

THE “MOBILE-WORKPLACE”?

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Abstract

This paper reports the collaborative use, and marking of locations in mobile workgroups, which are dispersed in a vast geographical area. We have performed fieldwork, investigating today’s practice among bus drivers and road inspectors. To organize and conduct their working task there is a need for a shared understanding of their workspace. How the understandings are shared is what we pursue by looking at what sustains the stability of the “mobile-workplace” and the physical environment in which it occurs. The bus drivers and the road inspectors conduct ongoing mobile work in a road setting. It is not a fact of movement between different physical places, seeing that the continuous movement could be understood as the main activity itself. Still the participants actively attend to collaborative activities and relate to each other as members of a social space, a workplace. The movement of the participants illustrates these social similarities and differences, i.e. relations to colleagues, roadsides, road-users, and people far remote. While conducting this ongoing movement, participants continuously relate themselves and others to the physical environment. The “mobile-workplace” is kept stable through local adaptation and shifts of relations, locations and place. Still, the geographical locations and relations play a crucial part in the conceptualization of the social. An understanding of this space can be crucial when designing tools to support collaborative activities.

Keywords: Mobile IT-use, physical environment, empirical fieldwork, mobility, marking, locations

Different views on the mobile-workplace¹

Up to recently, studies in the field of Computer Supported Cooperative Work (CSCW) has mainly focused on centers of coordination, where collaboration is crucial and the updates of current state of work need to be made in real time. However, the success of such studies have heavily relied on well-established

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understandings of the goals and “workings” of the structure of the workplace itself – the social character of work [Hughes et al 1994]. The assignments become even more problematic when work-practice becomes mobile by means of technological development, and a further enhanced work setting. The order of work and work activities no longer can rely solely on the physical limitations of the workplace, or the proximity to colleagues. Work become distributed and conducted through, and during mobility. The possibilities to access colleagues by mobile phones and computer-mediated communication compress geographical distance. This separation in space, and time, is often seen as a complicating factor when performing collaborative tasks.

When technology facilitates an independence of place, it has been argued that work undoubtedly could be performed anytime and anywhere [Kleinrock, 1998]. But still, people have strong reasons for being mobile, such as the need to be at certain places to perform work, the need for specific equipment, etc. [Bellotti & Bly, 1996] [Heath & Luff, 1998] [Wiberg & Ljungberg, 1999]. In application oriented IT-research, there have been several attempts to explain and model this phenomena by focusing on the characteristics of mobility [Kristoffersen & Ljungberg, 2000] [Luff & Heath, 1998]. We argue that these attempts are strongly influenced by the characteristics of stationary work, and consequently do not fulfill their purposes.

Laurier presents another view [Laurier, 2001B] in his study on traveling salespeople. He does not focus on what is happening when they arrive at a place, instead he concentrate on the activities taking place during the movement to the specific place. He argues that the salespeople in his study try to make the driving hands-free rather than their use of mobile phones. They use moments of less concentration focused on driving, to perform their office work in the car, i.e. they work while being stuck in traffic jams (a semi-mobile context).

Other studies of today’s practice among mobile workers show upon those who conduct work while being “even more mobile” (see for example [Juhlin & Vesterlind, 2001], [Juhlin & Weilenmann, 2001] and [Esbjörnsson & Juhlin, 2002]). In all cases the work is conducted while being on the move, and the continuous movement could be understood as the main activity itself. In this paper, we introduce two case studies where the participants perform collaborative work in a truly mobile and vast setting, namely

the roads. Bus-drivers [Juhlin & Vesterlind, 2001] and road inspectors [Esbjörnsson & Juhlin, 2002] have been selected when gathering the empirical data. Even if they work alone in their vehicles, each in a separate geographical area, a high level of collaborative activities takes place to perform their tasks. Beside the situated co-ordination with other road-users these workgroups engage in a simultaneous co-ordination revolving around the collaboration within their own workgroup. When summing up, we discovered several similarities in their use of places and the notion of their “mobile-workplace”.

