A Practical Sense of Knowing: Exploring Awareness Strategies in a Mobile Workplace

Carljohan ORRE[a1] & Leon A. WATTS[b2]

a Department of Informatics, Umeå University, Sweden
b Department of Computer Science, University of Bath, UK.

ABSTRACT. This paper presents and discusses strategies used by homecare workers to establish and maintain awareness in a mobile workplace. It capitalizes on data derived from a longitudinal translocal ethnographic study of homecare and the utilization of mobile technology. The study exposes two distinct dimensions of the work context, denoted the Case and Base dimensions, which are used as vehicles to describe situations of collaborative practice that occur (1) in a coordination meeting, (2) on a homecare visit, and (3) in an on-the-fly 'illicit' use of mobile technology. We propose a new conception of collaborative awareness as a 'practical sense of knowing'. Findings from the ethnographic study are consistent with a well-worn distinction between "knowing that", declarative knowledge, and "knowing how", procedural knowledge. Conventional structures of organizational control, encoded both procedurally and as declarations of responsibility, are routinely broken and reformed. This happens as workers devise new strategies in order to maintain the keen sense of their collaborative situation required to sustain an orderly workplace.

Keywords: Homecare work, Cooperative work, Awareness, Mobile technology, Control, Autonomy

Introduction

Awareness, in all its varieties, is a well-known and much-discussed concept in HCI and CSCW research; it is a core concept for ambient displays [14][26], for media spaces [8][7], for video conferencing [30][31], and for shared-workspace technologies [9][13]. However it may seem, awareness is something of an enigma in CSCW research. Schmidt has described it as an "elastic" concept that constantly threatens to slip through the fingers of designers who wish to support it [27]. Heath et al [11] stress the need to unpack the concept of awareness and take the domain seriously in order to provide enough guidance and knowledge when building systems that aim to support collaboration among distributed individuals (p. 345). Mobile collaborative systems bring a new dimension to the problem. This paper seeks to expose some of the challenges that attend the advent of mobile collaborative work and to bring a fresh

perspective to the concept of awareness among collaborators. It does so through the lens of a four-year ethnographic case study of mobile homecare work teams.

According to Moran & Anderson [18], an approach to the relationship between awareness and work activities is important for the introduction of cooperative technology. They place *fluidity of action* at the center of the problem, asserting that collaborative practices inherently rely on a *keen sense* of who and what is around when they are needed. They write: "[it is] how people slide to and fro between the formal and informal in doing the things they do within the daily round of work. This fluidity is a fundamental feature of work activity, and we need to be attuned to how technologies of various kinds can play a role here..." (p. 386). Addressing awareness more directly, they observe that: "…people are very aware of what goes on in their environment; without such awareness they would feel isolated….the environment needs to signal the availability of these things by tapping on people's ability to peripherally process the non-attended parts of the environment so that they can redirect their attention when appropriate…" (p. 386).

Moran and Anderson were addressing work activity in office environments. Fluidity of action takes on a new significance with the loss of collaborators' attentional cues and the loosening of environmental bonds inherent in mobile work. The nature of the challenge we see here is to move away from the prevailing notion of office work as a baseline condition for unpacking awareness. That is not to say that office work is less important, as is evident in the studies reported by Belloti [3] which focus on local mobility within the office. Rather, office work is associated with such an abundance of proximal information that it can be hard to distill out the "keen sense" of collaborative practice.

This paper reports a longitudinal case study of mobile collaborative work, and the practice-based utilization of mobile technology. It is in set within a context of homecare work; thus, people not artifacts are the main concern of the practice. We focus on a team of homecare workers who conduct home visits to elderly people. Despite the ostensibly solitary nature of their work tasks, the day-to-day duties of team members depend on close collaboration of activities for which they take collective responsibility. We begin by introducing prior research on the provision of technological support for distributed groups and for homecare work. We then describe the sociotechnical context of our study. We go on to present our analysis of homecare work in practice, distinguishing Case and Base work contexts through the use of three vignettes: (1) in a coordination meeting, (2) on a home care visit, and (3) in an on-the-fly unauthorized use of mobile technology. Each vignette is drawn from observations, field notes and interviews.

1. Coping with mobility and achieving an orderly workplace

Mobility is a dimension of cooperative work in which awareness plays a central role, as recent work exploring mobility and mobile work clearly demonstrates. Sherry & Salvador [28] describe the use of mobile devices to support mobile work as something akin to jazz-like improvisation, where the work performed owes to a constant interplay between unplanned and planned activities. In their study of mobile workers, Churchill & Wakeford [6] identify the access of information and access of others as core

elements of mobile collaborative practice: both are aspects of potential awareness. Laurier [15] focuses on how mobile work can be discussed as socio-technical accomplishment, where the awareness given through the use of mobiles makes possible the reconfiguring of spaces so that they are made suitable for work activities. Weilenmann's [32] analysis of shared technology led to a conception of awareness of others that focused on the need to negotiate the context or frame within which collaborators act. Most of these studies concern mobile workers who are engaged in collaborative activities which occur in office environments or result in the joint production of documents. Whether working as consultants, sale representatives or engineers, the nature of their work is ingrained with "the office". Sherry & Salvador argue that exploring remoteness from an office or from a home base is a place of richer resources for the researcher [28].

These studies are of mobile devices actually give the people the means to handle collaboration at a distance by transforming shared work into coordinated individual work. They are in consequence less concerned with intense collaboration. However, work even when notionally delegated can often retain a shared character. Belotti [3] showed that office workers frequently engage in a kind of "social browsing", strolling around, chatting, and picking up crucial information that was needed in order to make decisions in their own individually delegated work. Orr [20] and Wiberg [33] similarly address loosely coupled collaboration, where individual workers took steps to jointly establish a support for similar aspects of awareness by establishing conventions for meeting in places such as restaurants and cafés, or local offices. These locations played a crucial role in the workers' *strategies* for establishing social interaction and exchanging experiences and troubleshooting stories.

