A Generic Concept for Task-driven Remote Usability Testing in Mobile Ecosystems

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Abstract
Although mobile applications have become widely used during the last few years, there is little knowledge about how they are used in detail. While existing techniques and tools focus on the analysis of e-commerce related metrics and descriptive statistics, lab-based methodologies are mostly based on the evaluation of predefined user tasks and of few samples from a potentially large user group. We address this topic by introducing a concept for transparent interaction logging and automated usability evaluation of user navigation inside of mobile applications. Therefore, we introduce a dynamic and interactive graph in order to visually identify common usage patterns, such as favoured application tasks or usage paths, from data that is collected in real-life environments.

Author Keywords
Usability evaluation, Mobile applications, human computer interaction

ACM Classification Keywords
H.5.2 [Information Interfaces and Presentation]: User Interfaces—*Evaluation/methodology, Theory and methods*.

General Terms
Measurement, Human Factors

Introduction

During the last few years, the mobile domain has been and is still experiencing an unprecedented hype. Together, the four leading stores (i.e. Apple App Store, Google Play, Windows Phone Store and BlackBerry World) hit 13.4 billion downloads, with revenue of $\$2.2$ billion in Q4 2012. At the end of 2012 Google tied Apple with 700,000 mobile applications in the Google Play Store. As a consequence, consumers are not able to decide which application to buy solely based on functional features. If consumers have to choose between two applications that basically provide the same functionality, they will prefer the application that presents this functionality to them in a comprehensive manner so they can benefit most from it. From this it follows that effective and easy user interfaces are crucial for mobile applications in order to be successful.

However, applying lab-based, task-driven usability evaluation methods to mobile applications might not be sufficient in order to estimate an application's usability to the greatest possible extent. Mobile applications have to cope with external and in most of the cases uncontrollable stimuli (e.g. quickly changing user context, connectivity issues, etc.), which are difficult to emulate during lab-based experiments. Also, due to a lack of resources, typical usability evaluation scenarios cannot be executed over a longer period of time, and they cannot be applied to arbitrarily large user groups in most cases. As a result, it is not possible to evaluate the usability of mobile applications in real-world scenarios. According to the Nielsen Norman Group[1] this is one reason, why mobile user experience is improving slowly.

[1] http://www.nngroup.com/articles/mobile-usability-update/

Research Focus

Basically, good user interface design can make the difference between product acceptance and rejection in the marketplace. In contrast to Kaikkonen et al. [1], we believe that conducting unsupervised and automatic field studies will result in more thorough results than it is the case for supervised field studies.

Therefore, we address the issue of combining remote usability testing of mobile applications on the one hand and unsupervised field studies on the other hand. We are working on a concept for sensing mobile phone interaction in the field, while real application users actually interact with their mobile application. Generally, the main focus of our research is to give significance to interaction data by establishing a connection between interaction events such as touch interaction, user navigation such as common navigation patterns and the context such as user activity or external stimuli (i.e. light, sound, connectivity, etc.). As a consequence, we will be able to visualise user interaction in a comprehensive manner so that it is possible to derive certain usability issues (e.g. navigation problems) automatically from the collected data. We expect that with the proposed research it will also be possible to derive certain usability tasks directly from interaction data instead of having them predefined by usability experts. For example, Fig. 3 shows that we are already capable of associating common navigation patterns with actual tasks (e.g. ordering a bus ticket in a public transport ticketing application).

Based on the previously defined research focus, we already identified some of the research questions we would like to address:

As presented by current research, the definition of usability tasks is crucial for a successful usability evaluation.

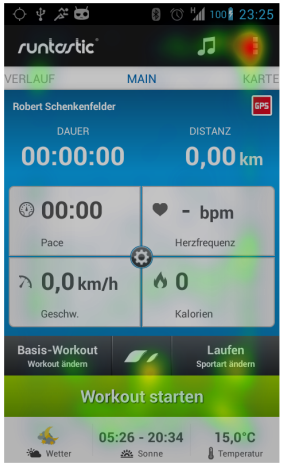

Figure 1: Heatmap visualisation of touch points in the Runtastic app for Android.

Figure 2: Heatmap visualisation of scroll gestures in the One23 People app for Android.

Therefore, considerable knowledge of the usage domain is needed to decide which tasks are important.

