Extending the modality of travelling

Designing travelling support for mobile IT users

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Abstract

We report from an ethnographical study of mobile service technicians at Telia Nära examining the process of travelling as a mobile activity, for the purpose of designing for new mobile IT use. Taking a point of departure from information appliance *as a vision for designing information technology and* activity theory *as a framework for grasping activities in context elaboration is made upon how to design travelling support for mobile IT users. As a result from the empirical investigation the prototype* PACK-IT! *is developed and then discussed from the perspective of* information appliance. *One problem dealt with concerning the design is that* information appliance *according to Norman is not appropriate when it comes to travelling. However, as shown in the scenario of the travelling support application, we argue that if information appliance is appropriately applied to the mobile context it could function as a good vision of how to use information technology even in mobile contexts.*

Keywords: Activity theory, Information appliance, Modalities, Mobility, Mobile IT use, PACK-IT!

BRT Keywords: AP, BD0103, CA11, DA0303, GA05, HA03

1. Introduction

With the growth of global informational worldwide networks such as the Internet people has become independent of the physical/geographical location of each other and virtual meeting places on the net are evolving rapidly. However, people tend to travel as much as before, or even more. Dahlbom (1999, 1998, 1997, 1996) goes as far as talking about a new society, “the talk society” with people (or networking *nomads*) characterized by their actions (verbs). In this case; *moving* and *talking*[1].

The two trends of globalization and mobile IT use has simultaneously found some ground and mobile IT use has become very popular due to its power of supporting those *nomads* and making people able to work ”anytime, anywhere” (Kleinrock, 1998) independent on physical location. However, much more effort has been paid at research and development of techniques to support globalization (the development of the WWW, browsers, HTML editors, EDI, etc) and mobile applications are still very "stationary biased” (Kristoffersen & Ljungberg, 1998b) in both industrial design (small screens, keyboards, etc.), metaphors (the traditional desktop metaphor) and use (PocketWord, to-do lists, schedulers, PocketExcel, etc) and very little attention has been paid at making technologies that fits the mobile context. Another aspect of current applications for

[1] A similar statement about the development of the network society is made by Castells (1998).

mobile IT use is that they only support the current moment, e.g. a specific place in a specific time (such as the design of the mobile phone).

The empirical case underlying this paper is a clear example of the two trends *globalization* and *mobilization*. By use of mobile technologies (such as mobile phones and laptops) they can perform different, traditionally stationary activities, when being on the move, and by having built up an international radio network they can receive information from the central station thus being online for communication.

However, the technology and its use is not well suited for the mobile use context from traditionally perspectives such as *usability* (i.e. it is hard to operate the laptop while driving the car), *technological suitability* (i.e. the passenger seat is occupied by computers, printers, etc) , nor *ergonomic* (i.e. keyboards, mouse commands, bad screens, sun light and driving is no good combination).

Thus, we argue that there is a need to explore the ways people are mobile, both empirically and theoretically, to come up with new concepts, metaphors and innovative applications to really support the context of mobile work.

As a point of departure the *Activity theory* is used as a framework to capture the context of mobility as a complex structure involving different *goals, activities, actions* and *operations*. Another point of departure is what Norman (1998) terms *information appliance*, i.e. a vision[2] of how technology should be designed to fit into a specific context. A third and final point of departure is taken in Kristoffersen & Ljungberg´s (1998a) categorization of modalities of mobility, e.g. *travelling, wandering* and *visiting*.

1.1 Purpose

The purpose of this paper is to *extend the modality of travelling* with the purpose of designing new mobile IT use. More specific to empirically investigate the *activities, actions* and *operations* of service technicians at *Telia Nära* by use of *activity theory* as a framework for identifying and structuring the findings in a format suitable for designing new mobile IT use.

1.2 Structure

This paper is structured as follows; First of all this paper is put into its proper context by relating it to similar developed applications and research made, such as the developed framework of *modalities of mobility* (Kristoffersen & Ljungberg, 1998a). Then the research method is presented followed by a description of the empirical research site. After that the *activity theory* is presented as a theoretical framework for capturing activities in mobile contexts. From the theoretical investigation the modality of *traveling* is extended from simply addressing travelling as a *verb* (or action) to concern the whole process of travelling including the action-chain of *planning, packing, moving* and *arriving*. Then follows an introduction to the idea of *information appliances* as Norman´s (1998) vision of how IT should be designed to work optimal as "invisible in the use context" (Norman, 1998). Finally PACK-IT! is introduced, described and suggested as a prototype aiming at supporting the activity of travelling. We end up the paper by describing how PACK-IT! could support an extended version of the modality of travelling in a fictive scenario and then closes the paper by discussing PACK-IT! from an

[2] For a discussion of the importance of a vision in design work see Stolterman, 1991 and Löwgren & Stolterman, 1998.

information appliance perspective and present our conclusions.