Pinell & Gutwin have explored mobile collaborative work in a similar context to that which we shall go on to describe [25] [23] [24]. They have focused on the design and development of technological support for the coordination requirements they have identified for loosely coupled groups. They provide a well-founded design framework that capitalizes on the characteristics of multidisciplinary homecare practice in Canada. However, homecare differs in scope and meaning depending on the social system of which it is a part. It even differs between municipalities and districts within the same country. One of the differences between different cases is the degree of coupling between the activities of team members. Pinell & Gutwin's design framework concerns loosely coupled groups beyond the world of homecare work. The activities of the team we report in this paper vary widely in degree of coupling from tight to loose.

Nilsson & Hertzum [19] report their analysis of homecare and mobile collaborative work in terms of coordinating rhythms. They describe how major temporal organization is furnished by individual, collective and social rhythms, which collectively bring about the collaborative flow of activities. The individual worker', collective and social rhythms raise questions of which "drummer" workers should listen to, and to which tempo of reverberations the care receivers should be attuned. The multitude of rhythms is noteworthy, since it is illustrative of the constraints on the time, location and activity of homecare workers the difficulties of articulating work schedules. Their focus on rhythms and tempo aligns well with our concern for the fluidity of practice, which is perhaps the dominant factor, adding the character and variation of the activities during a day of work. When comparing these studies, and while considering the overall trend of ICT-based support for homecare work, it is clear

that there is more work to do in order to understand the nature of collaborative practice in homecare settings.

Paying attention to awareness as it is exposed in mobile work practice has the potential to guide design towards feasible solutions, not only for mobile collaborative systems but also for more general support for collaboration work. There is a particular value in examining settings involving mobile collaborative work practice where information and interactive aspects of the work are distributed in and through a multitude of devices. There is a real need to examine the assumption that it is a simple matter to integrate traditional administrative-oriented use of information technology and the use of mobile technology, where the mobile activities do not primarily concern administration and document management.

2. A socio-technical perspective on the mobile workplace in homecare

2.1. Technical context

The homecare workers in this study had two technologies at their disposal. These were a conventional mobile phone (for use in emergencies) and JoLiv, a purpose-build mobile system. JoLiv, contains two separate modules, a desktop application and an application that runs on PDAs. These applications are interlinked by asynchronous connections through a docking cradle (see Figure 1). Docking allows the information in either of these components to be synchronized. The information held by the system is centrally stored in a remote database that can be accessed by all the local homecare groups in the organization. The concept of the system is quite simple. The main application functions as a diary for the homecare workers. The application is used to manage the administration of care work to be done for the elderly under the responsibility of the homecare organization, and of the care workers themselves.

Figure 1: The morning meeting place (Left). And the JoLiv PDA and desktop (Right): Base setting

The application allows the workers to access information about planned actions and information about those under care, and consequently to see what remains to be done, and which of their colleagues is responsible for certain tasks. In principle, these features can help to inform individual homecare workers about the general scheme or collaborative context within which their own individual tasks are to be carried out.

2.2. Organizational context: Direct and indirect objectives of homecare work

Organizational procedures enforce a fundamental distinction between two aspects of the work place. This is due to the direct and indirect objectives and goals that the practice holds. The indirect objectives concern preparatory activities such as articulating the division of labor, administrative tasks and activities that occur in the homecare office environment. The direct objective in home are work is to tend to the elderly. The duties comprised in this activity are carried out in the homes of the elderly and force the personnel to adjust and acclimatize to new physical conditions for each and every visit. Every location has its specific features. For each and every house call the personnel have to adjust to someone else's organization of things, such as the use of household commodities, including plates and cups, towels, furniture, vacuum cleaners and more, and has to be treated according to and within those restrictions that each and every elderly person imposes on their own environment.

The health condition of the elderly person is another factor that heavily influences actions and the completion of scheduled tasks. The physical or psychological condition of the elderly has a strong bearing on the strategies that each homecare worker devises and adapts before and during a visit. The goal for each visit is to both see that the elderly was going to cope with the situation until the next visit, and at the same time to use the situation as a preparatory stage for the next visit. Of course, there is a difference in level of detail in strategies from person to person, but the key aspect is that these strategies are determined from shared knowledge which is generated through practice and which aims for the best solution for the team to provide the best possible care.

These strategies are often a result of, and an elaboration on, the information given during the morning discussion and coordination activities. Administrative tasks, which keep track of every action and record these for future evaluation, are intended to help meet the indirect objectives of homecare. This work is carried out in a locale that multifunctions as an office, dining room and as a meeting room (see Figure 1). Almost all the social activities carried out during work hours by the whole group take place here. Consequently, it is also the place where all document repositories are kept in a state of continuous maintenance and update. Paper files are created and, depending upon the sensitivity of the information these files contain, they are filed in locked archives or are kept on bookshelves.

2.3. Rationale, structure and system usage

System procurements depend on a rationale for their deployment, which crystallizes the long-term goal of what is to be achieved. This rationale is inscribed on the design of the system, and thus generally prescribes the work to be carried out with it. According to Berg [4], ICT support always embeds an inner logic of the work to be done in a way that strives to guide those that use the system. Agre [1] describes this in terms of a grammar which is related to the activity supported by a specific architecture. JoLiv mobile care™ is a system designed to support a homecare organization as a whole. Thus, the system will give the organization a mechanism for inspection, to attain a "full picture" of what the organization does, what resources are used where and when, to assess the quality of work by a number of formerly unattainable variables, and to employ powerful tools that will assist planning and budgetary work. However, the organization's main concern is to tend to those under its care. The workers need to be

mobile and operate in a vast working area. The resources to be measured are found in the mobile work place, in the homes of the elderly. It is this work that is supposed to supply the system with data through which measures such as planning and budgeting can be made to work.

