

**THE MOBILE WORKPLACE -  
COLLABORATION IN A VAST SETTING**

Daniel Normark  
danieln@tii.se

Mobility, The Interactive Institute,  
P.O. Box 24081, SE-104 50 Stockholm, Sweden  
Fax: +46 8 783 24 60  
Mobile: +46 70 248 50 49

and

Dept of Science and Technology Studies, Göteborg University  
P.O. Box 510, SE-405 30 Göteborg, Sweden

Mattias Esbjörnsson  
mattias.esbjornsson@tii.se  
Mobility, The Interactive Institute,  
P.O. Box 24081, SE-104 50 Stockholm, Sweden  
Fax: +46 8 783 24 60  
Mobile: +46 70 316 56 50

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## **ABSTRACT**

This chapter discusses how truly mobile occupational groups relate to locations in a vast working area when collaborating with each other. It brings forth two ethnographic studies on mobile professionals, working on the roads. Their work setting has predominantly been described from a perspective where they are isolated in the drivers-seat. However, seeing that the environment in which they drive through constitutes their workplace, the chapter examines their relation to the surroundings when performing their tasks. The empirical data illustrates the importance of mutual understanding of locations to successfully perform collaborative tasks. For example, coordinates supplied by a GPS-receiver are not sufficient in the performance of their tasks. It is rather the mutual understanding of locations, being in proximity, or other visual clues, which are of importance. The authors argue the need for a detailed understanding regarding the use of locations, to succeed in the development of future mobile position-based services.

## **KEYWORDS**

Ethnographic study, information and communication technologies, mobile technologies, human computer interaction, collaborative technologies.

## **INTRODUCTION**

This chapter focuses on the importance of location in mobile collaborative work. The interest in the topic derives from the rapid technological development in mobile data communication and positioning systems, which facilitates the development of mobile position-based services. The potential to support various mobile occupational groups, as well as supporting leisure activities, emerges. However, current services have not yet reached a major breakthrough on the market.

We argue the need for a detailed understanding of users behavior to succeed in the development of such new services. The purpose of this chapter is to bring forth an ethnographic study on collaboration among mobile workers. We discuss how truly mobile occupational groups, working on the roads, relate to locations in their vast working area when collaborating with each other. Their work setting has predominantly been described from a perspective where they are isolated in the drivers-seat. However, we will examine their relation to the surroundings when performing their tasks.

The occupational groups studied, consist of bus drivers and road inspectors. Both groups constantly move around in a vast area, while performing their tasks. They are not only collaborating with colleagues far remote, but as all other road-users they also adapt their actions to the surrounding traffic. Geographical locations along their routes are important in the interaction between the workers. An understanding of this dependency plays an important role in the design of mobile position-based services supporting collaborative activities.

The chapter is organized as follows. First we consider related research on place and space, mobile work and the physical environment as a resource in mobile collaborative work. We continue by describing our methodological approach, followed by the empirical material, introducing the two occupational groups and presenting excerpts from the fieldwork. Finally we summarize and conclude the chapter.

## **BACKGROUND**

### ***Place and Space in Interactional Work***

Many disciplines, CSCW (Computer Supported Cooperative Work) as one of them, have taken a “spatial turn”, where geographical concepts to understand and describe our social world are

widely used. With no intent to be conclusive we provide a brief background concerning the concepts of space and place by looking at computer-mediated communication (Harrison & Dourish, 1996), organizations (Schultze & Boland, 2000) and technologies (Brown & Perry, 2002).

