

Designing Technologies for Mobile Communication and Collaboration

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Abstract. This paper explores the applicability and effectiveness of novel design methods to create technologies that support and augment mobile and distributed work. Data collection investigating collaboration and communication 'on the move' was carried out, both remotely and co-located, across a variety of settings. The research findings have fed into the development of prototype mobile technologies to support awareness, communication and collaboration that will be returned 'into the wild' for evaluation.

Introduction

CSCW research has long investigated how to assist human interaction and communication through the use of digital technologies. However, the research carried out (until recently) has focused on resource-rich environments where users have a particular set of resources to support their activities. But mobile work is not like static, office-based work. Instead it has been described as *heterogeneous* [3], in that its context is constantly changing as people interact and re-orient themselves to their environment. Given the physical constraints of mobile devices (weight, screen size, battery consumption, connectivity failure) and the challenging nature of mobile work itself (distributed and dynamic), interaction designers have begun to review their development techniques and methodologies for the next generation of computing devices [4]. The aim of our research is to continue this work to better understand the collaborative and informational requirements of mobile workers, and understand how mobile technology can be effectively designed to support mobility, awareness and collaboration by exploring innovative methods for prototype design.

Research Method and Findings

The preliminary research focused on the underlying patterns of mobile activity of mobile workers. Fieldwork has been used to examine the way mobile workers' collaborate and use space and supporting artefacts. Fifteen users of digital mobile technology were interviewed *in situ*; this was supplemented by ethnographically inspired observations in a variety of on-the-move locations (air and railway settings) to supply additional context - gathering data on constraints and problems that mobile workers experience [2]. The findings were then transformed into implications for design to augment the kinds of working practices observed using methods drawn from Contextual Design: affinity diagramming, artefact models and scenarios [1]. These implications were subsequently developed into prototype technologies that will be iteratively evaluated to see how they support or change patterns of mobile work, and to see how acceptable the designs are to mobile users. The evaluative studies will therefore both motivate future designs and offer an insight into the potential effects that this technology might have on work itself.

The key findings from the research are presented here with their corresponding implications for design. Firstly, we found that mobile workers did not do their jobs in isolation - even if they were often seen to be working on their own while on the move. Instead, mobile workers had to organise and coordinate their work activities around each other - either as part of a community of knowledge or as a community of practice (e.g. electricians had to coordinate their activities with plumbers on a building site). This led to a need for others to know what the mobile workers' schedules were and for the mobile workers in turn to know other people's schedules so activities were carried out effectively. In the fieldwork data this was often resolved by ad hoc agreements being made over the telephone and using paper diaries. While a shared electronic diary would help facilitate the coordination process, the feeling of some of those interviewed was that a full diary would give out too much information to co-workers and bosses as to their work activities. Instead, the design implication that seems best to suit the needs of a dynamic workforce is a dynamic 'to-do-list' schedule that is open for viewing by specified others. Our second key finding was that managing information on the move could often be very challenging for the mobile worker. One of the mobile workers interviewed recalled an occasion where she opted not to answer the phone during her working day and missed around 125 calls [2]. While none of the other people interviewed had as many voice calls to deal with at the same time, often our mobile workers could not just work anytime, anywhere and mobile calls went unanswered for several hours. Thus, when picking up their voicemails, the mobile workers had to deal with a lot of information sequentially, unaware of the importance or trivial nature of each message. This implies allowing mobile workers the opportunity to quickly establish what calls they had received, who they were from, and even possibly a topic 'header' so they can decide to listen or not listen to specific calls

immediately and reply accordingly. Third, mobile workers often work with other members of their community of practice (or community of knowledge) while on the move. However, current digital technology often fails to support the need for constant communication between co-workers who may just be in the next building or room. This points towards a need to fully integrate such 'always on' support into future cellular/wireless technologies in order to facilitate more smooth collaborative mobile activities. While videophones are available, mobile workers are often too busy with their changing environments to look at a phone screen (with its cognitive demands) and utilising voice alone seems a more effective solution

Design Implications and Conclusion

Building on the design implications, we have developed designs for several potential prototypes, focusing on facilitating awareness, opportunistic interaction, communication and mobility. Three of these technologies are being developed for field evaluation. The first of the prototypes is a dynamic, lightweight collaborative to-do-list, utilising location-based information. This offers users the opportunity to allow their colleagues to know their work activities, provide real-time information on schedule changes, and reorganise their own work around each other. The program has limited read/write capacity for colleagues. The second prototype technology is an 'awareness' tool that allows mobile workers the opportunity to have additional text notification of their mobile phone voicemails, via their phone. This will allow organisation of the *order* that users can listen to the calls and provides a permanent archive of all voice calls. The third technology is an 'always on' radio-awareness device utilizing IP addresses to allow communities of practice (e.g. builders on a building site) the opportunity to remain aware of each others activities while mobile. Evaluation is yet to be carried out on our prototypes, but will focus on how mobile workers can integrate these new technologies into their work practices and establish how appropriate the technology is to their needs. This will provide a fuller understanding of mobile work in terms of the appropriateness of the information representation used in the prototypes and point towards design iterations. In this respect we are using the technology as a 'technological probe' to explore the underlying needs of mobile workers, whilst not seeing the technology simply as an end in itself.

References

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