This general rationale for the system, and the user behavior it promotes, can be formulated as support for documenting the work while the work is being performed. The user can access a computer anytime and anywhere through the utilization of the mobile devices. In relation to the context in which the technological system is used, the rationale of the system prescribes certain ways of involving the technological support in practice. This system implies that work is carried out according to sequences based on the notion of a diary metaphor: one house call at the time, where the following house call adds to the sequence of actions and so forth. In other words, the ICT support formalizes aspects of practice, where the starting and stopping of activities is imposed, and a formalization is attained that loses the fluid character of house calls in general. Recall the importance ascribed to fluidity in office settings by Moran & Anderson [18].

Information about the group and work in general is found not only in the archival form of the repositories; in addition, a vast amount of information is posted on the closet cupboard doors and on different bulletin boards. The work in the homes of the elderly is not possible without the daily meetings. In this situation they have a mutual relationship that continuously evolves and the connection between these mobile and static components of their duties and work are a critical achievement for the workers. We denote these activities as Base activities. The others, discussed as the Case dimension, comprise those activities which are not carried out at a fixed location. There are crucial differences between the continuous change of contexts and situation while on the move and Base work activities carried out in a local office, or "Base". These dimensions have emerged from the longitudinal study of how the mobile support system gradually becomes interwoven with practice. The move from a Base to Case dimension is one which tools utilized in mobile cooperative work needs to address.

Base and Case dimensions are mutually dependent and the connections between them are crucial linkages which need to be acknowledged. However, our knowledge of these connections is under-researched and poorly understood. Ethnographic analysis of the relationships betweens these linkages promise to reveal how and why current designs are exploited to bridge these dimensions of mobile collaborative work.

3. Homecare Work In Practice

Over a period of four years, and with the advent of the JoLiv system, the work practices of homecare workers have been subject to ethnographically informed investigations to understand their functioning and evolution (see Orre [21, 22]). The fieldwork, which commenced during the autumn of 2001, has a translocal connection to related projects and sites that share a similar focus, exploring the utilization of mobile technology in mobile practices (see Hedestig et al [12]). How the research activities have unfolded during these years of prolonged fieldwork is found in the strategies that construct the multi-sited ethnography of Marcus [16]. Similar approaches are discussed in work by Weilenmann [32] and in Harper [10]. First and foremost we have *followed the people* and their situation while working in the sites

outlined below. We have been supported in field activities by using a strategy where we have *followed the object*. The strategy [16] implies that the researcher follows an artifact in and out of the various contexts through which it travels. More specifically, we follow a mobile device, along with other means of supporting cooperative work, through the activities engaged in by mobile workers, as is the case for this study.

Our data collection methods consisted of participant observation, active involvement in work activities, and interviews both with groups and individuals. In addition, we drew upon both official and un-official organizational documents. Most interviews and video recordings were transcribed, and the remainder have been catalogued and cross-referenced with the notes taken during interviews and video sessions. Interview data allows a plausible reconstruction the flow of thoughts and rationale behind observed actions. For this paper, we have constructed three vignettes from our corpus of data. Each vignette represents a realistic account of what actually happens in practice (see Van Maanen [29]).

3.1. Base work vignette

The first vignette embraces the local office – the coordination hub for the homecare workers' activities. It describes the use of some of the artifacts that connect the different places for the primary, secondary and preparatory tasks of the care workers. Several studies, including those by Wiberg [33], Orr [20] and Brown et al [5], have pointed out the importance of place for providing recurrent opportunities for social interaction and the development of a mutual understanding. Every agent has an articulated need to socialize and exchange experience of the past day's work and the day yet to come. For this activity, the place is a big table around which all the homecare workers sit. The table serves many purposes. During the morning meeting, besides the coffee mugs and occasionally sandwiches, homecare workers use the table as a focal point to plan their activities for the day, and to get enough information from colleagues about the elderly they themselves are to visit. It is a multipurpose table and most of the resources found among binders and diaries, and the desktop computer are usually covering most of the space (lower left-hand corner, Figure 1). The large group diary is a particularly important artifact, containing specific case information that carries over from previous home visits. The discussions and the uses of technology are interwoven in a complex web of tools and gestures that often hold parallel threads of topics and concerns. The numbers in the Base vignette are codenames used in this practice to maintain the anonymity of elderly clients, in case aspects of work and house calls are discussed in public spaces in the village.

"…The morning meetings are one of those highlights that Anne looks forward to every morning. When someone asks her the main reasons for her staying and working in the homecare business, even though she often complains about the salary and the irregular working hours, her answer is always the satisfaction of being in contact with the elderly and in the team work with her colleagues. The morning meeting is one of the few opportunities for the whole group to meet before they carry out their daily activities. As she came into the room, she shared a joke with Agneta about their night out the previous week. Yesterday, she promised elderly 516 to book an appointment with the hairdresser. The time was set for Friday 3pm and she sticks the hairdresser's business card with all the necessary information into the diary at the table in the meeting room. -*Now, I will not forget to take her there, I have booked the time for 516 hair on Friday….Carrie- you will work on Friday won't you?* Carrie who was

sitting right beside her replied – *yes I will, was it about 516?...She mentioned something about it earlier this week...no problem..*