In a seminal article Harrison and Dourish (1996) argued that spatial models in computing science were preoccupied with properties of three-dimensional structures rather than the “mutually-held, and mutually available cultural understandings about behaviour and action” (p 67). Instead they proposed a shift in focus towards the “invested understandings of place” rather than the structures of space. It was the meanings and the activities of places that should be the inspiration for designing computer mediated platforms for social interaction rather than the evocative objects and the spatially constraining and structuring elements. Thus, they defined space as the spatial structures and place as a space invested with understandings. The challenge in this perspective was to understand places without spaces – i.e. virtual places.<sup>1</sup>

Both Shultze & Boland (2000) and Brown & Perry (2002) provide fairly different definitions of space and place. Shultze and Boland (2000) define space and place as opposite concepts that are “locked into a duality whereby the one meaning constitutes the other” (p 216). Space stands for the possibility to generalise; globalisation; standardisation; social independence; expansiveness; objectivity; flexibility; perfectibility; unrestrained movement; progress; future; continuous change. Whereas place connotes boundedness; tradition; being; restricted movement; limited change; constrained growth; situatedness; subjectivity; presence; physicality; specialist knowledge; stability. However, one aspect of an organization can be both globalized and bounded i.e. that both space and place operate simultaneously. Shultze and Borland explore how technology workers (contractors) struggle with the dualistic tensions between space and place within the organisation. On a day-to-day basis the contractors were continuously negotiating the relationship

between space and place, e.g. their situated involvement in fiddling and fixing the technologies (i.e. place-like practise) was, by documenting the daily activities, reduced into an objective and detached work practice (i.e. space-like practice).

Brown and Perry (2002) tie characteristics of technologies to the discussion of space and place. The usefulness of technologies is not only a usability issue but also a geographical issue (p 252). For them space and place are general concepts that “highlight features of geography and action... To call something a ‘place’ brings attention to its located, embodied, personal human nature. And to call something a ‘space’ is to bring attention to abstract, objective, global, general, inhuman qualities” (p 249). In their article they illustrate how the tension between these features brings out the conflict between local/contingent and abstract/distributed. For example, maps are predominantly space-like (p 250-251). They are representations of a geographical space, formalized and standardized with grids and symbols, easy to understand after learning one map. Maps do also contain many place-like characteristics, such as that they are read in specific places, reveal the history of places and that some places are excluded from the maps. The tension of technologies having both place-like and space-like characteristics helps us exploring its use of them, the representations through the maps helps us find our way by interpreting them to fit with the place where we stand.

In line with Shultze & Borland (2000) and Brown & Perry (2002), we use the tension between space and place to highlight the issues on the use of locations in mobile collaborative work. The representation of the place, the activities associated to the places, the mobility, the use of communication technologies and the vast setting of their work are important when studying the workplace. In the following we will look how place previously been described in mobile work.

### ***Mobile Work***

Despite the geographical distances, mobile work is heavily dependent on fixed locations. Consequently a large body of research on collaborative mobile work explores different notions of geographical dependency (see e.g. Bellotti & Bly, 1996; Luff & Heath, 1998; Wiberg & Ljungberg, 1999; Bardram & Bossen, 2003).

Mobility occurring within a building, a department or a process plant, has in the CSCW literature been termed “local mobility” (Bellotti & Bly, 1996). The resources such as scanners, meeting rooms, colleagues etc, were located within the site, which in turn generated mobility. People moved around, i.e. they were locally mobile, within the building in order to talk to colleagues, or to use shared resources. Bradram and Bossen (2003) studied local mobility at a ward in detail, where they found that mobility itself is work of trying to make *the right configuration* of people, places, resources and knowledge. Places at the ward were often specialized towards specific activities or to provide solitude. There was also a wide selection of medical equipment and -machinery, which was stationary such as X-ray machines or CT scanning devices. In what they then call *mobility work*, the configuration of people, places, resources and knowledge is balanced in sets of contradictory concerns i.e. availability vs. seclusion; mobility vs. localization; orderliness vs. flexibility. Concluding that “[a]ction is intrinsically not only temporal but also spatial” (p 372) they observed that spatial dimension of articulation work has often been overlooked.