In order to understand the mobile workplace we start by looking at how the workplace sustains stability, and the environment in which the movement occurs, rather than distinctive features of physical movement. This paper explores the use of locations, in an environment in which one travels through, as a collaborative resource in mobile work. We adopt a spatial description of social similarities that constitute their own and colleagues’ work-tasks, and formal and informal descriptions of relations. We identify how various locations are marked and maintained to strengthen a sense of a shared “mobile workplace” within the group.

Sustaining a stable workplace

We tend to put an effort in maintaining social similarities and differences despite continuous displacement of objects, people and thought. Several resources are used to render a stable work and work organization, i.e. locations, relations, places, mediated communication and even mobility. Particularly the geographical or physical environment has played a crucial role in the conceptualisation of the social, (and ultimately the notion of the workplace,) where the spatial definitions of the social have concurred with its physical representations. With increasing mobility, geographical descriptions no longer sufficiently describe the resources used to maintain social similarities and differences.

Understandings of workplaces are in many occasions similar to the extensive research on place, since place is often used as a resource for establishing and maintaining social similarities and differences. One contemporary definition of place is that it is “a space which is invested with understandings” [Harrison & Dourish, 1996], and that these understandings, or “perceptions of the place” vary with the different groups of people that share these understandings [Lynch 1990]. For example Rofel’s study of a

Chinese workplace reveal how different groups within the staff share different understandings of workplace and organizing structure. They relied on their experience of the place in relation to contemporary Chinese politics to create different notions of their work organization and workplace [1992]. Thus, place plays an important part in creating and maintaining concepts of communities and groups, not only for those settled in their territory [Hasturp & Olwig, 1997, Fortier, 1999]. But it seems that the interrelation between the understanding and its invested space is more problematic. The notion of place is dependent on how we understand what we call “the social”. Previous researches focusing on workplace have been able to regard the physical environment as static or given, in which the shaping of the physical environment in relation to the on-going activities has become transparent. Many workplace studies in the field of CSCW are conducted in places, such as control rooms [Heath & Luff, 1991; Mackay, et al, 1998], even though the technology they use are supposed to bridge the distance between distributed workgroups.

Networks² are another way of describing social similarities and differences in which relations rather, than physical locations, establish stability of a “workplace(s)”. A network is held stable by keeping the relations between objects, humans and activities intact, as in the case of the telecommunication engineers [Wiberg and Ljungberg, 2000]. Moving from one node to another is a way of keeping the relations, thus sustaining the stability of the “workplace(s)”. What Kristoffersen and Ljungberg [2000] describe as a “modality of travelling” is an example of the work necessary to maintain the relations within a network. However, as these studies focus on relations between participants and nodes of places in which they work, researchers tend to regard physical environment that the workers travel through as temporary inconveniences [Kristoffersen & Ljungberg, 2000].

In two articles Mol and Law, [1994; 2001] write about social similarities and differences by finding ways to describe the “shape” of “the social”. They use the mathematical discipline of topology as a metaphor when describing “social spaces”. “Social spaces” that are stable through the use of places and borders are called regional topologies and “social spaces” that rely on relations are referred to as network

² Network is in this paper used as a metaphor for groups of humans expressing social similarities and differences. We do not use it to refer to networks of nodes and connections in a strict technical/object/artefact perspective.