The meeting usually takes an hour and during this time they all have time to catch up with most of the important events that unfolded the day before. They also divide the tasks that are to be carried out during the day. Eva and Margret, who worked the evening before had added the note that 576 would need a reevaluation of his service plan since his condition had got much worse the last couple of days. *–Perhaps it is time to get the process started to get him a room at Råbocken*, (one of the old peoples' home in the village) - *if he continues to be this weighty in future...*(Carrie added to the concerns that Eve and Margret were expressing)*...-we cannot have 5 visits a day much longer than for one single person...*

There is also time to go through those records and files that concerned the elderly people who she is about to visit. Usually, it is not necessary to go through those files in detail, since almost all information that would be helpful is discussed during the morning, but one cannot be too sure, better safe than sorry as usual. Fortunately she found out that elderly 413 were staying with relatives during the whole week. *-Someone must have missed writing the note about 413 and the fact that he will be away for the whole week...*she immediately made the correction to the information on the desktop computer

Agneta was very concerned about 534 and the rapid change of her health condition: *-She was not looking well at all yesterday afternoon. Her eyes where blurry and she had fever*. *-We consulted DSK* (the primary care unit), *and they agreed too that we give her the medicine she has been subscribed* (Eve added more information about the case, and continued). *-We have to observe her condition close today. -By the way, who will take her today? – I can do that,* Susan quickly answered, *-I will have to go to 489 anyway, and it is on the same route*. Susan asks if there are anything more that I should consider regarding the visit to 534, Susan added... *– If her condition is worse, just contact DSK*, Agneta added...*-next 587...-who will assist him today..."* (The meeting prolongs through the articulation of work and simultaneous discussion about the care receivers continues).

The Base vignette demonstrates the collective management of parallel information which accompanies a shift change. Similar information is kept in a multitude of locations, which involves a lot of work to maintain attention and consolidate for any set of visits. Most of the situations from late in the previous day that the homecare workers felt to be of sufficient importance are recorded in any of the information tools during the morning meeting. Thus, each assistant contributes information they think relevant to the whole meeting or to specific colleagues. This socially concerted aspect of awareness work involves a number of interesting components.

During the day shifts the workers often choose to take on house calls where the situation of the elderly client suits the skills or interests of a particular worker. These interests do not result in 'cherry picking', or choosing work tasks that would mean an easier case load for the individual worker. The choice criteria can also include for example the fact that a particular worker may have had an argument with one of the elderly clients, or that it has been a long time since an elderly person was handled by the particular worker.

Since responsibility for every elderly person is handed over every morning, each meeting also requires that the handover process is a person-to-person interaction as well as adding all the relevant information to the computerized history of the specific elderly client. These stories or fragments of information are identifiable in the tools, which hold these currents of information in the mobile work place. One such repository is the group diary. It is here that workers can find the information that concerns crucial details, often as a result of encounters that colleagues have had with the elderly during

house calls. It is also a tool which is browsed through several times during a day, even if the person browsing does not add any information to it. The design of the digital diary did not quite fit the custom and practice of the homecare workers, a fact they repeatedly remarked upon during observations and interviews. Although its role is to communicate case-specific information for specific care workers, its circulation also contributes: (i) knowledge of ongoing case history (medium-to-long term), (ii) situational case knowledge (yesterday and today, short-term history) and (iii) colleagues' responsibilities and dispositions for the day. In short, the way it is used fosters a generalized sense of awareness in the work place, both of collaborators' activities and the objects of collaborative work. In order to understand the linkages materialized in the diary, we next turn to the activities of Case practice as they are actually performed outside the walls of the Base.

3.2. Case work vignette

Case work is performed in the homes of the elderly. Most municipal homecare organizations are concerned with Case work while discussing the efficiency and quality of the services they offer. It is especially notable in the argument that high quality care is typically associated with spending as many hours as possible in the homes of the elderly. There are actually incentives that, as a direct consequence, sweep away Base activities, since they are seen to be unproductive. The mobile workplace is a vast geographical area through which the workers move, by bicycle, foot and car, making their way to the homes of the elderly, and traveling back and forth to the Base locale. In all weathers, day and night, homecare workers must get from A to B and know how best to do so, given the opportunities for travel at their disposal. It is also in the Case dimension that we can identify the sources that hold the information carried in the dairy and which are articulated through discussions. The sources for these discussions are found in the case dimension.

Case work usually involves six to ten house calls a day for each and every worker. A number of these house calls involve concerted collaboration in that they require attendance in pairs. The work is physically demanding and is governed by health and safety laws, union agreements and organizational directives. These impose significant coordination demands on the assistants; it is not an easy task to go through a list of given assignments one after the other. While undertaking care of the elderly, mobile technology does not have any particularly important role for the actions. The main objective has the full focus. The situation where the system is used is to sign off a task, or check who will be visited next. We will follow Anne to this morning's first assignment, and perhaps more interestingly, follow and see the links of information which give awareness in the workplace.

> "…Her first task for the day was to tend to 513 and see to that she took her medicine and was up on her feet. Her experience told her that this type of visit would normally take about 15 minutes. Including conversation! However, as usual, things didn't go quite as planned. 513 was in a tricky mood. She was not very keen on taking her pills, even though the doctor had prescribed them, and the task required that Anne saw with her own eyes that 513 really swallowed without keeping the pills in her hand or spitting them out afterwards. But 513 insisted on talking about the construction work by the library, using the time to her advantage. Anne knew the lady was lonely, and for sure wanted more of Anne's attention if possible. The visit had overrun by 10 minutes when Anne made a note in the medicine list posted on the

cupboard door in 513's kitchen before she left. When she got outside, she rang Maria to tell her about the delay, unfortunately without any success. She was supposed to meet Maria for the next visit; the second task for the day was to tend to elder 562.