Occupational groups working with infrastructure management have a strong geographical dependency, seeing that they need to be at certain places to inspect and repair defective equipment. Recent studies have set out to explore the consequences on organizations of mobile work when the locations where they work are widely distributed. Examples of such studies are the ones on process engineers (Bertelsen & Bødker, 2001) and service technicians (Orr, 1996, Wiberg,

2001). At a glance, the tasks performed by the process engineers (Bertelsen & Bødker, 2001) can be seen as individual, but their actions affect the running of the plant, and therefore also their colleagues. To facilitate their work there is a need to share information, but not in the sense of universal access to everything, everywhere. The information cannot be separated from specific actions, which in turn is tied to specific places. Accordingly Bertelsen and Bødker characterize the environment as a common information space, and highlight the importance of being on location to take the correct actions. The studies describing service technicians (Orr, 1996, Wiberg, 2001) reveal certain similarities with the process engineers. However, a slight difference can be observed by the fact that they have to move in greater distances between the locations where they work.

These studies show both space-like and place-like aspects of mobile work, such as shared information spaces and mobility work. However they are limited to local mobility within buildings, departments and locations within process plants. In the following we will look at work in a road setting, and driving in particular.

### ***Work While Mobile - Driving and working***

Some of the studies of mobile work, introduced above, briefly describe how tasks are carried out while moving (Bardram & Bossen, 2003; Wiberg, 2001). This is a distinguishing feature of work conducted on the roads. In one of Laurier's (2002) studies on mobile workers the workplace consists of a region, accomplished by the movement between the customers and the large business company. This accomplishment is not only conducted during meetings at certain nodes, it is performed while being on the move i.e. they use the time in the car, as they drive to accomplish their work. The car is a modified workplace, i.e. a mobile office.

However, the car is not a workplace where you can engage exclusively in work. You have to actively attend to road-use. Road-use refers to multifarious use of roads, such as driving, cycling, exercising, playing or window-shopping (Juhlin et al, 2000). Thus driving involves many other simultaneous side engagements and practical actions. People work while they drive; they talk in their mobile phones; they fiddle with papers; etc. (Esbjörnsson & Juhlin, 2003). Laurier introduces another study on an occupational group conducting sales related work while driving (2001). He argues that the mobile workers in his study try to make the driving hands-free rather than their use of mobile phones. They benefit from moments of less attention on driving, to perform their office work in the car, i.e. they work while being stuck in traffic jams.

Thus driving is an activity that, like other practical actions, require more than cognition. Subtle negotiations are vital in the activity of using the roads. However sociological studies on auto-mobility tend to leave out the interaction and collaboration *in* road-use and instead study the social and political contingencies *around* road-use. For example when Sheller and Urry (2000) describes the fragmentation and disintegration caused by traffic and how drivers interrupt pedestrian interaction, or when Beckmann (2001) describes driving by referring to Adorno and Horkheimer stating that: “Men travel on rubber in complete isolation from each other” (p 601).


A study, which combines the collaborative act of driving, simultaneously as performing other type of work, is the one on the snow-sweeping group at Arlanda airport (Juhlin & Weilenmann, 2001). The participants interact with each other locally, as well as with a remote control centre. The local interaction concerns the collaboration with snow-sweepers in visual sight of each other. As with the occupations described in this chapter, the snow crew is undertaking a job where they are almost constantly on the move. The work can be termed truly mobile work (Sherry & Salvador, 2001). Movement is the purpose of their work and not only as means to

reach a workplace. The ongoing mobility is visible in how they communicate, the system supporting work, as well as in the rules surrounding their tasks. For them, the positioning of their co-workers is under constant negotiation.

### ***Physical Environment as a Resource in Mobile Collaborative Work***

Among researchers focusing on mobile work, the physical space that one, while mobile, passes through have become somewhat ignored. As when Urry (2000) writes that the road-users are seated in “a place of dwelling that insulates them from the environment that they pass through... The environment beyond the windscreen is an alien other, to be kept at bay”(p 63). This is not the case in the field of architecture and city planning. In writings by e.g. Lynch (1990), Appleyard et al (1964) and Venturi et al (1977), the visual qualities of roads, roadsides and buildings along the roads are taken into serious consideration. By conducting field trials, where the researcher and the subjects walked a pre-defined tour around a block, the conversations and a follow-up interview was recorded and analyzed. Lynch (1990) found that:

“there was apparently a drive to organize the environmental impressions into meaningful patterns... Since the city environment is complex and fluid, this is a difficult operation... Certain elements seem particularly important in furnishing distinctions for area classifications in the city, such as people and activity; land use; and general physical form, spatial form in particular” (p 198-199)

The environment perceived through motion is organized into meaningful patterns that are not only cognitive, but also interactional. ”Cognition is an individual process but its concepts are social ions. We learn to see as we communicate with other people” (Lynch, 1990, p 233). The communication and use of locations, as one pass them, is thus part of the social character of work. Even the conversations on places involve a level of membership analysis (Schegloff, 1972). Thus:

“The diverse ways in which different groups see the same place are important... from similarities in the nature of the social relations within groups which at first glance may seem wildly dissimilar. Similarities of cognition are particularly useful... They are essential if people are to communicate and cooperate with one another” (Lynch 1990, p 236).

In the continuation of the chapter we elaborate on how the mobile workers have a workplace, which is wider than the confinement of the vehicle. Further, we discuss how the roadside beyond the windscreen plays an important part in the interaction between mobile workgroups (Juhlin & Vesterlind, 2001; Esbjörnsson & Juhlin, 2002).

## **METHOD**

Many road users conduct different forms of work as they drive along the roads. This is severely constrained by the activity of being in traffic. As with many other studies “making co-operative work visible” (Crabtree, 2003), we have adopted ethnographic methods to study how mobile-workers “put together” their work and organization. Ethnography was originally developed within the area of anthropology and sociology as a method to gain insight into the cultural practices of societies (Prus, 1996). In addition to interviews, ethnography relies on observations where the researcher follows the work process as it unfolds. The activity of being in traffic poses challenges also for the researcher, when observing collaborative work. For example, the informants move around while being studied. Hence, the ethnographer has to participate in the vehicles. Some of the methodological problems are general for research on mobile activities (see e.g. Weilenman 2003).

We have studied two occupational groups as they travel through their environment, conducting their everyday tasks (Juhlin & Vesterlind, 2001; Esbjörnsson & Juhlin, 2002). In the winter 1999-2000 we followed the bus drivers for three weeks, sitting in the front seat on the right side of the driver. In a similar manner, we participated in the road inspectors’ daily work, during two

weeks, in the summer of 2000. We took extensive field notes, which were transcribed. The transcriptions were analyzed, and a set of themes was identified. A few themes and representative sequences are presented in this chapter.

## **ROAD INSPECTORS**

Road-use relies on passable roads, which is the main responsibility of the road inspectors. They take care of objects and defects that can disturb the traffic. A precondition to be able to stop and repair the defects, is to observe and identify possible defects simultaneously as driving. Consequently, each inspector spends most of his working day alone inside the cabin of the truck (Esbjörnsson & Juhlin, 2002).

The inspector is surrounded with a large palette of equipment inside the cabin of the truck, including an FM-radio; communication radio (UHF); a handheld computer; and a mobile phone equipped with hands-free. The *ProData*-system, consisting of the mobile computer connected to a GPS-receiver, is the main tool for gathering information during inspection. All defects reported are coded and linked to the geographic location. The codes are based on a contract with the orderer, described in a document placed in each vehicle. The log created by *ProData* will then verify that the roads have been properly inspected. Mobile phones are used to inform colleagues about local contingencies and to delegate tasks. It is also necessary to communicate with colleagues to stay updated on the status of the road network and to share joint information regarding their tasks.

### ***Performing Road Inspection in a Vast Working Area***

The inspector patrols the road-network according to a predetermined schedule. The frequency of the inspections on each road type is determined by traffic flow and road size. Main roads in the

region are inspected every other day. Consequently, the minor roads are inspected less frequently. The inspection tours lasts around seven hours and takes the inspector 150 to 250 kilometers.