2. Related Work

This section aims at relating this work to previously work done both concerning developed applications (within research projects as well as commercial ones) for mobile work as well as more theoretical work done. The purpose with the section below is not to capture all of the work that can have bearing for this study. Rather it is to be seen as a context from which we started out this research.

2.1 Frameworks for grasping mobile contexts

To frame the context of mobility there has been some theoretical work done aiming at characterize different modalities of mobility (Kristoffersen & Ljungberg, 1998a) i.e. *visiting, travelling,* and *wandering*. Visiting is working in different places for a coherent but limited period, e.g., maritime consultants engaged in the classification of ships. Travelling is working while travelling in a vehicle, such as an airplane or a train. Wandering is working while being mobile locally, i.e., local, physical mobility of users, e.g., a distributed and mobile team of IT support staff.

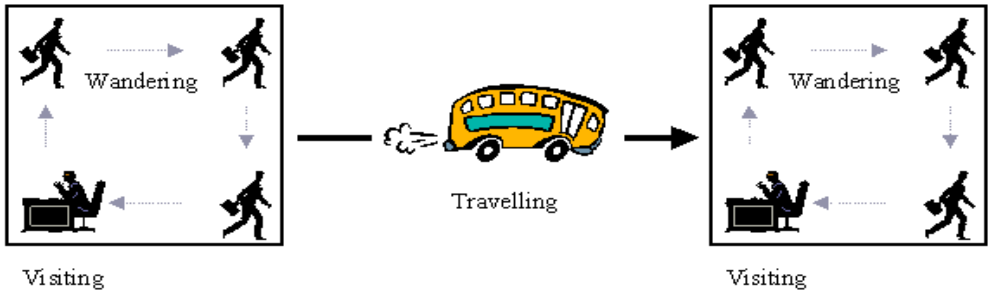


Figure 1: The three different modalities of mobile work (Kristoffersen & Ljungberg, 1998a).

However, the modality of travelling is seen very much as a *state* rather then a *process*. The model describes travelling by use of a Bus-metaphor and a arrow indicating movement. But the arrows is not considered within the model as a process of starting off from some place at some time and arriving at a destination. Rather, the arrow is used to indicate the one mode of being mobile is to travel and that it thus can involve some movement. So, current models built up with the purpose of framing the context of mobility misses some fundamental aspects of mobility by focusing only on the main *activities* when being mobile, such as visiting, traveling and wandering.

Another framework, which is also applied in this study is *activity theory*. Activity theory has been widely used as a framework to inform design work (Nardi, 1996). Nardi (1996) describes activity theory as the richest framework for studies of context, (among frameworks such as distributed cognition and situated action). The main reason for this he claims lies in its strength concerning comprehensiveness and engagement with difficult issues of consciousness, intentionally and history. Activity theory seems to be increasingly applied by CSCW researchers as a theoretical foundation for their research work. The theory has several historical sources, ranging all the way from classical German philosophy to the writings of Marx, as well as the work of Vygotski, Leontev

and Luria in the Soviet Union in the beginning of this century (Kuutti 1994, pp. 51). During the last couple of years the theory has been developed further by, amongst others, Yrjö Engeström and Victor Kaptelinin.

Hutchins (1996) can be seen as the father of an alternative approach to grasp context. An approach focusing on how cognition is distributed between human beings and artifacts, e.g *distributed cognition*. Just as *activity theory* the framework of distributed cognition provides a theoretical and methodological framework for analyzing and explaining a variety of contexts. These include one person interacting with external representations to socially distributed systems at large (e.g. organizations). Distributed cognition also, like the framework of activity theory, provides us with a level of description that can be informative when considering the design and deployment of new co-operative technologies. It also provides a level of description that focuses on the computational and representational properties of artifacts and how they are coordinated in distributed work and, just as activity theory it highlight mechanisms that are crucial to CSCW and also the bottleneck that other methods may overlook. Distributed cognition has been used to identify redundancy and breakdowns in communication for the purpose of informing design of systems to support collaboration and co-operative work.

2.2 Related applications

There has been a few attempts in commercial developed applications which share some aspects with the developed travelling support for mobile IT use as shown in this paper. An example is PowerPoint´s wizard "Preparing for travelling" which is a built-in functionality in PowerPoint helping people to pack their files, links and PowerPoint viewers onto a disk before going on a trip.

The picture shows a screen dump of the wizard "Preparing for travelling" from Microsoft's PowerPoint application.