topologies. We do not intend to apply these theories on “social spatiality” since our focus is not the “shape” of “the social”, but rather the ongoing activity of sustaining “the social”. However Mol and Law describe a third “topology of the social” that they call the fluid topology. The description of this “social space” is of interest since the “social space” sustains its stability differently from the regional and network topologies. Mobility and flexibility are resources to maintain stability of social similarities and differences rather than places and relations. A “workgroup/workplace” can be stable by shifting relations rather than fixating them [Law & Mol, 2001]. In the article by de Laet & Mol [2000] they follow the Zimbabwe Bush Pump ‘B’, to find that the object “shows configurational variance” [Law & Mol, 2001:613]. The workings, construction and even the components of the pump vary depending on where it is located. Still, “[t]here is a sameness, a shape of constancy, which does not depend on any particular defining feature or relationship, but rather on the existence of many instances which overlap with one another partially.”[Law & Mol 2001:614] The success of the object or a “workgroup/workplace” lies in its ability to *change and adapt* rather than fixating, to maintain its constancy, “movement rather than stasis is crucial.”[Law & Mol, 2001:615] It is appealing to use these descriptions as examples of social similarities and differences with regard to everyday mobility. But not as a way to describe: “patterns of social interaction... significantly freed from spatial, temporal and contextual constraints” [Kakihara & Sørensen, 2002]. Instead we find that the resource available for maintaining stability of the “mobile-workplace” is to re-territorialize the landscape in which the mobility occurs [Hasturp & Olwig, 1997].

“Traveling-through-Mobility”

Mobility is commonly described as a means for participants to reach co-presence, being linked to human corporeal travel. Besides, as an effort of reaching co-presence of people the expression also refers to the availability of, or access to, objects [Urry, 2000b; Wiberg & Ljungberg, 1999]. Thus being mobile is diminished to something that occurs between the main activities, i.e. meeting people, or actions coupled to physical objects. The mobility is understood as a non-activity. Even though it still is a vital issue in many sociological writings, since it enables many other activities such as co-presence and displacement (spread) of thoughts and ideas [Urry, 2000a]. Kakihara et al [2002] has shed some light on the

understanding of mobility as a concept that relates more broadly to the interaction people perform. In the research area of CSCW a great effort is concentrated on bridging the distance in time and location by the use of information technology – creating a support for distributed work. Recently, systems based on mobile technologies have received a lot of attention in this, and other related research communities. Thus the research on user centered collaborative mobile work is now beginning to arise as an important field in its own right [Luff and Heath, 1998; Bergqvist et al, 1999; Brown et al, 2001]. There are now a growing number of studies of mobility in collaboration that offers observations and findings about the actualities of mobile work. Still, questions at issue have emerged from studies of stationary settings supported with collaborative systems. These settings with predefined places of interaction do also constitute a convenient environment to study. Examples are the tendencies to focus on filling the time-gaps between movements with mobile IT-use, when users have the possibility to focus on something else than motion [Perry et al, 2001].

Studies in auto-mobility (sometimes referred to as the ‘modern mobility paradigm’) tend to leave out the interaction and collaboration that is necessary for the entire road-use complexity to work at all. For example Beckmann when he refers to Adorno and Horkheimer. “Men travel on rubber in complete isolation from each other” [2001:601]. Our objective is to focus on this interaction in road-use. We see road-use in itself as a collaborative activity where the maneuvering of a vehicle is dependent on co-located road-users. It relies on an understanding of the other road-users intentions and upcoming movements, where co-ordination can be established through flashers, horns and the current positions of the vehicles [Juhlin & Sjöberg 1999]. Thus to understand the sociality of road-use one must observe the work in which road-usage is created. Among researchers that focus on mobility it is also common to focus on the environment that the subject takes with them, while ignoring the environment that one, while mobile, passes through. When Urry refers to road-use, he focuses on the environment within the car with its “controls and sources of pleasure”. The road-user is 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”[2000a:63].³ Kristoffersen and Ljungberg [2000] describes the traveling modality as problematic for instance since the setting is unsuitable for traditional human computer interaction.

Laurier [2001] has also performed fieldwork in a road setting, where he discusses an often-noticed feature of mobile phone calls, namely the geographical locating of each other. He has been following people sitting in the passenger seat, and overheard discussions on the mobile phone where at least one part has been on the move. The participants of the conversations have been geographically separated, and the initial question is important to receive contextual information regarding the one on the other side, for example if it is suitable to discuss work related tasks. Brown and O’Hara elaborate further on the contextual adaptation [Brown and O’Hara, 2002]. They discuss the reconfiguring of the “static place in movement” so as to fit the characteristics to be suitable for current work activities. Effort is put on the artifacts and the relationships, which are possible at different locations.

