

# Understanding Real World Practices: a Place-Centred Study of Mobile Workers

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## ABSTRACT

This paper discusses a case study reflecting on the importance of designing interfaces for specific interactions within specific situations and locations. The study focuses on sales representatives and their work practices during the transition from a paper based system to an electronic system based on a PDA / Phone. We argue that, in order to design effective mobile technologies, it's necessary to go beyond the basic considerations of functionality and even usability of a system. There is a need to focus on en-placed activities according to the features, possibilities and boundaries that each of their work-places offers them.

## Categories and Subject Descriptors

H.4.0 Information Systems Applications, general. H.5.2 User Interfaces: Theory and methods

## General Terms

Design, Human factors

## Keywords

Nomadic work; mobile computing; en-placed activity.

## 1. INTRODUCTION

This paper briefly presents the findings of a case study featuring the introduction of a hand-held device to support a group of mobile “nomadic” users. The aim of the study was to understand the impact of the technology on workers’ situated practices and activities, and to suggest future solutions for the design of mobile interactive artefacts. Whereas the people we studied conduct their activities through a number of different locations, we look at their practices as situated in place, and therefore shaped by the features, resources and limitations that the physical environment presents to them [2], thus highlighting the limited possibilities of interaction which can be performed within them.

In the paper, we will introduce our case study of sales representatives for a major Irish joinery company. We will present a brief account of our ethnographically-based study of their work practices before and after the introduction of the technology. We will highlight the necessity of evaluating the system beyond standard usability heuristics and guidelines, and show the necessity to examine the interactional boundaries that can come to the fore in certain emplaced activities.

## 2. MOBILITY

### 2.1 Mobile workers and mobile devices

Several studies have been conducted with the aim of evaluating and reflecting upon the introduction of mobile technologies to support work. Different aspects of the impact of mobile technology on work have been examined. For example, Kakiyama and Sorensen [4] argue that to understand fully the impact of newly introduced technology, it is necessary to articulate multiple aspects of the notion of mobility [4].

Brodie and Perry [1] examine mobile workers in multiple locations (for example offices, hotels, trains, etc), and discuss how these environments present their own features in terms of resources and constraints over human interaction, communication and collaboration

In a case study similar to one presented in this paper [5], the authors describe the introduction of an electronic record keeping system in a building site, replacing the paper-based allocation sheet. The new system was intended to be a mobile resource for the foremen to support in-situ discussion with other people. Despite the good intentions of designers, the laptop was used only as a stationary record-keeping device. Although it was found useful by the workers, the notebook did not become a support for the mobile dimension of the work, as intended. The case study we are presenting describes another attempt to replace an extant paper-based system with a computer-based one which had similar outcomes. We aim to highlight the need to fully understand the possibilities, limitations, and scope around that of the; locations that are used as work places, the mobile worker and the tool they use.

### 2.2 The “NomadS” Project

The NomadS project aims at studying the practices of mobile, nomadic workers as they transverse a number of locations and make them into workplaces. We aim at highlighting the constraints that they encounter while doing so, thus investigating how each location supports actions and activities in different ways.

Our work focuses on a particular group: sales representatives for “Irish Joiners”, a manufacturing company operating in Ireland and the UK. The majority of the “reps” work is contacting old and new customers, taking orders, communicating them to headquarters and handling any issues that arise. Their workplaces

include building sites, the car, offices (most of them maintain a home office) and other customer sites.

When the company decided to fund the development of a mobile tool to support the sales representatives, a small group of reps were selected for a trial of the new system. We became involved in the project taking on the role of evaluators of the new system and of advisors regarding its future re-designs and developments.

We wanted to gain a better understanding of their work *in situ* as it stood before any new device was introduced. On this basis, we aimed at comparing the findings arising from the first phase of the study (prior to the introduction of the new handheld device), with those of subsequent studies carried out once the device had been introduced and in use for a period of time. Our aim was to gain a strong knowledge of their activities, their role within the overall practice of the company, how and who they communicated with etc.

### 3. METHODOLOGY

We conducted informal interviews that took place in situ at the reps' workplaces. The relatively small number of participants selected meant that we could explore their activities in rich detail, using in-depth interviews and shadowing techniques [3]. We interviewed and observed six different individuals, with different attitudes, different approaches to the use of technology and different strategies in carrying out their daily activities.