The following field note illustrates the importance of the physical objects situated along the pre-defined inspection routes.

```
01   When turning into the Vallentuna-exit Jacob discover the loss of one
02   reflection-pole. When in place of the lost pole, we can see it lying in the
03   ditch. He stops the car and starts to look in the list of available defect-
04   codes. He selects a code, and enters a text where he describes the exact
05   position, despite the position given by GPS. He justifies it with the
06   argument that he wants to make it obvious that the pole was placed in the
07   curve of the exit. This is done without leaving the vehicle. He leaves the
08   pole until he comes back to take care of the defect. He memorizes that he
09   has to bring some extra poles, since the top is broken on several others.
10   He does not take notes on this.
```

**Observation 1: A broken reflection pole.**

Implicitly from this field note, and the introduction to the road inspectors, the vast setting of the inspection tours plays an important role in their work. The performance of the working tasks does not only take place inside the cabin of the truck, thus the inspector has to divide his focus between driving and inspecting the environment outside. The inspection-area is vast, containing amounts of objects, which all possibly could cause working tasks. However, as in the case presented above, it is the lack of a physical object (line 1-2) that causes action.

Furthermore, the way he deliberately leaves the broken reflection-pole (line 7-8) as a visual clue, even though he could have loaded it on the truck, indicates the importance of the physical objects. The reflection-pole now fulfills an additional purpose, as a physical object defining the location and the task connected to it. The location is of importance seeing that he has to take care of the identified defect at a later occasion. This example illustrates how the road inspectors associate understandings to locations. The *ProData*-system is supposed to be the main tool when re-

porting and managing identified defects along the roads. Nevertheless it has its shortcomings, it appears not to be strong enough alone to define a location. The inspector specifies the location by a textual geographical description, in addition to the one supplied by the GPS. However, this annotation is done in combination with the left reflection-pole. This could be due to the fact that the reported data is not accessible while being out in the car.

## **PUBLIC TRANSPORT**

The primary task of public transport is to pick up, transport, and drop of passengers. For this distributed and mobile activity, the busses are coordinated to move in a somewhat organized fashion. Bus drivers rely on formal plans to provide the service in a predictable and reliable manner. They have pre-defined routes, available on maps, to follow at given times, available in the timetable. The bus drivers also try to maneuver the busses so that they follow a predictable rhythm on the road. Through several drivers' movement, an intricate network of coordinated public transport is created. However this coordinated network depends on each driver's ability to maneuver according to the pre-described timetable. Inconsistencies can be handled by shifting to active collaboration by using communication support available in the bus (Juhlin & Vesterlind, 2001). This consists of radio communication systems that is provided and monitored by the contractors, however the drivers' private mobile phones are also used for that purpose. Further, the route is ascribed with a number displayed on each vehicle.

### ***Using Bus stops to Coordinate Reinforcement Traffic***

Bus stops along the route play an important role in public transport. These are spatial arrangements (Crabtree, 2000), i.e. the poles or booths are visible and constructed for their visibility but also that they are commonly known for passengers and bus drivers and signalizes a location

where passengers can board or disembark from public transport. As pickup and drop off locations for passengers, bus stops are an important part of the drivers' workplace.

Bus stops are important in the co-ordination between passengers and bus drivers, but they are also a resource when drivers actively coordinate their movements in relation to each other. As in the following excerpt when the bus drivers are involved in reinforcement traffic. Sometimes one bus is not enough when there are too many passengers waiting along the route. By reinforcing a route with an extra bus public transport can temporarily increase the local passenger capacity.