Another example is "My portfolio" which comes with Windows 95/98. This little feature allows sharing of files between two computers (i.e. a stationary and a portable computer). However, none of these applications concerns mobile IT use[3].

Nokia (www.nokia.se) has also made some effort on supporting the context of mobility. In their latest models (such as the Nokia 6150) there is a built-in support for context switching (the 'Profiles' function). The function can be used to put the phone in different modes appropriate to current context. When put in a specific mode the phone

[3] For a discussion of the difference between mobile and stationary IT use see for example Ljungberg and Kristoffersen (1998b).

alter speaker volume, ring signal, etc according to the predefined settings. However, the application demands for interaction in the situation when context is altered, i.e. the build-in idea is to support the *action* (or verb) of being mobile.

There has also been some research done aiming at designing mobile IT support for people on the move such as the 'NewsPilot' (Dahlberg et. al 1999), the 'Portable Project Database' and the 'Dynamic To-do List' (Bergqvist et. al). However, none of these projects has taken mobility as an *activity* (involving a processes, or chain of actions and operations) into account, rather the focus is on supporting the current moment of interaction, i.e. a specific *time* (the present time) and a specific *space* (the present location where the interaction takes place). Nor is there any discussion relating the design suggestions to the different modalities of mobility.

In this paper this related work is taken as a point of departure for our research focus and design. Below we give a short description of the method used in the empirical study, the research site and how we used the theoretical frameworks to structure our data, analyze it and use it to inform our design of PACK-IT! the travelling support for mobile IT users.

3. Research background and method

This paper reports from a larger project, conducted in co-operation between the departments of Informatics and Social and Economic Geography at Umeå University.

Our primary interest in studying *Telia Nära* was to find out characteristics for mobile decentralized work as it really is “in the wild”. A secondary interest was to analyze this findings to find out the role of ICT (information and communication technologies) and related problems in order to come up with some design implications for how to improve and support mobile work. The study is conducted at a mobile work site by observing the workers activities "in the wild". The idea was to capture as much as possible from the context in this early phase of investigation. Thus, a natural choice of method became the ethnographical approach (Hammersley & Atkinson, 1983)[4]. We have chosen four methods to find out and answer the overall questions made above:

1. *Interviews* were conducted with both service technicians as well as with people responsible for the organization and planning of the work. That was done to capture perspectives of how the mobile work site is organized and how it is perceived by different members of the organization. The interviews was valuable because it made it possible for us to check it we had understood correctly how the work was conducted.
2. *Close observations* of the workers made it possible to capture how they are making themselves through the work, as solving problems, coordinating activities, etc. By doing that we could get the possibility of making detailed analyzes of day-to-day work. The focus here was specially on the use of the ICT (information and communication technologies) both in the service cars as well as at the station where the coordination of the cars and their activities is done. By doing those close observation we gathered data necessary for identifying the main *activities, actions* and *operations* performed in the day-to-day work.
3. *Literature studies* was done to relate the findings to previous work done concerning decentralized work sites and mobile work. The studies also made it possible for us

[4] For a detailed description of ethnography see for example Button and Dourish (1996).

to discuss and determine what aspects of the work to look closer at during the direct observations of the service technicians. Three fundamental aspects concerning this particular paper was found; 1, *Activity theory* as our overall framework for analyzing the context of mobile work, 2, *Information appliance*, as our vision to guide us in the design work, and 3, to what extent there has been work done by use of 1 and 2 when it comes to designing IT for mobile contexts.

4. *Brainstorming and scenario planning* was our last and probably most unusual approach to find out things about the technological requirements of mobile work. By discussing our ideas of what seemed to be problematic in the nature of mobile work context with the persons actually performing the work it made possible to come up with a design suggestions for future design of mobile ICT, i.e. the prototype PACK-IT!.

All four parts of the methodological approach is often used within the field of IS research. Especially in the field of CSCW and mobile computing[5].

4. Research site

The field study was conducted at *Telia Nära* which is part of Telia, the government owned telephone operator in Sweden. Telia Nära is divided into 35 market companies each containing the three divisions; (1), *Service*, including service technicians serving the telephone network (2), *Support*, including a call center and task dispatching unit called "The Station", and (3) *The Store*, where products pertaining to use to Telia's communication system are sold; telephones, faxes, modems, computers, subscriptions, etc.

Our study focuses on the service part of Telia Nära in Umeå, Sweden. The service technicians travel to customers scattered over a vast area (some customers are located more than 300 km from the Station), fixing problems like cable breakdowns, overhearing on the lines, etc.