- To what extend is it possible to automatically derive usability tasks from interaction data, where are the limits (i.e. wrong tracks) and which characteristics of usability can still only be explored interactively by usability experts?
- How can a possible visualisation concept look like in order to display navigation patterns, which allows both, usability experts as well as developers without specific knowledge on HCI-related topics, to identify common usability issues?
- If navigation patterns – respectively tasks – can be derived automatically from common interaction cycles, how is it possible to automatically distinguish between experienced users (i.e. usability) and novice users (i.e. learnability) under the assumption that the learning curve cannot be considered being equal for all users?
- How can a possible concept look like in order to compare different usability tasks automatically?

Current research shows that the context, in which an application is used in, has a crucial impact on the results of usability studies. In the industrial domain for example, the line of sight can have an impact on the error rate. Also it can be assumed that context such as light or sound have an influence on display technologies as well as interaction paradigms such as speech input.

- How does context influence the user experience and usability while using mobile applications?
- Are sensors that are integrated in mobile phones providing sufficient information in order to draw conclusions on an application's usability?

Current Status of Research

In course of the research project *AIR (Advanced Interface Research)*, we did the precedent research in order to transparently collect interaction data on mobile phones. As a proof of concept, we developed an interaction logging framework, which is based on aspect-oriented programming and thus capable of hooking into mobile application source code, respectively into its life cycle. As a result, the entire logging process is abstracted from actual application developers so their code stays clean during design time. Besides the design of the proposed logging concept for mobile applications, we also progressed in the perspective of these research topics:

- First drafts for visualisation concepts in order to visualise multi-touch interaction and multi-touch gestures based on heat maps (see Fig. 1 and Fig. 2)
- Conceptual work as well as a rudimentary prototype in order to visualise common navigation patterns throughout mobile applications (see Fig. 3).
- First feasibility studies and publication of the results in international conferences [2].

Further Research

Further research is carried out within the *AUToMAte* project. The research vision for this project is to provide new usability evaluation concepts, methodologies and also tools in order to assist developers and designers in improving the user experience as well as the usability of

their mobile applications, which are tailored to the specific requirements of the mobile domain.

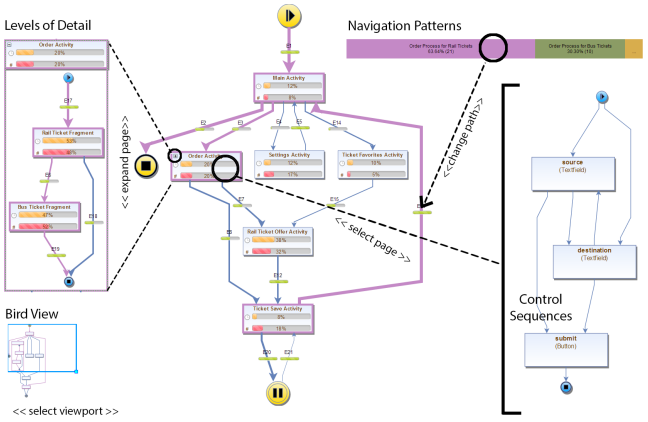

Figure 3: Illustrates a concept to visualise user navigation paths.

In order to prove that the presented approach is generally applicable, the project will be realised in three different domains (i.e. automation engineering, e-commerce and telecommunication) with partners from the local economy over a period of at least three years. The main focus of the project will be to identify common usability issues with regards to the specific domains. For example, it is planned to evaluate if the replacement of control elements providing haptic feedback with multi-touch capable terminals in the field of automation engineering has an impact on application usability (i.e. effectiveness, efficiency and error rate) as well as on the safety of their operators. Under these circumstances, especially the coherence between usability and context is considered being very important.

Objective and Biographical Sketch

As our goal is to combine concerns of different research areas, there are many open questions besides the research questions that we already defined. Thus, we regard input and fresh ideas from other fellow researchers as being extremely valuable and worthy. Especially because our research focus is interdisciplinary, we think that this could also lead to interesting discussions at the doctoral school.

Florian Lettner received both his bachelor and master degree from the University of Applied Sciences Upper Austria, Campus Hagenberg (UAS). Since October 2012 he is enrolled in the PhD program of the Johannes Kepler University, Linz (JKU). The primary supervisor of this work is **Michael Haller** who holds a professorship at UAS and is the head of of the Media Interaction Lab (http://mi-lab.org/). The secondary supervisor is **Gnther Blaschek** who holds a professorship at JKU. The expected time of completion is in 2015.

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