Actually, "562" meant attending to two people. Anne looked forward to this meeting every day. The lady suffered from dementia and had difficulties with her mobility, and her husband undertook the heavy lifting of her every day, even though he was several years older than her. The task involved helping the lady with washing and dressing. The husband needed to get his frustration off his chest at the same time, blaming him self for not doing enough. This was one of the cleaning days. The regulation implies that Anne does not undertake cleaning tasks or heavy lifting by herself. There are usually two assistants on these tasks and Maria had already started to assist the lady in the bathroom when Anne arrived. The husband opened the door and they talked about what had happened since the last visit. Maria had for certain heard the story when she came, but the bottom line was that the night had been calm without any mishaps. Anne went to the kitchen to fetch a small broom and a dust cloth. While in the kitchen she went through the medicine list posted on the fridge…"

Before each house call, the workers need to (i) to prepare for the situation they might find hiding behind the care receiver's front door. While being delayed from earlier house calls, rushing in to a completely new environment is a usual scenario. The information given through the diary and the day-to-day ongoing discussions is a support in these situations since it often signals when unexpected situations may occur. Such information is also given in everyday stories of a specific house call, or through the diary where the note gives similar advice. Discussion about the specifics of every activity is part of the culture and emphasizes participation in activities which would otherwise be conducted in isolation. The way specific tools are used generates a vital sense of what is going on, helping to attune workers to the circumstances: here the diary, computer, and the continuing discussions play an important role through which information can be shared.

While indoors, the workers need to (ii) adapt to the home of the care receiver, meaning that one needs to learn and be aware of routines and habits that a care receiver appreciates or is accustomed to. When adapting to such circumstances, it is unavoidable that the workers get involved in their care receiver's life. This involvement is also visible in the discussions that the workers have when the orderliness of a care receiver is affected. The care receiver's health might of course be as such that it is difficult to discuss what is appreciated. Here, maintaining or establishing habitual patterns is a factor which helps both the care receiver and the workers. The method is often applied when the care receiver is suffering from dementia, which is a common reason why homecare is involved if the elderly person is able to continue living in his/her home. It also helps the workers to perform as if they were one carer and also ensures that the service plan approved by the assistant officer is carried out. The social dimension of homecare, such as chatting over a cup of coffee, is another important mechanism which allows the worker to uncover health information as part of the awareness process. It is often through such conversations that crucial information emerges which is later reflected in discussions and in the diary.

Most of the care receivers are on medication. It is also an element that connects homecare and primary care. The homecare workers are (iii) delegated to give medicine by injection if necessary, or carry out care procedures delegated by the primary care unit. The intake of prescription medicine is often closely watched. Medication is regarded among care receivers with suspicion, and some house calls only have the role

of regularly watching that subscribed medicine is taken properly. In the majority of the care receivers' homes, one will find an information hub where the information about the medication and the routines are kept. Usually these hubs are kept somewhere in the kitchen area, since the medicine is stored either in cupboard that is not easily accessible or the fridge if it needs to be kept cold. The arrangement also helps family members who share their time helping the care receiver. All intake of medication is carefully recorded in a list. Routinely checking the information hubs and ensuring that the right amount of medication is taken provides information about the health status of the care receiver, and should there be doubts, this is reported and shared amongst the team members.

3.3. Transport, weather, ill health: Contextual factors enforce illicit case coordination

The work involved in keeping up a reasonable level of orderliness is the other side of case work and it concerns efficient articulation and coordination of tasks, transport and time. The only factor among these three that constantly increases is the number of tasks. Transport and time are the crucial and scarce resources. The planned sequence of actions after the morning meetings is rarely valid for more than an hour. Even if most of the house calls on the rounds usually take the time stipulated by the service plan, exceptions affect a whole chain of events. At the same time, there is a general understanding that the worker should stay longer than planned if the health condition of the care receiver demands it. Even if such actions add to the work pile and generate more work in terms of re-coordinating and rescheduling planned sequences of house calls, they are worth the effort since care receivers get the care and attention the team considers appropriate. If any of the transport and supporting activities is delayed it may similarly require the chain of activities to be re-articulated.

The time needed to keep the operations going does vary with the seasons, but during the weeks and months when weather conditions do constrain the options of transport, more effort is consequently required. The geographical area over which the elderly people are distributed does, in most cases, demand the use of cars or other means of transport, e.g. bicycles, on foot, or in private cars. Yet another factor that provides constrains for case work is the teams' shared responsibility of the personal alarm each care receiver has installed in his or her home. These mobiles are, according to organizational policy, not allowed to be used for anything else than answering emergency calls and making calls connected to such circumstances. Three cars are assigned to the homecare work group, and at times when the workload is too heavy, private cars are used as well. The third vignette continues to follow Anne as her day unfolds. Here, Anne is on call for emergency calls and is entitled to use one of the homecare cars available for the team:

> "...The car door closed behind Ulla, who would tend to 456 in the next 30 minutes. - *If everything goes well in the next few hours we should manage to get through the assigned house calls before lunch - if no emergency calls are made, that is,* Anne said out loud in order to get Karin's attention. The beeping noise beside her was Karin looking at, and maneuvering, her handheld computer, to check the assignment list for the whole group. – *We just have too much to do nowadays, how will we manage this with the numbers of staff we have, we should at least be allowed to call in more replacements.* This was one of the heated discussions of the moment. Some of the staff had recently been talking about how much they had to do. They were even forced to use their private cars frequently or they would not have managed to get it