We find, and further elaborate in this paper, that the environment beyond the windscreen still plays an important part in the conceptualization of “the social” [Juhlin and Vesterlind, 2001; Esbjörnsson and Juhlin, 2002]. Such environment is more situational and its shape differs as one travels through it. Mobility becomes the main activity to withhold and create shared understandings within these vast “mobile-workplaces”. In this environment, seen through motion, actions continuously affirm “the social”. But how can we understand this environment, and the patterns as sensed in motion? Remarkably little has been said about the “environment as perceived through motion” even in the research areas that study mobility. Instead we have turned to the theories and methodologies developed within the field of architecture and city planning, namely the writings of Kevin Lynch and his colleagues. Lynch acknowledged that even when mobile “[t]here was a apparently drive to organize the environment 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” [1990:198-199] The environment that is perceived through motion is organized into

³ This paper refers to the environment as the surroundings of activities, a “physical space” outside the windshield. Features of the environment are taken into attention, used and invested with understandings, thus part of what constitutes places and tasks. It consists of trees, forests, and lakes etc. but as we use the word, in this paper we do

meaningful patterns. Through further empirical research he also found that these concepts were “social creations”: “We learn to see as we communicate with other people” [1990:233].

Thus, ethnography and other qualitative methods have to be taken into consideration, even though they were “main target of criticism” over place-focused anthropology [Hasturp & Olwig, 1997]. Therefore to understand the use of the environment that one passes through we adopted a method similar to ethnography but also to the methods that Lynch used [see Appelyard et al., 1964 & Lynch, 1990]. We have followed our informants as they travel through their environment narrowing our focus to two small, intimate social groups as they go about their everyday affairs [Juhlin and Vesterlind, 2001; Esbjörnsson and Juhlin, 2002]. Furthermore our study has not been focused to bring forth an understanding of the positions along the route that are of importance for the area that we studied. Our objective has been to investigate how locality and markings of positions, as defined within groups, can be a collaborative resource. We have studied how the participants of the group communicate and cooperate with one another regarding or through the use of these markings. Thus we hope to enrich the understanding of the mobile “workplace”.

Road inspectors: Marking locations

Road-use relies on passable roads, which is the main responsibility of the road inspectors. Each inspector spends most of his working day alone inside the cabin of the truck. He identifies and deals with objects and defects that could disturb traffic. These tasks are all regulated in a contract with the orderer. An inspection tour lasts around seven hours and takes him 150 to 250 kilometers. 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. Minor roads are inspected with less frequency.

In many cases there is a weak understanding of locations, especially between different work groups. There are elements of interaction with people outside their organization e.g. the police and/or the Traffic Information Central (TIC). When one of the inspectors described his working tasks during an

not refer to environmental change and pollution.

inspection tour, he commented upon the difficulties of driving and simultaneously observing, and identifying, possible defects in the road safety fences. One major problem occurs when the police open up the fence to help animals away from the road. They are supposed to inform the inspectors about their activities, but they seldom do. From the inspectors' point of view, the relation is insufficient. Since the police and the road inspectors do not share a similar understanding of locations situated in their common area of work, the collaboration seems to be lacking. Even though the locations are defined by physical attributes such as broken road safety fences, it is difficult to identify them in the vast working area. The meaning is out of date for the police, as they have accomplished their task when their activity has given a meaning for the road inspectors. A problematic issue when defining locations is when the participants cannot be simultaneously present, and the location do not affect them in the same way. As members of two different workgroups the understanding and importance of the location vary. The mutual understanding of location between the police and the road inspectors is weak, or almost non-existent, even though they have technical equipment in the vehicles to mark up specific locations, and thereby communicating them. The inspector is surrounded with a large palette of technological equipment, including an FM-radio; communication radio (UHF); a Psion handheld computer; and a mobile phone equipped with a hands free speaker. The *ProData*-system, consisting of a mobile computer (Psion Workabout) connected to a GPS-receiver, is the main tool for gathering information during inspection. All defects reported by the inspector are coded and linked to the correct geographic location. The codes are based on a contract with the orderer, and they are 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. In excerpts below, we will see how they create stronger relationships by marking locations and sharing the understanding of them.