The service section has recently gone through a reorganization including providing the technicians with advanced computer and telephony technology, and introducing a new economic incentives system. The new ICT makes the technicians completely mobile; any information they need can be accessed from the car. Similarly, anybody who wants to pass information to them, by telephone or computer, can reach them in their cars. There were three main goals of the reorganization; (1) closer customer relations by providing service from a single technician throughout the whole problem solving activity, (2) JIT (just in time) delivery of parts and services, and (3) route minimization by use of mobile ICT.

The ICT at Telia Nära can be divided into three distinct but fully integrated systems:

1. The *car systems* with terminals at all times connected to the Service call center downtown over a radio LAN. The cars have systems to support scheduling of activities, putting work on waiting lists, search the telephone network for errors, getting in contact with the other cars, redirecting missions to free cars if something unexpected occurs, etc. The technicians can, for example, search for errors over the telephone network from the customer's site. The new ICT also makes it possible to plan the route for the day at home and reschedule it during the day. It can also be

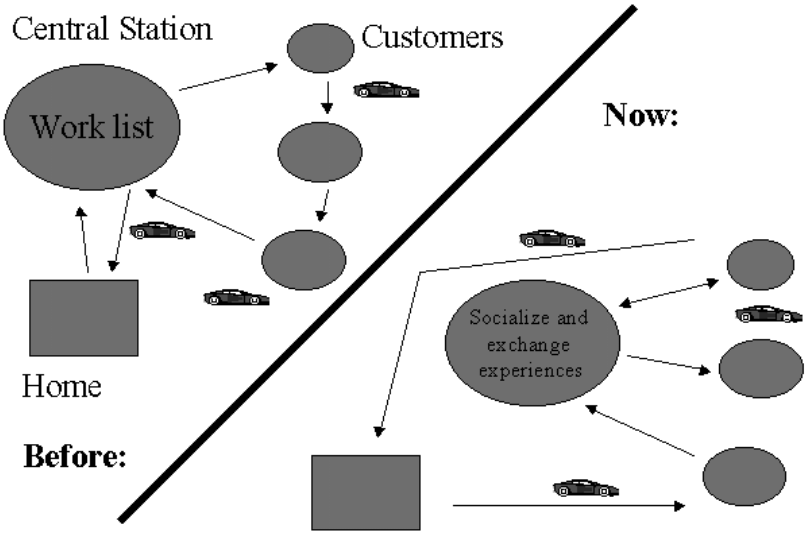
[5] See for example Bellotti and Bly (1996).

used to order parts needed to be changed at the customer's site and plan a route for the day in a optimal manner.

2. The *cellular phones* receiving SMS-messages (short message service) from the Station, telling of breakdowns in the telephone network. The SMS message contains the customer's telephone number, so the technician knows where the customer is located. It also contains information about what kind of problem there is from the description given by the customer. The SMS-system is connected to the mobile car system, so the short description using SMS given over the cellular phones can be further investigated by consulting the car system.
3. The *Station systems* necessary to receive calls from phone customers needing help, scheduling of those, and resource allocation among the cars, i.e. where to send which car.

The pictures show the interior of a service car with the mobile system installed.

Being mobile at work is crucial for the technician's ordinary work, but the new system has increased the ability to work from anywhere so as to reduce the travelling. They can check the work assignments from home in the morning and plan the route for the day, or schedule a whole week. They also receive new assignments, additional information, and changes continuously during the day. So, nowadays (in respect to how work was done before the reorganization) the mobility of the workforce can be viewed as follows:



The figure shows the alter from how work was conducted and organized before into the current work situation.

Before the reorganization the central station played an important role as a coordinator of the workers. It also served as a place where the service technicians got their list of what to do (and where, and in what order) during the day. Nowadays the situation is something altogether different. The central station does not have any organizational, nor coordination role. Rather the role of the central station is to serve as a based for the technicians where they can meet, change experiences and socialize.

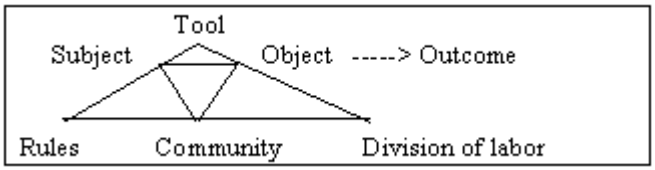
To get into detail and capture the context of what goes on as the service technicians travel allover the figure shown above the activity theory will be used as a framework for structuring our empirical findings.

5. Introducing Activity Theory

Activity theory, as described by Kuutti (Kuutti 1994), is primarily concerned with human activities, such as work. An activity is an action directed towards an object, which is transformed by a subject, i.e., a human actor, using one or several tools, into an outcome. This is assumed to take place in a community, i.e., among subjects sharing the same object. The three parts of an activity, i.e., subject, object and community, which together produce the outcome, are related to each others through so called *mediators* (Kuutti and Arvonen 1992, pp. 235 - 236).