all together. Anne usually took the initiative to be assigned as the person responsible for the alarm phone – a mobile phone through which all emergency calls were to be handled. They arrived at 314 and it was time for Karin to get out. *-Then we meet at 563, in one and a half hours*, she said before she closed the door. What Karin referred to was the cleaning call by 563 which was a call squeezed into the plan this morning. It was impossible to find a time slot the same afternoon when cleaning calls were usually planned. RKF needed a service (the cars the team have at their disposal are referred to by the letters on their license plates). It was Ulla who had noticed that the summer tires were still on. It is a criminal offence to drive in winter conditions with such tires. Anne picked up the emergency phone and dialed the number to one of the repair shops she knew in the village. *–Hello John, do you by any chance have the time for our RKF this week…- Perfect…on Friday you say..Friday it is then…yes, it's the tires, you have them stored have you not?...perfect, see you then…bye.* She hangs up. The car started to gain speed again. Her first duty this morning was to prepare breakfast and coffee for 576, an older lady who had almost lost most of her hearing, but who had amazingly sharp eyes. Just before she pressed the doorbell, the alarm phone rang its hard and sharp signal in her pocket. It was not an emergency call thank God this time, as she checked the phone. If it had been an emergency call, she would have had to call some of her colleagues and say that the missed house call needed to be attended to before 10am. But it was Ulla who called saying that she had finished earlier than planned and wondered if she should sit and wait, or if she should call Birgitta and tell her that she was on her way by foot to assist her with 543 instead, *- you do not need to pick me up as we agreed, I think Birgitta took her own car so we will have to use that until lunch, if she is not there I just walk to 544, see you at lunch…*and she rang off. The breakfast was served 576 at 8.45am sharp, with fifteen minutes left until Karin was supposed to be picked up when the emergency phone rang again*, same, same* Anne said out loud *- it must be the usual toilet visit by 435.* 435 had figured that if she pushes the alarm button rather than wait until the homecare workers arrived, they will show up earlier. 435 was not the only elderly person that used the alarm this way, it was quite common. It usually ended with the assistants turning up earlier, and as always, explaining to the old lady that the button was for her own safety when it really is for real, you know. Anne called Karin that she had to go to 435, and added that there was no reply when she tried to ring her, so she had better go and check it out. *-I will be twenty minutes late at 563, you can start, I will show up in time…"*

The vignette reveals the spatiotemporal coordination complexity of homecare casework as a collaborative activity. In terms of awareness, we notice that mobile phones are used to make colleagues aware of a late arrival or if another route is chosen instead. But this is a different variety of awareness to that discussed earlier. It is rather a just-in-time delivery of awareness information, valid at a specific moment in time and space, and directed towards an immediate and proximal response. Mobile phones are routinely used as an important tool in the mobile workplace, with decisions concerning the moment-to-moment logistics of maintaining the orderliness of the workplace.

Private means are by any argument a feasible solution for any of the parties, even if the workers are compensated when no other solution is there to be found. The obvious need for smoothness in daily operations, keeping up the relative "normality of affairs", constantly invokes an illicit use of the emergency phone which should be a dedicated line. The worker with responsibility for the emergency phone suddenly gets to play the important role of mobile coordination central. This eases the logistics during days when transportation is scarce. Moreover, it also allows a culture of remote coordination through mobile phones to develop, a development not sanctioned by management or policies. The culture of keeping each other aware of how work is progressing and developing is given new means through mobile phones: in this case they form a technological infrastructure which works in parallel with the mobile

support they have at hand. The observation is that the mobile support at hand is seldom used during case work as this system does not align to the activities taking place. Rather, other means offer a more adaptive architecture, providing the means to establish a just-in -time connection to their peers.

4. Discussion

This paper set out to explore the problematics of awareness in distributed groups by examining how homecare workers conduct their affairs in a mobile workplace. We propose a generalized concept of awareness: *information that is acted on by collaborators as knowledge, which is generated, given or accessed, through interaction constituting and contributing to the cooperative accomplishment of an orderly workplace*. We found it most useful to deal with the underlying concept of awareness by exposing patterns of action. Workers obtain and disseminate knowledge about changes in one anothers' whereabouts, the condition of those in their care, the daily schedules around which they coordinate their actions, and so on. We describe this aspect of their joint work as awareness strategies embedded into their collaborative work practice. Awareness is knowledge by another name; knowledge that is infrequently articulated but frequently used to determine an appropriate choice from a repertoire of practical actions. Having a "keen sense" of appropriate action, for us, means having a set of strategies to obtain and maintain a workable set of constraints on action in the face of the frequently ephemeral and transient nature of the constraining forces.

Bearing in mind that usage of technology may be involved already in established awareness strategies, how might one anticipate the value of involving additional or replacement forms technological support? The question is like the chicken and the egg; it is difficult to pinpoint why and when a particular scheme of use emerged.

What we see through our exploration of the mobile work place and workers' awareness strategies is that Base and Casework dimensions are interconnected through tools and repositories. Both can provide and enable awareness to be actively communicated. The examples provided though the case work are the mobile phone and the diary. Tools are chosen and used according to their ability to provide a form of *practical sense of knowing* what is happening in the mobile work place. Returning again to the importance of fluidity, and according to Agre [1], the transformation of institutions is about being less tied to places, with the activities becoming more fluid. This is partly a change brought about by the introduction of new technologies - technologies which have paved the way for flexible work arrangements. Moran & Anderson [18] found that fluidity is an ordinary part of everyday organization in office settings. Here, the idea of fluidity has a depth hitherto unplumbed. The work is fluid because the situation 'on the ground' is always changing. Whereas one might consider fluidity to be a normal perturbation of office procedures, it is almost the reverse in mobile homecare work. Procedure is a normal perturbation of fluidity. The ability to muster a set of tasks into a workable sequence is a practical skill that is used to counter the volatility of the elemental activities to be performed. The degree to which it is possible to do this is not only a matter of resource coordination (material, co-worker, transport) but also of a "keen sense" of the laterality for acting within and beyond the limits set by the organization. So it is also made fluid in a very different way, namely,

by the degree of autonomy for deciding what to do next that has resulted from the 'abuse' of the alarm phone.

