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Fieldwork for requirements: Frameworks for mobile healthcare applications

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Abstract

Ethnographic approaches to study of work in the field have been widely adopted by HCI researchers as resources for investigation of work settings and for requirements elicitation. Although the value of fieldwork for design is widely recognised, difficulties surround the exploitation of fieldwork data within the design process. Since not every development project can support or justify large-scale field investigation, the issue of how to build on previous work within a domain is particularly important. In this paper we consider this issue in the context of development of mobile healthcare applications. Many such systems will be built in the coming years, and already a number of influential studies have derived concepts from fieldwork data and used them to support analysis of healthcare work. Using a patient review process as an example, we examine how the concepts from such exemplar studies can be leveraged to analyse fieldwork data, and to facilitate requirements elicitation. The concepts, previous interpretation within the domain, prototypical requirements and associated critique together provide a framework for analysis. The concepts are used to highlight issues that must be addressed and to derive requirements. We make the case that these concepts are not "value free" and that the course of our analysis is significantly altered through the palette of concepts used. The methodological implications of this proposition are also considered.

Keywords: Healthcare; Mobile applications; Requirements; Conceptual frameworks; Fieldwork

1. Introduction

The healthcare environment raises many challenges for design, with many different roles and stakeholders involved, safety critical tasks being performed, large volumes of information being generated and accessed, and highly mobile workers carrying out their activities in a variety of different settings. Due to the nature of the work, and recent improvements in technology, there is increasing use of mobile technology within the environment. Thus, as use of these technologies becomes commonplace, a large number of development projects can be expected. For such complex work systems, understanding the context of use and the practical realisation of the work in the field is critical for successful design.

In recent years, fieldwork based techniques have been increasingly employed in the healthcare domain with a number of research efforts producing influential studies, and motivating fieldwork-informed designs. Typically, a field investigation will yield a lot of information on the different users, working practices, use of artefacts and information, and activities as they currently happen. Many of these field studies involve the use of ethnographic or ethnomethodological analysis. Ethnomethodology in particular has had a substantial impact on Human–Computer Interaction research. A useful definition of Ethnography is that it is a method for understanding what activities mean to the people who do them (Harper, 2000, p. 244). One breakdown is that it comprises the fieldwork programme, an analytic programme, and documentation and presentation of the results (Rönkkö, 2010). Other approaches making use of a fieldwork programme can be seen as coming under the broad umbrella of case study methodologies.

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While there are a variety of views on how to incorporate design fieldwork into the development process (Randall et al., 2007), a number of difficulties remain. Whereas textbooks on requirements engineering typically focus on modelling (Lamsweerde, 2007), it is widely acknowledged that "contextual approaches based on ethnographic techniques" do not map well onto current formal specification and analysis modelling methods (Nuseibeh and Easterbrook, 2000). Difficulties in translating the observational record into a requirements document have also been noted in studies of ethnographically informed system development (Bentley et al., 1992).

There has been considerable debate on the role of ethnography in requirements engineering (Hughes et al., 1995; Shapiro, 1994). It has been argued that it should assume *an exploratory role in innovative technical research* (Crabtree, 2003), and identify researchable topics. However, in spite of the above mentioned difficulties, there has undoubtedly been successful progress on integrating fieldwork study techniques into a requirements process. Much of this work is predicated on including an ethnographer in the design team, but this option is not always available. When it is, establishing effective communication between ethnographers and developers can be difficult, even within a multi-disciplinary design team (Denley and Long, 2001). In some cases ethnographic study may not be the most appropriate approach. Anderson (1994), for instance, states that: "Many designers of CSCW and other types of collaborative end-user systems are now turning to ethnography as a means of requirements capture. In my view, it is not ethnography they want but field experience. To get out into the real world and understand the context of use may provide them with all the access and insight they feel they need". We take the position that designers should base a significant portion of their decision making on such fieldwork data. It is on the use of fieldwork data for identifying requirements and critiquing designs for mobile healthcare work that we focus in this paper.

There is also a pragmatic concern that previous fieldwork studies within a domain are built upon and exploited in a way which is accessible not just through the experience and knowledge of the analyst. Plowman et al. (1995) ask the question, "Is it desirable, practical, useful and economical for a workplace study to be carried out *ab initio* every time a CSCW system is to be developed?". This is particularly the case for small-scale development projects and for cases where a generic software system requires bespoke tailoring work in order to fit in with the working practices and requirements of a specific setting. Such projects are unlikely to justify large-scale field investigation, and so it is important to derive benefit from previous studies within the same domain where possible.

1.1. Conceptual frameworks

A number of general-purpose methodologies for analysis and design have been proposed, such as contextual design (Beyer and Holtzblatt, 1998) and cognitive work analysis (Rasmussen, 1986; Vicente, 1999), each drawing on different traditions within HCI, and oriented towards a particular type of domain (e.g. business information systems, process control). These generally draw on similar fieldwork methods such as interviewing, observation and artefact analysis, and in many cases leverage models of the setting and of the work.

In this paper, our concern is not with generic methodologies, but in specific analytic concepts and frameworks which have emerged from the study of healthcare work. A number of analytic frameworks have emerged, which can help to transform fieldwork data into input to the design process. These frameworks are tied to particular case studies, but also have a relationship to broader theories used within HCI such as distributed cognition (Hutchins, 1995) and activity theory (Nardi, 1995), although the relationship between ethnography, theory and system design has been the subject of considerable debate (Macaulay et al., 2000).

Teams looking at the development of information systems to support mobile healthcare work are often faced with the choice of which framework to use. In the following sections we argue that this choice will have a strong effect on shaping the designs which are produced, and will also impact on the ability to reason about evolution of the overall system in response to higher level changes within the organisation, for example, the push towards multi-disciplinary team meetings (MDTM's) (Kane et al., 2007).

The use of frameworks in analysis of fieldwork data is something shared with ethnographic approaches. While some traditions in ethnography (particularly ethnomethodology) avoid commitment to particular models, this does not rule out the use of particular tropes or themes, some of which may be specific to a domain. While the frameworks we discuss in this paper are fieldwork-inspired rather than directly produced from ethnographic analysis, one potential point of contact with ethnography is its use for "developing abstract design concepts by consulting perspicuous settings—i.e. workplaces that may shed light on what abstract design concepts might mean concretely" Crabtree and Rodden (2002). However, we are particularly interested in cases where a framework used for the analysis of fieldwork has resulted in the identification of concrete requirements, whether "ethnographically informed" or otherwise.

We make the case that using a conceptual framework helps to generate requirements from fieldwork data; that the set of concepts used has a profound effect on the requirements derived and the type of system that results; that a number of different concepts have been previously employed in the study of mobile healthcare work, and that a whole set of such concepts can be leveraged in the analysis of new projects within the domain. While many of these concepts will generalise across other kinds of mobile work, the interpretation will differ between domains, so we restrict the scope of our analysis to healthcare work.