01     **Joseph:** [Passing a bus stop] there is a passenger standing there but I  
02     won't pick him up, a bus behind me will. I will start picking up passengers  
03     at "ICA Långhem". By the way, this is called reinforcement traffic. I'll  
04     drive into the village of Limmared while the other bus drives straight pass  
05     that village. I'll pick up the passengers on road 27 as well.  
06     [Shortly thereafter, as he stops at the bus stop by "ICA Långhem" he says]  
07     **Joseph:** See, here comes the other bus behind us.  
08     [He continues the route in front of the other bus without stopping at any  
09     bus stops even though there are many passengers waiting there. After the  
10     third bus stop from "ICA Långhem" he says]  
11     **Joseph:** I'll pick the passengers going to Limmared that stands on this bus  
12     stop. [The bus driver looks at the waiting passengers while he slows down  
13     the bus. Then he suddenly speeds up again and drives off without stopping.]  
14     **Joseph:** Well, they didn't stand there. There are usually two guys standing  
15     there that go to Limmared. But they weren't here. Of course if someone  
16     doesn't know how we drive then he has to go into Limmared as well or he  
17     might call me up on the com-radio. We have tested our way through in order  
18     to be able to get into Tranemo in time, and I think the way we drive now  
19     works fairly well.  
20     **Researcher:** How have you realized that this way of managing is good?  
21     **Joseph:** We have tried driving in different ways. Once we took every second  
22     bus stop but then we got so delayed with the ordinary bus route and it  
23     didn't work with those that were going to Limmared.

**Observation 2: Reinforced public transport, dividing bus stops and route between two bus drivers.**

This is an example of how bus drivers handle reinforcement traffic where two busses collaborate on the same route. Joseph's first comment (line 1-2) can be understood as a reflection on a formal task plan associated to bus stops i.e. when a passenger stands at a bus stop the bus should stop.<sup>2</sup> Joseph continues by providing an explanation to why he is not stopping to pick up the passenger since he is participating in reinforcement traffic. Reinforcement traffic is defined (line 2-5) as an exception from the rule where two busses share the same route simultaneously. To con-

duct reinforcement traffic within the times of the timetable the drivers divided the bus stops between each other. Joseph says that this division of bus stops was agreed upon after a period of trial and error (line 21-23), the bus drivers tested different ways of reinforcement traffic (e.g. stopping at every other bus stop). Testing different ways of reinforcement traffic shows (line 14-19 & 21-23) that the division of bus stops is not only dependent on picking up passengers, equally important is that bus stops are used for passengers to disembark from public transport. Joseph therefore have to coordinate their division of bus stops to the expected travel plans of their passengers and this is rarely available for the bus drivers in advance. However, in this example Joseph knew the expected travel plans of some of the passengers (line 11-15). The expected travel plan of “the two guys” is part of the division of bus stops that the two bus drivers agreed upon. When the driver can see that the two guys “didn’t stand there” (line 14) he decides to continue driving without stopping at that particular bus stop. The view of the bus stop is thus equally part of how the driver maneuvers his bus, and the absence of the two guys makes him alter the agreement of how reinforcement traffic is performed.

The coordination between the two drivers was smoothly performed without any communication. This could be due to their agreement of how to divide the bus stops between each other, but equally important was what they both could see beyond their windshield. They could follow or alter their division of work depending on what they saw in relation to what they knew about the passengers standing (or not standing) at the bus stop. The bus stops, as places, were an important part of their workplace particularly when collaborating with each other.

## TRAVELING THROUGH: COORDINATING AN ORGANIZATION

The physical environment is part of the mobile workplace, seeing that road inspectors and bus drivers relate to their colleagues by referring to locations along the road. As in the following observation where the researcher is traveling with a bus driver that is supposed to meet another driver at a pre-defined meeting-place.

01       **James** [*Driver in loudspeaker*]: John over?  
02       **John** [*Driver whom researcher travels with*]: Yes John speaking. You were the  
03       one who tried to reach me just a moment ago? Over.  
04       **James**: Yes. I am turning into Lockryd a bit late; we are just passing the  
05       railway in Aplared. Over.  
06       **John**: Good, then I don't need to call and tell that I'm late.  
07       [*After the conversation the driver turns to the researcher.*]  
08       **John**: In these cases, when informing the connection bus, the communication  
09       radio works well.  
10       **Researcher**: He told you where he was, why?  
11       **John**: It's better to say so, that he is passing the railway and then I know  
12       exactly where he is, and then I know how he drives and so forth. It's also  
13       easier for me to know when he is coming.