Homecare workers continuously strive to learn about each other's activities. It is a proactive articulation behavior of work place activities that the whole team adjusts to. Mark [17] sees such behavior as having a normative effect on work place conventions, proposing awareness as a learning device. It is thus surpasses implementation of awareness features, e.g. setting user modes state in a buddy list. It concerns the activities that trigger the mode setting. The proactive behavior enacted by the homecare worker is also featured in the diary, in different binders, and in computer files. Heath et al [11] identify the potential of awareness to foster learning. Or as we discussed, having or attaining *a practical sense of knowing* generates and capitalizes on the active involvement of workers, contributing to the ongoing discussion and development of the workplace. Heath et al. also discuss the potential for providing the user with automatically revealed awareness information: we could provide the users themselves with tools, allowing people to selectively generate traces of their ongoing activities and actions which are visible to others in different ways. Thus, it is a matter of consenting surveillance. However, as we have seen in the study, the reward given through sharing seems to be supplementary and is contingent on the culture of the team.

The conventions in which the use of such tools are either promoted or rejected seem to be playing a crucial role. This is especially evident when comparing the use situations of different tools. Diaries, computer applications, PDAs and mobile phones can be mapped to particular ideas of conventions of convenience and utility. Within the architecture these tools provide a freedom to act [1] which is negotiated collectively. For our homecare team, these conventions have their roots in efficiently sustaining orderliness and the well being of the elderly. They are in some sense treated as constraints that have an equivalent legitimacy to those imposed by the regulations of their institution. The autonomy enjoyed by homecare workers seems to have contributed to the flouting of a clear organizational directive: not to use the emergency mobile phone for any purpose other than an emergency. Their practice knowledge led to an understanding of the likelihood and nature of any emergency call. They were able to exploit the device by virtue of the position in which it was held in the team structure: central, always on and associated with transport. Furthermore, the fact that multiple devices (private mobile phones) could work with the emergency phone overrode the disincentive of using personal property and incurring personal expense for work. They were only able to do this since a major part of their work relies on a keen understanding of its spatio-temporal nature and, arguably, the "culture of giving" that characterized this group of healthcare workers. Part of their practice knowledge involves recurrence of route traversal, of particular people and their particular environments, and of procedures. The phasic nature of the work integrated with a phasic technology. Such mobile technology as a mobile phone has the flexibility to challenge these conventions; as a case activity tool, it is a technology which easily supports the transitions between Base and Case.

5. Concluding Remarks

A central characteristic in the homecare practice reported in this study is that the workers need to observe and take notice of what is normal, what is not considered to be a normal event, or a development that is heading towards an unwanted situation. The health condition of the care receivers and the service plan are the core markers that need to be in accord. Information is related to exceptions and when a situation goes beyond the service plan. It is common practice to inform the whole group in these cases, to put that piece of information in the diary and to use other tools which connect pieces of information to the discussion. The practice that surrounds such mnemonic tools involves everything that is a noteworthy observation after, before or during a house call and thus gives each and every worker *a practical sense of knowing*. Thus, any information connected to the health and wellbeing status of the care receivers is shared through discussions or stories triggered by what one might find written in these repositories. The information has an effect on the daily or upcoming work schedules and plans, which makes the ability to attune to the ongoing discussion even more important. There is a well-worn distinction between "knowing that", declarative knowledge, and "knowing how", procedural knowledge. Our contention that awareness in all its varieties is a manifestation of a practical sense of knowing, bridges this distinction: at least some articulated knowledge originates from knowing how to function as a member of a collaborative group. The relationship between collaborative practice and procedural knowledge is complex. Certainly, in terms of tool support for mobile collaborative work, it requires further investigation. Agre [1] and Mark [17] have variously argued that practice is tied up with local conventions for work. These conventions mediate between organizational rules ('institutions') and tools and structures ('architectures'). For us, authority and control are critical and inescapable components of the awareness concept. The reality of mobile collaborative work is that conventional structures of organizational control are broken and reformed. Change of this kind brings with it the potential for compensatory surveillance mechanisms to maintain control. Equally, as with this case study, control can be delegated to local groups to bring about a new autonomy.

References

[1]   Agre, P. Changing Places: Context of Awareness in Computing. *Human-Computer Interaction*, *16*. 177-192.
[2]   Bannon, L. and Bødker, S. "Constructing Common Information Space". in *Proceedings of the European Conference on Computer-Supported Cooperative Work ECSCW'97*, 1997.
[3]   Belotti, V. and Bly, S. Walking away from the desktop computer: distributed collaboration and mobility in a product design team. in *Conference on Computer Supported Cooperative Work*, ACM Press, Boston, Mass, 1996, 209-218.
[4]   Berg, M. *Rationalizing Medical Work: Decision-Support Techniques and Medical Practices*. The MIT Press, Cambridge, Massachusetts, London, England, 1997.
[5]   Brown, B., Green, N. and Harper, R. (eds.). *Wireless world: social and interactional implications of wireless technology*. Springer Verlag, 2001.
[6]   Churchill, E.F. and Wakeford, N. Framing Mobile Collaboration and Mobile Technologies. in In Brown, B., Green, N., and Harper, R. ed. *Wireless world: social and interactional implications of wireless technology.*, Springer Verlag, 2001.
[7]   Daly-Jones, O., Monk, A.F. and Watts, L.A. Some advantages of video conferencing over high-quality audio conferencing: fluency and awareness of attentional focus. *International Journal of Human-Computer Studies*, *49* (1). 21 - 59.