- The relationships between the subject and the object is *mediated* by the tool. For example, the relationship between the crafts person and the artifact she creates is mediated by the hammer.
- The relationships between the subject and the community is *mediated* by rules. For example, the relationship between the individual's efforts in an organization is regulated by institutionalized practice, culture, formal routines, law, and so on.
- The relationships between the object and the community is *mediated* by the division of labor. For example, the relationship between the car produced at Volvo and the work force is mediated by the division of labor, e.g., work groups, roles, and shifts.

The above items, when put together, form the basic structure of an activity (Kuutti 1994, p. 54). This is visualized in the figure below.



The figure shows the basic components of activity theory (Cole & Engeström in Salomon, 1991).

A disadvantage of the framework however is its rather abstract and complex construction. To enrich the theory in a more concrete manner, Kaptelinin & Nardi (1997) have developed *the activity checklist*. The purpose of that development was to provide a concrete framework for evaluation and design of artifacts by starting of from the basic principles of activity theory.

Activity theory takes into account the *social, cultural, historical* and *psychological* aspects of human activities. By doing that, that idea is to give a rich understanding of human beings, their goals and motives, in their natural environment. As described by Kaptelinin & Nardi, two ideas can be said to underlie the whole theory. First

of all;

> "the human mind emerges, exists, and can only be understood within the context of human interaction with the world" and second, "this interaction, that is activity, is socially and culturally determined" (Kaptelinin & Nardi, 1997).

The unit of analysis in activity theory is the *activity*. Kaptelinin & Nardi describe the basic elements to consist of the three fundamental things, (1) a subject, an individual or a group), (2) a motive or an object, and (3) sociocultural rules (Kaptelinin & Nardi, 1997).

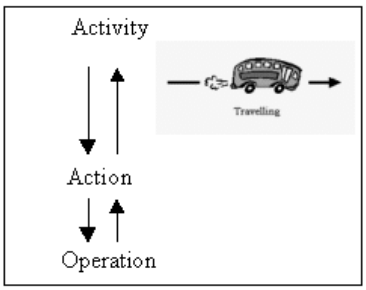
> "In activity theory the unit of analysis is an activity. Leont'ev, one of the chief architects of activity theory, describes an activity as being composed of subject, object, actions, and operations (1974). A subject is a person or a group engaged in an activity. An object (in the sense of "objective") is held by the subject and motivates activity, giving it a specific direction. "Behind the object," he writes, "there always stands a need or a desire, to which [the activity] always answers."."(Kaptelinin & Nardi, 1997).

6. Results: Extending the modality of traveling

Reporting the results from the empirical study we identify four *actions* fundamental to the modality of travelling as it took place in the mobile work setting investigated. These are: *planning, packing, moving* and *arriving*. Below we show how activity theory was applied as a framework for making the identification of the four actions possible.

6.1 Identification of main activity, actions and operations

Considering the modality of travelling at Telia Nära, from the perspective of activity theory, shows that if the main *activity* is *travelling*, and then there are several *actions* possible to identify. In this section a specific part of activity theory will be used to inform on important aspects to consider in the activity of travelling, i.e. activity theory's distinction of *activities, actions* and *operations* as shown in the figure below:



The figure shows the hierarchical levels of an activity complemented with activity in focus for this study, i.e. the modality of *travelling*.

Activities are longer-term formations (processes) and their objects are transformed into outcomes not at ones but through a process that consists of several phases. There is also a need for shorter-term processes. That is activities consisting of actions or chains of actions, which in turn consists of operations forming the levels in the figure above.

Down below an *action-chain* out of the main activity *travelling* is identified together with the next level of the activity, i.e. the *operations*. Travelling can be seen as a process (the main activity) consisting of the *actions*: *planning, packing, moving* and *arriving*. And common *operations* involved are according to that:

Actions	**Operations**
Planning	Make a list, check, sketch, redraw list
Packing	Put things together according to the plan. Make sure that the planed things are packed.
Moving	Use some of the carried information
Arriving	Use the carried information

To make a design suggestion out of this as well suited as possible for the mobile context the concept *information appliance* developed by Norman (1998) will be examined as an idea or vision of how to design optimal information technology.

7. The vision of information appliance

Norman (1998) describes a vision of the ultimate designed information technology. By that he mean technology that disappears in the use context, i.e. the complexity of the appliance is that of the task, not the technology at hand, the technology becomes invisible. A few examples according to Norman is the calculator, the phone and the TV. The vision is called “information appliances”.
Norman defines an *appliance* as:

- A device or instrument designed to perform a specific function, especially an electrical device, such as a toaster, for household use. See synonyms as **tool** (instrument, implement, and utensil).