Normally the visual indications are of great importance when defining and maintaining a location.

This is illustrated in the following case.

When turning into the Vallentuna-exit Jacob discover the loss of one reflection-pole. When in place of the lost pole, we can see it lying in the

ditch. He stops the car and starts to look in the list of available defect-codes. He selects a code, and enters a text where he describes the exact position, despite the position given by GPS. He justifies it with the argument that he wants to make it obvious that the pole was placed in the curve of the exit. This is done without leaving the vehicle. He leaves the pole until he comes back to take care of the defect. He memorizes that he has to bring some extra poles, since the top is broken on several others. He does not take notes on this.

Excerpt 1: A broken reflection pole.

The *ProData*-system is supposed to be the main tool when reporting and managing identified defects along the roads. Nevertheless it has its shortcomings, it appears not to be strong enough alone to define a location. Some of the reasons derive from the fact that the reported data is not accessible while being out in the car, and the information is not shared among members of the workgroup. The inspector specifies the location by a geographical description, in addition to the one supplied by the GPS. Furthermore, except from only using the system, he deliberately leaves the broken reflection-pole as a visual clue even though he could have loaded it on the truck. 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 in his work while he has to take care of the defect at a later occasion, and by bringing the needed equipment. The example show how the road inspectors associate understandings to locations and link locations to objects, both those in the environment and objects that they take with them.

Public transport: Order and organization

Public transport is an activity where those that carry out the service are highly distributed and mobile. But at the same time it is dependent on predictability and reliability – the organizations has to be held stable. The potential passengers must be able to get access to the vehicles that constitute public transport but also to be informed of the destination for the bus. Timetables, watches and bus stops are important to coordinate the movement of the bus with the anticipated movement of passengers enabling them to participate in public transport. There are bus stops located along the bus-route where passengers are supposed to board or exit the bus. These locations are marked with poles and/or booths. The passenger is expected to wait at the defined place (bus stop), prior to a time noted in the timetable. When the bus-driver passes a bus stop, with a waiting passenger, s/he is obliged to stop, letting the passenger to embark on the public transportation. But 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 location of the bus stop is also negotiable, thus shifting the location to undefined part of the road from the marked location with a booth and a post. Much of the workings of public transport are dependent on the marked locations along the route, but neither the locations nor the relation between them sustains a stable workplace.

The bus-drivers are dependent on well-organized plans and support for co-ordination while the plans also have to be flexible for the changes of their work environment. They have pre-defined routes, available on maps, to follow at given times, available in the timetable. These are important for the co-ordination between passengers and drivers. The route is ascribed with a number that the vehicle can display. But in order to establish a predictable public transport, passengers and drivers have to co-ordinate themselves temporally too. The vehicles have to follow a predictable rhythm on the road. The timetable is equipped with several departure times along the route enabling the driver to adjust their driving. Through several drivers movement on the road an intricate network of coordinated public transport is created. This coordinated network depends on each driver’s ability to maneuver according to the pre-described timetable. To handle inconsistencies communication support is available in the bus.