We visited their office at home, we overheard phone conversations with builders, clients and fitters, we asked questions and we encouraged users to speak openly about their thoughts and impressions, we went into their cars observing all the activities during travel time. Finally we went out to the building sites with them, observing how and in which conditions the measuring activities take place. This approach to conducting the study allowed us to see and experience their working lives, their problems and their needs.

### 4. THE STUDY: PHASE 1 - THE PAPER-BASED SYSTEM

In the following sections we provide an overview of the sales representatives' activities through the three main places where they carry out their work: the building site, the car and the home office. We will integrate observations with quotes from the interviews conducted with the reps involved in our study to highlight the main issues related to their workpractices.

#### 4.1 The Building Site

As the measurements of door and window opes are taken on the building site, they generally tend to be written in an untidy manner onto what is called an 'elevation sheet'. Therefore the elevation sheet is only a "shorthand" copy of data which will be subsequently transferred to a Contract Book. The contract books – which are completed subsequently- are filled out in more detail and with more time and effort taken to make them legible adding information such as material, opening type, vent location etc.

From the observational data, it is possible to see that there are some crucial problems with the system used until now by reps. For example the measuring activity relies on artefacts such as the elevation sheet and an electronic measuring tool called the "Digi-Rod". This means that the reps have not only to copy the information twice, from the elevation sheet to the contract book, but that they find it difficult to carry out the measuring in adverse climates where they have to change the tools in hand all the time. This was noted during one of the shadowing exercise gives great detail into the reps activities, and they can then be questioned about their thoughts of being in such situations while experiencing them.

"Measuring is an important part of the job, it takes a lot of time.(...) I'm alone on site I don't have any support, I have the elevation book and a pen in-between my legs and the Digi-Rod in my hands, so I'm measuring and I'm writing and I'm measuring and I'm writing".(Jane, 35)

Jane gives an excellent description of her activities on the building site and of the problems that the current procedure presents. The tools needed to take measurements and their records are bulky and unsuited for a location such a building site.

[The elevation sheet] "is very heavy to carry but I need also to write notes and you need a copy for each builder. I'll take it home and then I'll transfer the information from this to the contract book to get the official copy to fax to the main office. The elevation book can be a little bit messy, because obviously you are outside and it could be raining." (Jane)

The building site is a place where measuring often occurs in bad weather conditions, and the elevation sheet can be easily ruined.

#### 4.1 The Car

Company cars are a very important place of work for Irish Joiners' sales representatives. They are used for the storage of tools, documents, samples and catalogues and for having private phone conversations with customers and the main office. The car becomes a hub for communicating with stakeholders, as well as a safe storage environment and a means of transport.

"Customers ring me all the time. They never ask me 'Are you up on the scaffolding, are you measuring?'. They never say 'Can I talk with you, can you check something for me' But they ask me everything. So at least when I'm in the car, even when I'm driving, I'm looking through this information trying to give an answer. So I just carry everything." (Jane)

Jane's car is very much an "office on the move" for her. She deals with customer queries and sources relevant information in relation to them. The car is also where the reps plan the next phase of their working day while on the move from one building site to another:

Very different practices from those taking place in the building site occur in the car. Phone calls, information retrieval, scanning of appointments diaries are the main activities carried out in the car. There is a vast amount of paper work that the reps carry around with them during the movement, making the process of retrieving their information quite slow.

## 4.2 The Home Office

All the reps involved in our study have a home office where they spend about two days a week (usually Thursdays and Fridays), dealing with paperwork such as filling out the contract sheets with the information from the elevation sheet and plans and, most importantly, transmitting all the week's compiled order forms via fax to the Irish Joiners' headquarters.

"Friday is the day when I sit down in the office filling in the orders. (...) The fax is integral to everything. I need the fax to send my orders and I need the fax to photocopy my standard contracts. You need the fax for everything really. Which means, you can only do that when you are at home" (Pat, 42, 12 years with the company)

The paper based system does not allow reps to fax their orders anytime, anywhere. This activity is limited to one place, the office, and to specific days of the week.