And an *information appliance* as:

- An appliance specializing in information: knowledge, facts, graphics, images, video, or sound.
- An information appliance is designed to perform a specific activity; such as music, photography, or writing.
- A distinguishing feature of information appliances is the ability to share information among themselves. (Norman, 1998, p. 53).

Norman also presents three design axioms for “information appliance” (Norman, 1998):

- Design Axiom 1: *Simplicity* The complexity of the appliance is that of the task, not the tool. The technology is invisible.
- Design Axiom 2: *Versatility* Appliances are designed to allow and encourage novel, creative interaction.
- Design Axiom 3: *Pleasurability* Products should be pleasurable, fun, enjoyable. A joy to use, a joy to own. (Norman, 1998, p. 67).

The reason behind Norman's idea is that the computer of today is too complex and designed to be able to do all kinds of things, thus not being able to do anything especially well.

However, Norman clarifies that information appliance is maybe not the best way to design information technology when it comes to *travelling* since there is, according to

him, too many tools to bring along during a trip.

8. PACK-IT! Travelling support for mobile IT users

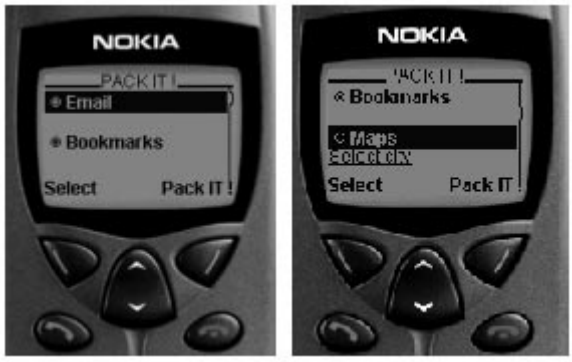
Based on our empirical findings we have designed PACK-IT! to support the extended meaning of the modality of travelling. PACK-IT! is a mobile travelling support implemented through the WAP standard with the aim of being a realization of an *information appliance*. PACK-IT! unify the features of the mobile phone (such as being able to connect to the network from every place within the networks range) and the syncronize features of handheld computers, e.g. the 3com PalmPilots synchronize button.

The simple idea is that PACK-IT! allows the user to prepare things on the stationary computer before leaving for the trip. On the stationary computer the user can use the computers ordinary mail program, browser, scheduler, etc. When the user then runs PACK-IT! the user can choose what information to download into the mobile phone. The nice thing with PACK-IT! then is that the user has the opportunity to prepared some information to bring along in advance but at the same time has the opportunity to complement that information by connecting to the stationary computer using the web.

The WAP (Wireless Application Protocol) standard is a new standard for developing internet based HTML-like applications for mobile equipment. No WAP-phones was available when the prototype was developed so the prototype was only able to test in the development environment from Nokia, i.e. the WAP SDK 1.2 (software development kit) (http://www.nokia.se) together with a JAVA based server running on a stationary computer connected to the internet. The WAP server was implemented by the use of JRE 1.2 (Java Runtime Environment). Although, in the current moment of writing, there has now been some models released on the market (see for example the models developed by Eriksson and Nokia).

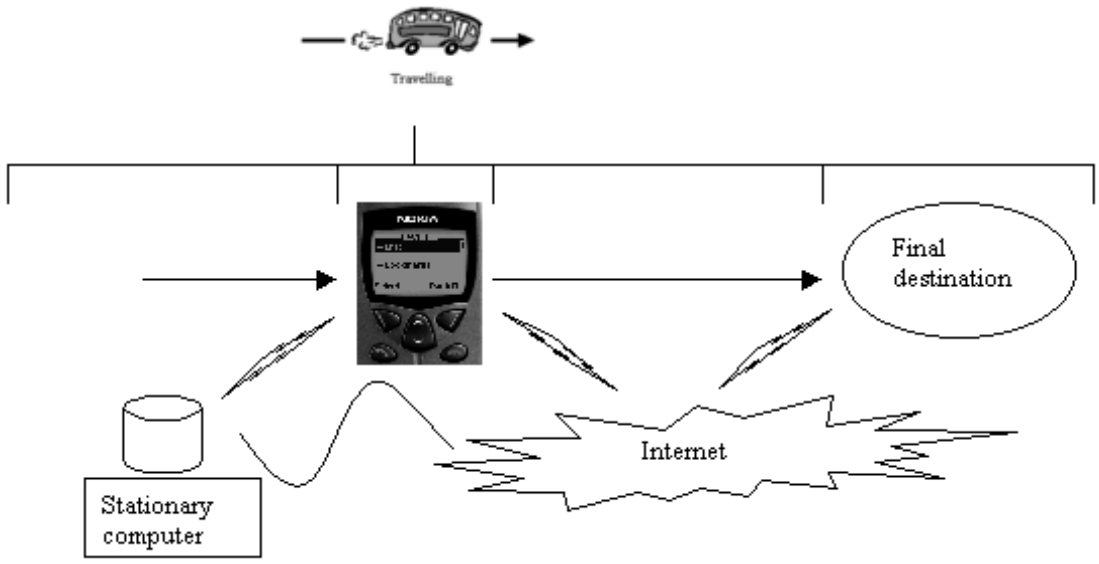
PACK-IT! is an application functioning as traditionally stationary applications (such as PowerPoints function ""Preparing for travelling" with is a function within PowerPoint to prepare the presentation before going on a trip or the built-in suitcase "My portfolio" in Windows 95/98). But PACK-IT! also have similarities with Web-based portals. PACK-IT! can be customized according to the needs of the person who is about to go on a trip. The functionality of PACK-IT! can be described as follows:

- *Bookmarks*: A feature allowing the user to bring along some important bookmarks from a stationary computer (for example in the home). When being able to bring some of that information Internet browsing will become much easier since it makes it possible to plan in advance sites of importance needed during the trip. It also makes it possible to bring along important information from the central system (in the case of the service technicians) or from a company intranet.
- *Email*: This function makes it possible to bring along (and also update during the trip) important information (such as door codes, error estimations, etc. as in the case of the service technicians) to the final destination.
- *To-do list*: A normal to-do list similar to the one developed by 3com (http://www.3com.com).
- *Maps*: Makes it possible to zoom a specific area of a map needed during the travel or when arriving at the final destination (and thus supporting the switch into the modality of *visiting* or *wandering*).
- *Other*: Possible to configure for specific use such as checking news, etc.



The picture shows two screenshots from the PACK-IT! application.

The idea of PACK-IT is to support the whole process of travelling thus concerning; *planning*, i.e. to make some choices of important information to bring along the trip, *packing*, i.e. to confirm a download of the important information to the mobile phone, *moving*, i.e. updating the information during the trip and *arriving*, that is to finally use the brought information. When preparing for a trip PACK-IT! is connected to a stationary PC and loaded with the important information in the *planning* and *packing* phase of the activity *travelling*, thus taking advantage of the features of the desktop system such as its big keyboard and high resolution screen. While being on the move (*moving*) there is possible, under the circumstances that there is possible to have an up and running connection to the mobile phone network, up update and refresh the information brought along the trip. When *arriving* (and thus entering the modality of visiting or wandering) information that has been packed and prepared before and/or collected during the trip can be used. By using this "prominence technology" interruptions or breakdowns can be smoothly avoided by not letting the technology interfere in the context when the information is mostly needed.



The figure shows a technical illustration of the scenario of PACK-IT! in use.

9. Discussion of PACK-IT! from the perspective of Information appliance

In this section the three design axioms (1, simplicity 2, versatility and 3, pleasurability) raised by Norman (1998) is used to discuss the advantages and disadvantages of the prototype PACK-IT! in a scenario of using PACK-IT! when travelling. The section starts with the advantages when switching to discuss some questions raised during the research process.

9.1 Advantages concerning Pack-IT! due to information appliance

According to the design axioms several aspects seams to be possible to live up to. Since the application is quite simple (which is a strong word when it comes to information appliance) PACK-IT! would with quite ease pass the requirement of *simplicity* since there is no need of massive interaction with the appliance, i.e. the mobile phone. The level of interaction needed with the system is somewhere in the middle between a word macro and 3com´s To-do list for their PalmPilot (http://www.3com.com).

The crucial thing of *information appliance*, when it comes to *travelling* as a mobile modality, does not seams to be the load of things to carry around (as Norman, 1998 claims) but rather to be certain about things like:

- Will the technology work during the whole trip or will there be breakdowns?
- Will the information be there when it is needed and in the right format?
- Will there be enough information available to solve the problem without risking information overload, i.e. being *designed* as an information appliance but used as a multifunctional ordinary technology?
- Will the network work?, i.e. is the phone in range and is the network up ´n running?

A common term used to describe this loads of questions is *reliance* (Preece, 1994). When being mobile it is of crucial importance that the user can rely upon the technology. One advantage concerning PACK-IT! is that the application can be tested in advance so the application is not dependent upon the environment no matter malfunctioning networks etc. However, that functionality does not exclude, as mentioned before, the possibility of, when in contact with the network, updating the carried information.