[8] Dourish, P. and Bly, S. Portholes: Supporting awareness in a distributed work group. in *Proceedings of ACM CHI'92 Conference on Human Factors in Computing Systems*, 1992, 541-547.

[9] Gutwin, C., Greenberg, S. and Roseman, M., Supporting awareness of others in groupware. in *CHI'96 Conference on Human Factors in Computing Systems*, (Vancouver, Canada, 1996), ACM Press, 205.

[10] Harper, R. The Organisation of Ethnography- *A Discussion of Ethnographic Fieldwork Programs in CSCW. Computer Supported Cooperative Work* (9). 239-264.

[11] Heath, C.C., Marcus Sanchez Svensson, Jon Hindmarsh, Paul Luff, and Dirk Vom Lehn Configuring awareness. *Computer Supported Cooperative Work. The Journal of Collaborative Computing*, *vol.11* (no. 3-4).

[12] Hedestig, U., Kaptelinin, V., & Orre, C. J. Supporting Decentralized Education with Personal Technologies. in *Proceedings of E-LEARN 2002*, Montreal, Canada., 2002.

[13] Ishii, H., Kobayashi, M. and Grudin, J. Integration of Interpersonal Space and Shared Workspace: ClearBoard Design and Experiments. *ACM Transactions on Information Systems*, *11* (4). 349-375.

[14] Ishii, H., Wisneski, C., Brave, S., Dahley, A., Gorbet, M., Ullmer, B. and Yarin, P. ambientROOM: Integrating Ambient Media with Architectural Space. in *Companion Proceedings of ACM CHI98*, ACM Press, New York, 1998, 173-174.

[15] Laurier, E. Work as a Socio-technical Accomplishment. in *In Brown*, B., *Green, N., and Harper, R.* ed. *Wireless world: social and interactional implications of wireless technology.*, Springer Verlag w, 2001.

[16] Marcus, G.E. Ethnography in/of the World System: The emergence of Multi-Sited Ethnography. *Annual Review Of Anthropology*, *Vol 24*. pp. 95-117.

[17] Mark, G. Conventions and commitments in distributed CSCW groups. *The Journal of Collaborative Computing Computer Supported Cooperative Work.*, *vol 11* (no. 3-4).

[18] Moran, P.A., R. J., The Workaday World As a Paradigm for CSCW Design. in *Proceedings of the international conference of computer supported collaborative work, CSCW*, (1990).

[19] Nilsson, M. and Hertzum, M., Negotiated Rythms of Mobile Work: Time, Place and Work Scheduels. in *Proceedings of the 2005 International ACM SIGGROUP Conference on Supporting Group Work (Group 2005)*, (Sanibel Island, FL, US, 2005), ACM Press, New York, pp. 148-157.

[20] Orr, J. *Talking about machines- An Ethnography of a Modern Job*. Cornell University Press. Ithaca. United states of America, 1996.

[21] Orre, C.J. Keeping track of notes- implications of mobile information and communication technology in homecare practice. in Wiberg, M. ed. *The interaction Society: Practice, Theories, and Supportive technologies.*, IDEA-group Inc, 2004.

[22] Orre, C.J. Put Mobile IT into Practice; Make Information Available Across Organizational Boundaries. in *Proceedings of (IRIS 25),The 25th Information Systems Research Seminar in Scandinavia*, Bautahoj, Denmark, 2002.

[23] Pinell, D. and Gutwin, C. *Designing for loose coupling in mobile groups*. ACM Press, New York, NY, Sanibel Island, FL, US. (November 16-20, 2002), 2003.

[24] Pinell, D. and Gutwin, C., A Group Design Framework for Loosely Coupled Workgroups. in *ECSCW 2005: Proceedings of the Ninth European Conference on Compute-Supported Cooperative Work*, (Paris, France, 2005), Springer, 65-82.

[25] Pinell, D. and Gutwin, C. *Supporting colllaboration in multidisiplinary home care teams*. AMIA, Bethesd, M, 617-621, San Antonio, Texas, USA, (November 9-13, 2002), 2002.

[26] Rønby-Pedersen, E. and Sokoler, T. AROMA: abstract representation of presence supporting mutual awareness. in Pemberton, S. ed. *Proceedings of ACM CHI'97 Conference on Human Factors in Computing Systems*, ACM Press, Atlanta, Georgia. USA., 1997, 51 - 58.

[27] Schmidt, K. The problem with Awareness. *Computer Supported Cooperative Work. The Journal of Collaborative Computing*, *Vol. 11* (no. 3-4).

[28] Sherry, J., & Salvador, T. Running and Grimacing: the Struggle for Balance in Mobile Work. in In Brown, B., Green, N., and Harper, R. (Eds) ed. *Wireless world: social and interactional implications of wireless technology.*, Springer Verlag, 2001.

[29] Van Manen, J. *Tales of the field – on writing ethnography*. The University of Chicago Press, US, 1988.

[30] Vertegaal, R., Conversational awareness in multiparty VMC. in *CHI'97 Conference on Human Factors in Computing Systems*, (Atlanta, Georgia, 1997), ACM Press, 6 - 7.

[31] Watts, L.A. and Dubois, E. Managing visibility in ubiquitous multimedia communication environments. in *People and Computers XII, the proceedings of IHM-HCI2001*, New Holland, Amsterdam, 2001.

[32] Weilenmann, A. *Doing Mobility*, Department of Informatics. Gothenburg University, Sweden, 2003.

[33] Wiberg, M. *In between Mobile Meetings: Exploring seamless ongoing interaction support for mobile CSCW*, PhD-thesis, Department of Informatics, Umeå University, Umeå, Sweden, (2001). *Department of Informatics*, Umeå Univeristy, Umeå, 2001.