Routes, bus stops, timetables and watches are used to move in a predictable way. But shared understandings of locations can assist co-ordination within workgroups as well. The understanding of the physical locations, as visual aid, can mediate division of work among the members. Divisions of work that have been agreed upon through continuous work and experience. The following excerpt is from bus-drivers involved with reinforcement busses. Sometimes one bus is not enough to take all the passengers waiting along one bus-route. By reinforcing a particular route with extra buses the management of public transport can temporarily increase the local passenger capacity. As he passes a bus stop he comments:

Bus-driver: [Passing a bus stop] there is a passenger standing there but I won’t pick him up, a bus behind me will. I will start picking up

passengers at "ICA Långhem". By the way, this is called reinforcement traffic. I'll drive into the village of Limmared while the other bus drives straight past that village. I'll pick up the passengers on the 27 as well. [27 is the "name" on the main road in the region]

A little later as he stops at the bus stop by "ICA Långhem" he says:

Bus-driver: See, here comes the other bus behind us.

He continues the route in front of the other bus without stopping at any bus stops even though there are many passengers waiting there. After the third bus stop from "ICA Långhem" he says:

Bus-driver: I'll pick the passengers going to Limmared that stands on this bus stop.

The bus-driver looks at the waiting passengers while he slows down the bus. Then he suddenly speeds up again and drives off without stopping.

Bus-driver: Well, they didn't stand there. There are usually two guys standing there that go to Limmared. But they weren't here. Of course if someone doesn't know how we drive then he has to go into Limmared as well or he might call me up on the com-radio. We have tested our way through in order to be able to get into Tranemo in time, and I think the way we drive now works fairly well.

Researcher: How have you realized that this way of managing is good?

Bus-driver: We have tried driving in different ways. Once we took every second bus stop but then we got so delayed with the ordinary bus-route and it didn't work with those that were going to Limmared.

Excerpt 2: Reinforced public transport, handling and collaborating through shared notion of locations.

The route for the reinforcement bus may differ from the main bus' route, something that needs to be negotiated and agreed upon. The driver in the excerpt explains the division of work between him and the involved busses as he maneuvers through the route – the relationship that has to be held stable between him and his colleagues. The excerpt is an example how shared understanding of passenger's requested destinations and the locations associated to those locations assists the driver's work in dividing the reinforced route. The organization between the drivers' are not created through a sequential pattern, instead it is negotiated through experience. The bus-driver knew the passengers that used to go to Limmared and at what bus stop these passengers used. But he also altered the intended action when he saw that his passengers were not at their bus stop. The location, the understanding of it (i.e. the passengers going to Limmared), and the drivers view over the location (the bus stop) helped him to maneuver his bus in relation to his colleague – thus he altered his relationship to his colleague due to the understanding of the marked location. He also showed that the experience regarding the location could differ depending on the circumstances, by saying that he was going to stop at one particular location but changed his actions when he saw the passengers at the stop. Therefore it is not only the location that is important for the co-ordination; rather the location associated to the experience on passengers travel requests. The driver maintains a stable "mobile workplace" by alternating between the relations to the

passengers travel requests and understandings of the locations – thereby rendering a predictable public transport system.

Locations with a given understanding are useful resources in co-ordination and organizing. It provides a relationship between people and objects that act in public transport. The physical environment organized into meaningful locations, are thus used in shaping “the social”. But the understandings of the location are rather flexible resources than stable and pre-defined. The articulation, flexibility and even weakness of the understandings of location become apparent when observing the interaction within and between workgroups in proximity to a location.

“Mobile-workplace”: traveling through - coordinating an organization

The sense of traveling through the environment is important for the understanding of the “mobile-workplace”. This becomes reasonable when trying to determine the actions among mobile-workers. The conception of other members’ whereabouts is important for the shared sense of social similarity. Locations are tools to relate and to describe relations. As in the following excerpt where the researcher is traveling with a driver that is supposed to meet another driver at a pre-defined meeting-place.

James [*Driver in loudspeaker*]: John over?

John [*Driver whom researcher travels with*]: Yes John speaking. You were the one who tried to reach me just a moment ago? Over.

James: Yes. I am turning into Lockryd a bit late; we are just passing the railway in Aplared. Over.

John: Good, then I don’t need to call and tell that I’m late.

[After the conversation the driver turns to the researcher.]

John: In these cases, when informing the connection bus, the communication radio works well.