The last criteria of information appliance, i.e *pleasurability* is the hardest one to imagine from a scenario perspective. How can we ever know, if there is any pleasure in using PACK-IT! or any other artifact?, (despite from when it is in use and the user can express his/her feelings about using the appliance). Csíkszentmihalyi (1996) says that pleasure moments, when it occurs in practice, is typically characterized by a challenge, a clear goal and direct feedback and an ability to manage the situation. Those moments is what he describes as *optimal flow:*

> ”Optimal flow results from a fine balance between challenge and ability, leading to a feeling of total harmony and living in the moment” Csíkszentmihalyi (1996).

But, what do we know in this specific case? One thing that we can be sure about is that when we do not have any *flow*, i.e. when nothing works, (especially the technology) and we are approaching a deadline we feel stressed up and in great need of having the appliance ready-at-hand. From our perspective it ones again comes down to

the reliance problem. One of the service technicians at *Telia Nära* expressed the problem of not being able to rely on the technology as follows:

> "Last weekend I was on a trip visiting a few people that I know. Of course, I was out of reach with my mobile phone [the one integrated with the system receiving all SMS-messages] and I had forgot to log it out that Friday [if the technicians forgets about that there is no automatic function turning it off so all messages continues to arrive as it he/she is having the weekend jour] so, when I came back to Umeå that Sunday evening I had 24 unmade works to deal with and... there is no one except myself and the system to blame for all the work that is left for me to do because on one is responsible keeping track of who is at work and who is on vacation..."

The service technician had wrongly relied on the SMS-system, convinced that he was off duty. But, as he got in contact with the mobile phone network again after the trip he realized that the system had expected him to be working the whole weekend and thus directed 24 tasks to him.

9.2 Questions concerning Pack-IT!

PACK-IT! seams to manage quite well from an information appliance perspective of the application in use. However, although there seams to be many advantages of the implementation due to the concept of *information appliance*, at the same time this realization of the idea into a prototype raises many fundamental and thus important questions concerning its underlying assumptions of it use and use context.

To mention two of the major questions raised during the research process:

- On the last IRIS conference (IRIS 21 held in Aarhus, Denmark 1998) there was a workshop focusing on *mobile informatics*[6] as a potential new area for IS research. At the workshop Kristoffersen & Ljungberg´s (1998) model of *modalities of mobility* where presented. The main question during the workshop was to what extent the modalities assume that there is a homebase taken for granted in the model, i.e. "are you only mobile in relation to the ones being stationary"? Designing PACK-IT! raises almost the same question. Since this work builds upon an extended modality (criticized for assuming other people or systems to be stationary) does it runs the same risk itself, i.e. assuming the stationary computer at home or at the office, the "stationary" internet, or the stationary infrastructure of the mobile networks?
- Starting off from Dahlbom´s (1999, 1998) descriptions of the future citizens as *nomads* one can raise the question concerning the second assumption made in this article, i.e. to *go* on a trip. How do we know *when* we are on a trip if we are always "on the move"? and, How can we decide upon where and when this trips start if is a continuos process? Maybe it is possible from the nomad perspective to question the whole modality of travelling?

However, from the perspective and scope of this paper we find those questions to broad, covering something much wider in their assumptions then this paper can handle.

So, while we are still in search for better models, theories and frameworks for capturing and analyzing the context of mobile work, we try to design new artifacts to support and challenge existing models, theories and practice and thus predicting our future by designing it[7].

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[6] For a detailed description of *mobile informatics* as a specific area in need for design oriented research see Dalhbom & Ljungberg, 1999 or Kristoffersen & Ljungberg, 1998b.

[7] For a discussion of design as an artificial science (amongst natural and social sciences) striving for

10. Conclusions

This paper adds to the existing body of both empirical and theoretical work in CSCW and HCI by dealing with a new and emerging kind of work, i.e. mobile collaborative work, as well as bringing *the activity theory* into new domains. Our empirical results provide a ground for further research and the proposed design PACK-IT! can be valuable as an idea of how mobile IT support for collaboration can be extended as a process covering different *actions* during a period of time and over switching contexts/spaces. Thus, the two dimensions *time* and *space*, as a framework for extending the areas of mobile IT use, seams to be of great importance for further research and design. The paper have also shown that designing for *information appliance* can be made possible if based on proper technology appliance according to the main activities, actions and operations in the mobile context.

Finally, this paper has shown that the *modality of travelling* is far from just an *action* (or verb) performed by the technicians at *Telia Nära*, and that a more fruitful way of understanding *travelling* is to, from an activity perspective, extend the main activity of *travelling* into the subordinated actions of; *planning*, *packing*, *moving* and *arriving*.

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creating the future see Simon, H (1969) and, from a design perspective on Informatics as an artificial science see Dalhbom & Ljungberg, 1999.

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