## 4.3 Discussion

The first phase of field work provided us with a detailed understanding of the reps' work practices, the different procedures that they follow, and the locations where their work takes place.

The building site seems to be the location presenting most practical problems for the activities of measuring, dealing with paperwork and conducting conversations (particularly by phone). One of the most striking issues emerging from the data is related to the working conditions that the reps are subjected to. They work on building sites all year around in every condition imaginable. Measuring is not always as straightforward as it may seem either as they may often need to manoeuvre themselves in between scaffolding and all other manner of debris and equipment found around the building site.

Another emerging issue is the reps' frustration and annoyance about the need to constantly re-enter item details from one source to another i.e. from the elevation sheet to the contract book, but also from the repetition of house details from the same building scheme that are entered in week after week for each new order. This is work, which for the most part takes place in their home office which means working there in the evenings or dedicating complete days to the task

"The paper based system seems to annoy and frustrate people all the time, it just seems to be endless; the amount of paper, and the amount of writing very similar information all the time." (Pat)

It is clear from both our observations and the interviewees' comments that the current work practice is in need of modifications, and that a technological aid could be very beneficial in this respect.

In the following section we will discuss the findings of the second phase of the study, focusing on how the reps' work was affected by the introduction of the PDA/phone tool.

## 5. THE STUDY: PHASE 2 – INTRODUCTION OF THE PDA

The main goals for the introduction of the electronic mobile device were to simplify and speed up the reps' activities, remove the repetitive nature of task of transferring information from one form to another, having the ability to fax orders anytime, anywhere and to create clearer orders for those that come in contact with them.

The initial intention for the use of the device was for the reps to carry it to the building site, this was so that the measurements could be recorded electronically during the measuring activity, therefore eliminating the need to transfer the measurements a second time.

With the previously mentioned factors in consideration it was decided to introduce a software system developed for the XDA2 operating on Windows Mobile 2003 for Pocket PC Edition. The system was developed over several months by a third-party company, in close collaboration with one of the reps. The aim of involving an end-user in the design was to organise the software in as simple a way as possible (as the end-users would vary considerably in their technical abilities) to minimise the disruption to their work practice during the transition from the old to the new system for both the reps and the Irish Joiners central office. Therefore the elevation and contract sheets generated from the XDA needed to be identical to those already in use.

We commenced the second phase of our study by conducting a usability study of the new Irish Joiners software using both heuristic evaluation and cooperative evaluation of the software in a laboratory setting, and also conducting observational studies during the reps' training on the software. Apart from a few small usability issues and some information layout problems, the reps all took to the device with great ease. Although with a number of functionality issues brought to the fore and a number of usability issues noted, there was very positive feedback given in relation to the system.

### 5.1 Discussion

In the following 5 to 8 weeks, we had kept in close contact with the developer of the system to be informed as to the extent of use of the new system, as to any problem that were noted during the early stages of use.

Once we began phone interviews at the start of the second phase of the studies, we collected data showing positive feedback regarding the device and the software system.

The possibility of conducting certain activities in a more flexible manner and through more than one location were certainly appreciated by the reps. There are certain types of houses that the measurement for the openings remain constantly the same and for these houses being able to change the number of the house on the electronic device and sending the order immediately is where the system has been of great success.

However, whilst the design of the interactive system was successful at both usability and functionality levels, it also appeared that the use of the device and of the software system was not quite the one that was originally intended, and this became increasingly evident once we observed the reps *in situ*.

Instead of using the device on the building site to record the measurements, they were reverting back to the old process of annotating measurements using the elevation sheet, and later transferring the measurements and details to the new system. When quizzed about their non-use of the XDA on site, they expressed a number of reasons for not doing so.

The environmental conditions and harsh physical conditions experienced on a building site do not lend themselves for the use of a somewhat fragile, small device that was not designed for such setting.

“I’d be nervous enough to about it – I keep it in the car with me. I don’t bring it out on site with me I’d be afraid of it falling out of my pocket, I’d be afraid of my life to damage that thing” (Pat)

The reps are familiar with using a thick hard-wearing book to record measurements, and they hold little value to it even though it is their only record of measurements, placing it between their legs and on cold wet dirty surfaces. They afford it little of the values that they express towards the new electronic device.