Daniel [*Researcher*]: He told you where he was, why?

John: It’s better to say so, that he is passing the railway and then I know exactly where he is, and then I know how he drives and so forth. It’s also easier for me to know when he is coming.

Excerpt 3: The driver informs about his present location

The conversation shows how drivers use locations along the route as tools to relate the work that they conduct themselves with the work of the colleagues. The linked relations rely on mutual understanding of locations. James describes the location where he is rather than estimating time of delay. This enables John imaginatively to follow his colleague’s work i.e. the movement from the described geographical location, towards the location where they are supposed to meet.

Due to the actions of the drivers and the way they talked made us assume that shared understandings of locations are important for the organization and co-ordination, but to confirm our notion we had to assume that they share and negotiate their understandings. Generally, negotiation and sharing on the understandings of locations are difficult for the researcher to identify since these understandings are based on experience and commitment. However, they appear when members disagree. This occurs when members meet, far from the location that is described, such as a conversation at a morning meeting, coffee break or through communication systems. A driver described the content of a conversation on a mobile phone that the researcher overheard: "It was my husband who is also a bus driver. He wanted to know the procedure of the connection between bus route 301 and 302... This morning a driver wanted to do the connection in Lockryd, that's what's written in the manual, but we normally don't do it that way. My husband asked me about my procedure, so that he could do it the same way." The bus-drivers had a conversation regarding a misunderstanding regarding the meaning of location, which occurred earlier during the morning. The driver who called did not participate in the situation when the misunderstanding occurred, but still he participated in an effort of forming a shared sense of understanding the locations. The misunderstanding made the drivers uncertain on their organization of locations. By calling each other they could confirm, or educate, a shared understanding of the location, so that the work could run smooth later on.

For "mobile-work" some information, to carry out their tasks, is only available in the environment. By communication about locations, an awareness of understandings arises. This could improve delegation of tasks between the members if the relations between "mobile-workplace" (with for instance understandings of tasks and responsibilities) and the locations were stable. But instead we found that the ones responsible for repairing locations were unable to delegate surveys of the location to obtain vital information even though colleagues were co-located at these locations. They had to be co-located to create an understanding of the location. This showed how relation varies depending on the proximity between "mobile-workplace" and location. Neither position nor relation is fixed. Moving in the proximity to locations can create collaborative tasks. When using the locations being in proximity, the details are available, which is not the case when being distant. Visual clues available in proximity are lost when

distant from the location. This inhibits the ability to identify, use and negotiate meaningful patterns when located distant from the location in question. An alternative is to bring physical objects that are linked to the location representing its features. As described in a sequence between two road inspectors:

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

Excerpt 4: Photos of the object in question.

This excerpt, exemplify how the environment that passes by is brought in to collaborative tasks as they start to discuss the problems concerning *Krukan*. It also exemplifies how it is difficult to recall remote locations, when discussing the abandoned cars. 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. Showing that the sense of the location (its sensed attributes) is as important for the place as the understanding of the location.

The “mobile-workplace” reconsidered

Workgroups that conduct mobility negotiate and share a common understanding of many locations along the road. Taken together the study indicates the complexity for the inspectors to localize objects of interest, to remember the task/information connected to it and to inform colleagues about these matters. The information gathered, and distributed, is an important aspect of the “mobile workplace”. It is needed when delegating tasks among colleagues, and in a broader sense every road user is dependent on augmentation of the road network. We find that these members are dependent on the use of locations as resource for coordinated mobile work. Further we note that objects in the environment, such as reflection

poles and passengers, and objects that the members carry, such as post-it notes and photographs, aid this shared understanding of the physical environment.⁴