### **Observation 3: The driver informs about his present location**

First, this illustrates that the bus drivers communicate with each other. James contacts John since he is late to their rendezvous at a designated bus stop. This exemplifies the collaboration and how they communicate to provide a predictable public transport; they repair the delay by informing each other. Second, the conversation shows how the bus drivers talk about time. They refer to the delay by relating to the physical location of the bus that is running late instead of estimating a time when James will be at the meeting bus stop. John describes this way of talking about time as the preferred way (line 11-13). John explains that, when knowing where James is, he can know how James drive and thus, in his mind follow the movement of James (line 11-13), i.e. John visualizes the movement of James bus through the physical environment towards the chosen bus stop. Third, the observation show that there are locations, apart from the bus and the bus stops that the bus drivers incorporate into their collaborative work activities and hence incor-

porate into their workplace. The conversation illustrates how drivers use locations along the route to relate the work that they conduct themselves with the work of the colleagues.

Another example of collaboration with colleagues illustrates the importance of the availability of visual details. This becomes apparent by the differences in recalling distant locations and locations in the proximity.

01 Robert calls Kevin who is sitting in the other road inspectors' truck. He  
02 recalled that he forgot to tell Kevin about the red Ford Orion which is  
03 located along road 76. Robert reported it the last week, so Kevin does not  
04 need to do it once again. Unfortunately Kevin has already done his report  
05 and he has to erase his input in the system. During the conversation Robert  
06 pass *Krukan* (a pottery and a café). The amount of signs along the road is  
07 increasing, and placed in the borderland of what is allowed. Kevin and  
08 Robert agree that the people back at the office have to take a look at  
09 this. Robert takes the chance to tell Kevin about another car along his  
10 section, but he cannot recall the specific location.  
11 Later the same day, Robert fetched newly developed photos. There were  
12 pictures on the Ford Orion, which he called Kevin about earlier today.  
13 Additionally there are some pictures on the other car. He calls Kevin  
14 immediately and tells him where it was.

**Observation 4: Photos of the object in question.**

The observation is initiated with Robert calling his colleague (line 1) to inform about upcoming local contingencies on the inspection route, i.e. an abandoned car. Robert drove the route last week, and took care of reporting the defect. He calls with the purpose of facilitating the work Kevin currently is doing. This illustrates the collaborative aspects of being a road inspector. Despite the fact that they are traveling alone in each truck there are certain tasks that are shared, in this case a road section. During the conversation, the topic changes from the abandoned car, to illegal road signs at a nearby café (line 5-9). The change in topic is presumably influenced by the fact that Robert is passing the café. The environment that passes by is brought into collaborative tasks. The discussion illustrates another aspect of collaboration, i.e. how they share a common understanding on the rules, and whose responsibility it is. However, the excerpt also exemplifies the complexity in recalling remote locations, when discussing the abandoned cars (line 9-10). It

is apparent that the locations are weak despite details about circumstances and the understanding of the location is obvious. Robert remembers the cars, but he cannot define its location. However Robert can recall the location of the other car with the visual aid of the photography and the temporal proximity to the discussion on the location as he fetches the newly developed photos (line 11-14).

### **MOBILE COLLABORATIVE WORK IN A VAST SETTING**

The work performed by bus drivers and road inspectors is conducted in a vast setting. The mobile workers drive their vehicles separated from their colleagues. Similar to Schultze and Borland (2000), Brown and Perry (2002) there is a tension between space-like and place-like features of mobile work, which becomes apparent when collaborating. To accomplish the collaborative tasks, the bus drivers and road inspectors make use of formal resources with space-like characteristics, such as bus stops, timetables, maps, reporting systems, inspection routes, etc. However, to solve their tasks they also refer to locations other than the formal ones. To benefit from this plethora of resources, they ascribe them place-like characteristics, e.g. in the reporting system, the road inspectors specify the locations, as part of their reporting and repairing work. The bus drivers refer to certain locations when coordinating routes with their colleagues.

