Evaluating Mobile, Ubiquitous and Context Sensitive Services in the Field

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Evaluating Mobile, Ubiquitous and Context Sensitive Services in the Field

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ABSTRACT
By utilizing the sensing and processing capabilities of today's mobile devices it is possible to capture rich quantitative data about the usage and context of mobile, ubiquitous and context sensitive services in the field. This paper discusses how the capture and analysis of this can be automated and put into a framework for conducting large scale field evaluations and presents an implemented prototype framework. Exploratory sequential data analysis (ESDA) is proposed as the foundation for creating novel automated analysis methods.

Keywords
Framework, methods, mobile, ubiquitous, context, evaluation, automated capture and analysis, usage patterns, context, ESDA.

1. INTRODUCTION
Whether to evaluate systems, applications and services (for simplicity they will all be referred as services in this paper) in the laboratory or in the field has been topic for much debate within the mobile HCI community. The issue at its core, as [9] puts it, is whether or not field experiments are worth the hassle. High experimental control and easy data collection are virtues of the laboratory, while quite the contrary is true for field experiments. The general belief is also that field experiments are more costly with regard to time and resources. The gain is realism when evaluating the services in their natural environment and context of use. This might not always be so much of a gain, as several studies including [9] have shown, but other studies like e.g. [10] show the opposite and that it is indeed worth the hassle.

Here it shall be postulated that for at least a specific class of services evaluation in the field may be a sensible solution. In the spirit of creating new words and thus adding to the already crowded and ambiguous vocabulary describing computing technologies, the term "mubicontive" is proposed for describing these services. Being a contraction of the already (vaguely) defined terms: mobile, ubiquitous and context sensitive. Although the definition of mubicontive and the corresponding services are no less fuzzy than the definitions they build on, they do stand out from other services from a user experience point of view

1.1 Mubicontive Services
They are systems, applications and services designed to be used anytime, anywhere – often while the user is on the move, and often as a secondary task to some primary activity done in parallel. The cognitive load in most usage situations is significantly higher than standard for desktop applications, and the user experience would be very sensitive to contextual parameters such as environmental (e.g. noise, lighting), social (e.g. presence of people) and network (e.g. available bandwidth) conditions. Being mobile and ubiquitous the interaction will often be awkward and limited (e.g. one handed input and limited screen space) and the situations are dynamic and even stressful.

It is hypothesized, that such services will gain a lot from being put out in the field for both formative and summative evaluations. Nevertheless, the hassle of doing so is not insignificant, and thus there is a grave need for new methods and tools for conducting field evaluations of mubicontive services in a more effective and efficient way.

The proposed approach which will be discussed in the rest of the paper, is to capture large amounts of quantitative data during field experiments and subsequently doing partially automated analysis of these data to achieve an understanding of the user experience of mubicontive services and to evaluate their usefulness.

2. METHODS
In a large survey of methods for automating usability evaluation in general, [6] defines the activity of doing such evaluations into three main parts which can be automated: capture, analysis and critique. The main idea is to fit the most effective and efficient subset of such methods into one coherent tool or framework, which can (at least partially) automate the resource consuming capture and analysis parts in field experiments.

2.1 Automatic capture
Several tools and frameworks have been created for automatically capturing data in field experiments with mubicontive services. ContextPhone [11] and MyExperience [4] epitomize the state-of-the-art. Larger companies such as Nokia have developed in-house tools which may be even more advanced than these, but they are not openly available and thus of virtually no use. The common ground for these frameworks is that they utilize the rich sensing and communication potential of SmartPhones and PDAs to capture data that holds evidence to the user experience. These data can roughly be categorized as relating to usage, context or user attitude (qualitative).

All three types of information has been captured with success in proof-of-concept studies, however there seems to be a lot fewer studies showing how the captured data is actually used to evaluate the usefulness and user experience of mobile systems and services. [1] and [2] are rare examples showing how context and usage data can be used to evaluate the impact of a mobile service and to recognize social patterns in daily user activity.

Three important questions are: What types of data to capture, when to capture it and how to use it afterwards? The "easy" and most used approach is to simply capture everything - all the time.

This leaves the researcher with a huge amount of post-experiment data to analyze which is a very time consuming activity; especially when it is not clear what to look for. For this reason many studies are never thoroughly analysed and valuable knowledge is lost. Automating the analysis to some degree might be a necessary step to take full advantage of these data.

2.2 Automated Analysis

ESDA (Exploratory Sequential Data Analysis) might provide the foundation for automating the analysis process. [3] presents ESDA in the most general form, but translating it to terms of evaluating mubicontive services is relatively easy, since observational data will almost always take the form of sequences of events, actions, interactions etc. Using ESDA on automatically captured data is about manipulating such sequences of events into meaningful patterns which reveal evidence of the user experience. In [3] it is suggested that there are eight types of basic operators which they call "the eight Cs": chunking, commenting, coding, connecting, comparing, constraining, converting and computing. They should be used interchangeably to manipulate the sequence into patterns. Which methods to use and when is the tricky part and in practise this is decided ad hoc by the analyst, hence the name exploratory. This process can be automated nonetheless.

In [5], existing methods and tools for extracting usability information from user interface events are surveyed, and interestingly the classes defined in [5] to a large degree coincides with the eight Cs from [3]. A special class of methods categorized in [5] is visualization, which is usually applied as a last step. Visualization is a way to draw on the human brain's ability to visually recognize patterns and trends.

The goal of the automated analysis is to find and present the right data to the researcher in a suitable way. The right data being that which hold evidence to the user experience

3. DIASNET MOBILE FIELD TRIAL

A prototype framework has been developed for evaluating DiasNet Mobile, a mobile diabetes management service (see [7] and [8] for details). The experiment was conducted over a three month period, where a single diabetic user was using in his everyday life. Figure 1 shows how the observational data flows form the user to the researcher. The (partially) automated analysis in this framework is based on ESDA principles.

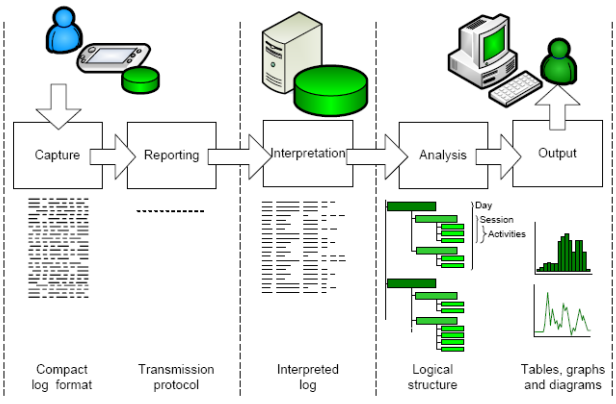

Figure 1: Automatic data capture and analysis framework from the DiasNet Mobile field trial [8]

4. DISCUSSION

The approach presented here is purely quantitatively oriented. The need for qualitative and subjective measures is fully recognized as being essential for uncovering the true user experience. The methods discussed in this paper are thought to be complimentary to such methods.

4.1 Conclusion

The tools and technology is available for conducting large scale field experiments. By using automatic capture rich data can be sampled with regard to usage and context. Studies such as [1], [2] and [8] give nice glimpses of what can be gained by mining such data from field studies. However, there is a significant lack of proven methods for exploiting these vast amounts of data in order to get insights into the user experience; specially how to include contextual data. Automatic methods using ESDA techniques are proposed as a road to explore.

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