current situation in the field, making sense of the remote information they receive. The information which the weather forecasts and maps provide is, trough talk, situated in the remote interaction between the workers in the control room and the mobile workers and public in the field.

The flexible character of human communication is also important as a part of reaching a mutual understanding of the location, activity and availability of others. In the recordings of mobile phone conversations, it was observed how the participants negotiated their availability, whether the place they were located in was suitable for having a mobile phone conversation or not. Location was particularly relevant if it could give any information about a future meeting. So for instance, when there is a meeting or a place both callers are going to and one party is late, location seems to be attended to as an issue of what this means in terms of getting to the place where the meeting is.

Predictability and expectations

The other party's activity, availability and location can be more or less *predictable*. To what extent this is predictable has to do with many things, among these whether the interactants are tied to a certain activity or place. For instance, in local mobility, the predictability is often high, because people share a work task together or are in a certain location to do some activity which takes place at a certain place. The participants can then expect

that the others are doing something related to this task, and that he or she is in or in the vicinity of this particular place. An example of this is that the snow crew studied in this thesis, expected the group to be in the area of the airport and involved in doing what they normally were doing at that time. This is not to say that actions are highly planned, but rather to say that the occurrence of different events at different times by different persons have a degree of predictability.

Closely linked to predictability are the *expectations* a person has on others using the mobile technologies to interact remotely. When initiating remote interaction, e.g. calling someone on the mobile phone or over the radio, there are certain expectations involved. The interactants have expectations on where the others are located and what type of activities they might be involved in. For instance, when calling someone at home, to a stationary phone, I can assume that the person to whom I am calling is involved in an activity which it is possible to do at home. It would be strange if the person said he was out for a walk, and it would strike me as odd if he said he was sitting on a train. In mobile phone conversations, because of the mobility of the phone, the range of possible activities increases as the number of possible locations to be reached in increases. However, just because it is possible to use the mobile phone almost everywhere, does not mean that it is always relevant to know where this everywhere is in every conversation (cf. chapter 9).

Studying mobility

Collecting data about the use of mobile technologies is difficult simply because the technology and sometimes also its users are mobile to various degrees, and in often unpredictable ways. Studying the collaborative aspects of mobility, as opposed to individuals' problems while on the move, is a methodological challenge since mobility can occur over vast geographical areas and interactants be separated. Many previous studies of mobility are limited in the use of data collection methods in that they use the office, control room or other fixed setting as the primary location to study the mobile technology. In this thesis, some ideas have been provided on how mobility can be captured.

In this work, it is argued that as the geographical scope of mobility widens, from the co-located form of mobility termed micro-mobility to the more geographically dispersed and unbounded forms of remote interaction, so does the difficulty to study the phenomenon. As the interactants get further away from each other, and the location in which the interaction takes places expands, the unpredictability of the situation grows. The complexity

increases, as the geographical scope widens. Observation as a study method is easier to use when the focus is on a limited geographical area. When interested in collaborative aspects of mobility, and not individuals' problems while on the move, it becomes increasingly difficult; the interaction takes place at two places which can be very far apart. This poses challenges to studying naturally occurring mobility which can occur over vast geographical areas.

Four approaches to capture mobility have been defined. These approaches are: follow the actors, follow the technology, study a place and study the virtual communication space. It is important to emphasize that these approaches can be combined; two or more approaches can be used to get a fuller picture.

The first approach is to follow *people around*, study them in the places they go and see how they use technology in the various situations they encounter. This approach has proven particularly useful when a specific group is under inspection, most commonly a work related group activity.

The second approach is to *follow the technology*. This means to follow the technology around, wherever it takes the researcher. The study begins with an interest in understanding in what situations the technology features and how it is brought about in general, or perhaps a more specific situation or by certain persons. In this thesis, the use of the Hummingbird was studied by following the technology. The aim here was to evaluate the technology and see in what situations it was used (or not used) in a selected group. The technology was then observed in use, wherever that use happened to occur. Following the technology might involve difficulties as technologies are involved in activities crossing the line of work and private life, and used in several locations, both public and private. Although some of these places are probably accessible, it can be difficult to do a useful field study of technology use in all these locations and situations. The study of the sharing of the mobile phone presented in this thesis, used this approach to some extent. The focus of this study was on the use of the mobile phone. However, this approach was combined with the approach to study particular places where the technology was used; public places where teenagers spend time.

The third approach is to *study a place*. This means to find a place where mobile people spend time or pass through and do the field study there. Centers of coordination can be such a place, where mobile workers move in and out. TIC A little bit different is the method to find a public place as the place to do the study. This does not require access in the same way, as there may be a greater flow of people through this place and the focus is not on a particular group with which one can negotiate access beforehand. With this follows that the activities people are involved in can be more diverse. This is a way to capture remote interaction, as well as truly mobile activities. Since they are mobile and distributed over such a vast geographical area, it is

difficult to get a hold of them. As mentioned, the study of mobile phone use among teenagers, presented in this thesis used this approach to some extent.

The fourth and final approach to be presented in this thesis is to *study the virtual communication space*. This means to capture another part of where and when mobility 'takes place', in virtual space. This is a solution to the problem of being present when remote interaction takes place, as it is unpredictable in many ways. A way to get around this problem is to use other data collection methods than field studies. In this thesis, recordings have been used in situations where it was difficult to be present for the researcher. By recording the mobile phone conversations, we could follow the use of the phone and have all conversations recorded. Similarly, in the airport, it was possible to record the radio traffic between the snow crew members, and thereby capture situations where the researchers were not present, as well as matching the recording with situations where the researcher were present. To study the virtual communication space means that the data can sometimes lack some information about the context in which the technology is used, and this is a problem. Therefore, it is useful to have additional data where possible. Combining the approach to study the virtual communication space with the approach to follow the actors, can provide richer data.

Doing mobility

The aim of this thesis has been to provide a number of empirical studies of mobility, and thereby contribute to the understanding of the nature of mobility.

It has been argued that the use of mobile technologies is now such a widespread phenomenon that previously defined categories of mobility are not enough to describe it. Trying to fit the rich character of an ongoing practice into categories results in overlooking the complexity of mobility. As the use increases and spreads to new domains in society, these categories are not enough to describe the phenomenon. The approach presented in this thesis has been to try to move away from categories of mobility, and instead ask what is relevant for the participants.

We need to take a new approach to mobility. This thesis presents the argument that mobility is something which is ongoingly produced and maintained by the participants; people themselves are doing mobility. One way to approach mobility is to investigate what the participants themselves are orienting to in their actions. The question is rather what categories or issues of mobility are relevant for the actors, involved in the activity in focus.

Based on empirical studies a few issues have been identified as relevant to people doing mobility. However, there is still much more work needed to understand the practicalities of situated mobility.

Appendix: Transcription Notations

Adopted from G. Jefferson's transcript notation, as related in J.M. Atkinson and J. Heritage (1985):

<u>not</u>	emphasis is indicated by underlining
e:hhh:	colon, indicates prolonged segment
(0.3)	a pause, timed in tenths of a second
(.)	a pause, shorter than one tenth of a second
?	rising inflection, not necessarily a question
!	animated tone, not necessarily an exclamation
Overlap []	simultaneous (overlapping) speech
+	Interrupted speech
H	outbreath, unvoiced laughter
>what<	word or part of sentence spoken faster than surrounding speech
AND	words in capitals are spoken louder than surrounding talk

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