Driving their vehicles and following their route to inspect is a solitary work. Still the participants actively attend to collaborative activities, e.g. when inspecting the same sections of the road, rendezvous at bus stops so that passengers can shift bus routes, sharing the same route simultaneously or when articulating rules and responsibilities of the organization. In this collaborative work they communicate and relate to each other as members of a social space – a workplace. Unlike the related studies (Bradram & Bossen, 2003; Belotti & Bly, 1996; Bertelsson & Bødker,

2001), the bus drivers and road inspectors move around in a vast setting, without any fixed locations where work is conducted.

As in other studies conducted on people working in their vehicles (Laurier, 2001; Esbjörnsson & Juhlin, 2003), the road inspectors and bus drivers perform their tasks while driving. Often mobile workers do not have to consider the roadside as part of their work since they are only passing through. However, this is different when looking at bus drivers and road inspectors. Here we can see that the physical environment plays an important role in the performance of their occupational tasks. Thereby the bus drivers and road inspectors do not only drive through an environment, they move through their workplace. Juhlin and Weilenmann (2001) found that the view beyond the windscreen was important for the mobile workers when they were in each other's proximity. Similarly we found that the view of the environment supported collaboration even when the distance between the mobile workers varied. The collaborative mobile work is dependent on the use of locations as a resource to coordinate tasks, e.g. it can be used to talk about time (delays in traffic) or they can divide their responsibilities in work by splitting up the locations between them.

The visual overview of the location is important when the mobile workers are close to it. What they see can even change how they choose to work collaboratively. Seeing that the visual overview of the location, and not only tasks associated to the place, is important can explain why distant locations are weak but also why the locations can be "strengthened" by using visual representations such as photos. This illustrates that, like the architects (Appleyard, et al, 1964; Lynch, 1990), we have to take the visual qualities of the roadside into careful consideration when studying mobile work.

Thus, the workplace for the mobile workers is the seat in the vehicle, the garage, roads, crossings, bus stops, beautiful views, industrial zones and passengers – everything that they associate with the activity of corporal mobility as they conduct their work. Places and objects on the road and at the roadside, such as reflection poles and passengers, and objects that the people carry, such as post-it notes and photographs, are resources for the collaborative work between the mobile workers. Taken together, this chapter illustrates how this space is not confined to the vehicle, it is rather the physical environment “beyond the windscreen” that is an integral part of their workplace.

### **DESIGNING MOBILE POSITION-BASED SERVICES**

We find, in line with Brown and Perry (2002) that there is still much to be studied regarding the *geographical* issue of making technology useful. The mobile workers we followed were equipped with several tools ranging from timetables, watches and post-it notes to mobile phones, radio-communication systems and positioning systems. However, the relational aspect of locations and the bridging between general and localized aspects of work was poorly supported despite all tools and timetables. This inhibited the collaboration between the mobile workers. The success of mobile position-based services are not only dependent on the ability to mark locations, but on how people currently use locations as part of their work.

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<sup>1</sup> However this approach (of spaceless places) have become questioned. Miller and Slater (2000) for example take a critical stance against the ways in which Internet (cyberspace or virtuality) have been examined. They mean that one

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has to understand the Internet media as continuous with and embedded in other spaces, that they happen within mundane social structures and relations that they may transform but that they cannot escape into a self-enclosed cyberian apartness (see also Brown and Perry, 2002). Similarly Hine (2000) provides accounts of how space and place are brought in to activities taking place on the Internet, as ways of structuring trust, importance, reliance etc.

<sup>2</sup> Standing at a bus stop does not necessarily mean that the people want to embark onto the bus. A subtle negotiation between passengers and bus driver is needed to handle the understanding of the location and to verify a shared notion of it. As one driver described: “People show their intentions. They walk forward if they want to get on the bus. They get up from the bench. They return into the booth and sit down or turn their backs to the bus if they don’t want to board... They can also wave to show that they don’t want to get on the bus.” Similar negotiation, and uncertainty, occurs when a passenger wants to disembark public transport. The bus stop is also negotiable and passengers and drivers can agree on stopping at other locations than those that are marked.

[DNV1] Ska vi reffa elle definiera vad vi menar med field trials om vi skriver så här?