Other issues noted are related to the design of the interface, which feature numerous drop-down menus, check boxes and a miniature onscreen keyboard. The interface layout and the effectiveness of interface metaphors such as the tree menu structure were not thoroughly considered to be used within the conditions of the users’ workplaces. There was no consideration given to the fact that the elevation sheets are ruggedised for a specific purpose and is only used as rough work in recording item measurements and that the contract sheet is where the time is given to detailing each item individually. Instead the two were attempted to be incorporated, hence no quick and easy way of entering the measurements into the system without having to either go through numerous steps or entering exact details of each item which is not possible in the given situation.

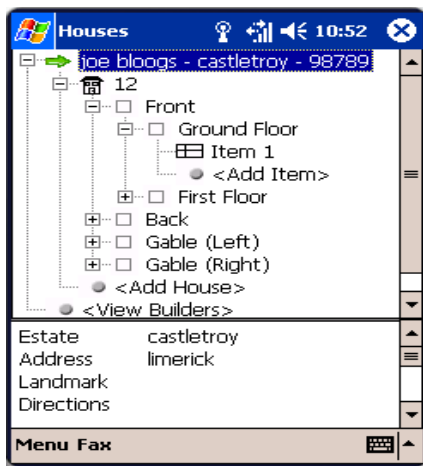


Figure 1. Current interface screenshot

Another reason for the limited use of the XDA is related to its use as a resource in dealing with customer requests:

“I still use my own sheet because it’s a handy record because you have them in the back of the car and if anyone ever rung me and said ‘Pat this window here I’m not quite sure what size you’ve written or what your looking for’, and I can whip it out there and then” (Pat)

While the ability to check sent contracts was something that had been suggested as a useful feature of the XDA, it was not used in such a way. The device does not support this activity very well. This is predominantly due to the fact that the screen size and to some extent the interface of the software limits the amount of information that can be viewed at any one time on the device. While the interface could be designed better the users find the practicality and physicality of flicking through orders useful.

The most relevant issues emerging from the second phase of the study highlight the limits of the new system in supporting the reps’ situated work practices. Whereas the software provides certain benefits to them and certainly reduces the amount of repetition which characterised the paper-based procedure in certain circumstances, the system has not been adopted for use in all the locations transversed by the reps in their job. The situatedness of work practices is something that needs great consideration and deliberation when designing systems that will ultimately be used within them

Due to the constraints of this paper I’m limited to selecting only a number of issues that were observed during our study, which was more in-depth than revealed here. However I hope to present and discuss more of the issues that were noted during the workshop

## 6. CONCLUSIONS AND FUTURE WORK

The study has shown that, the new interactive system is effective in terms of usability and functionality. However its introduction has not been entirely a success, as it has not had the desired effect on supporting their activities due to a lack of consideration of situated and en-placed aspects of activity during its design. The practicalities of users’ working practices and contextual conditions were not taken into account during the design of the system.

While it is something that can often be neglected, it is important to see how users react to certain devices in certain situations, in our case because of the perceived fragility of the device they were unwilling to use in their rugged work on site

Through our studies we hope to have highlighted and stressed the need to fit activities to place, taking into account the qualities and constraints of the environment as they are linked to the person’s practices, tasks and knowledge is of paramount importance

Through our studies we have identified a number of requirements for design leading us onto the redesign of the device for use onsite. As the measuring activity is of high importance we have noted the need for reps to transmit this information from the digi-rod to the final electronic device to be of highest priority. We are currently in the process of developing a Bluetooth enabled digi-rod to allow for the measurements to be transmitted seamlessly from one device to the other. This will complement the redesign

of the interface to support the quick and easy transmission of this data to the appropriate items stored on the device.

Another requirement we are addressing is to change the perception of fragility of the device, with such extras as cases, pouches and rubber sleeves. There is also that matter of colour to be considered, as we have noted there is a number of tough items used on the building sites which have the colour orange which we hope will lend its appropriation to a more ruggedised device

We hope to have emphasised that there should be more focus on stressing the en-placed activities and how to support them within the real-world. I hope to discuss some of the issues that I have noted and expand on them during the workshop, while also getting valuable feedback on them and our concept in relation to similar work carried out by other attendees.

## 7. ACKNOWLEDGMENTS

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