The notion of ‘workplace’ can be used to refer to physical characteristics as well as to tasks and understandings. For traditional work the ‘workplace’ has often been a central symbol in defining and keeping the social similarities and differences stable. But we find that it is difficult to speak of one workplace for road inspectors and bus drivers. One could describe the main office or the garage as their workplace; the workers have their lockers, lunchroom and their maintenance of the bus at the garage. Many tasks and understandings are associated to the physical characteristics of that building, but this is not the place where they conduct the activities they perceive as their main work - the mobility. If we describe the ‘workplace’ as a set of locations, objects and actors linked between each other by stable relations a more expressive description of their work emerge. Then the notion of ‘nodes of workplaces’ can be used to describe the social similarities and differences of their work. However the relations vary continuously as work progresses. The environment between the nodes of locations, e.g. bus stops, where often as important as the locations themselves. The stability and organization of the work depended on a flexible shift between both relations and locations. This led us to perceive the “mobile workplace” that surrounded these mobile workers as flexible, primarily since the motion is more than an issue of moving to a different place of work – it is the work itself.

On the other hand the physical environment was predominantly a part of the space in which they worked. The distance between objects, urban and rural spaces and the need for displacement between these were the motivation for their professions. The pre-described work activities, from identification of defects in road infrastructure, reporting of accidents and other disturbances in traffic to carry through repairs of the identified defects, to collaborations with colleagues and notion of common passengers, bus-stops, busses, crossings, meeting points, collaborative tasks, memories, accidents, etc are what continuously shapes their “mobile workplace”.

⁴ In the project on road inspectors there is an initiative to support the users with a tool, enabling them to bring representations of objects, which are possible to share among colleagues. The actions performed in the proximity of a place will be strengthened, as well as in the case of remoteness to locations. We augment the sense of motion and delegates remembering and sharing of location understanding. The design implications for a new system is introduced in [Esbjörnsson and Juhlin, 2002], which demands less of the user in terms of activities on the spot of the

How then, is a social space-of-work to be maintained without a ‘workplace’? In our fieldwork we found that a shared understanding between colleagues demands extensive mobility. Such mobility can be regarded as movement through placeless environment where the only the immediate environment within the vehicle and the mobile equipment is vital for the notion of the ‘workplace’. This is a common (and perhaps dominating) view of the “mobile” workplace, but this perspective disconnects the driver from her/his surroundings and creates islands of hermits in their private social spaces. We find that this perception ignores the collaborative and coordinating aspects of work, which is the focal point for social similarities and differences at all. By conducting empirical fieldwork on mobile-work, we found that:

- The environment, which the mobile workers pass through, is continuously marked by associating understandings to locations.
- These locations are shared with other members in the workgroup.
- The locations are part of what constitutes stability in the “mobile workplace” – the organization in which the work is conducted.
- The environment aids the “mobile workers” in their effort of understanding where the colleagues are and what they do.
- The relations between locations and those that travel through it vary depending on understandings, time, proximity to the location and availability of objects to associate with the location – it is flexible. It can therefore be difficult to recall tasks that are associated to locations that the mobile worker is distant from.
- The constancy of the “mobile-workplace” is therefore a result of the flexibility rather than its stasis.
- The locations and the recollection of them are strengthened through the use of objects, change of objects and movement of objects.

Thus, the ‘workplace’ for the members is the garage, the bus and roads, crossings, bus stops, beautiful views, industrial zones and passengers – everything that the drivers associate with the activity of corporal mobility as they conduct their work. Thereby the bus-drivers and road inspectors do not only drive through an environment, they move through their organization and upcoming tasks. Such “mobile workplace” is confined not only by its borders, its relations but also by its shifts as the “mobile worker” moves through the physical environment.

incident, or defect, since he is occupied with other activities, such as driving the car.

During our research we found that “mobile-workplaces” consisted of static objects and locations in the environment and mobile objects and environments, all invested with understandings vital for the mobile worker. Thus the worker benefited from the environment that s/he traveled through. Technologies that enable people to mark locations and share understandings of these will open up a new field of support for collaboration. But in order to realize the potential of these technologies we have to assess design theories that acknowledge the habitat of mobility i.e. in the environment that passes by.

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