

Comparing two approaches for usability testing of mobile devices

PRESENTATION SUMMARY

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|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Confirmation of ability to present: | <input checked="" type="checkbox"/> I will be able to present my poster at the opening reception. I will also choose two 15-minute timeslots on Wednesday and Thursday to discuss my poster. |
| Interest in the Poster Revolution | I'm interested in appearing in the Poster Revolution. |
| Topic Category: | <input type="checkbox"/> Usability perspectives <input checked="" type="checkbox"/> Methods and skills <input type="checkbox"/> Business and organization <input type="checkbox"/> Accessibility and Internationalization <input type="checkbox"/> "Outside the box" |
| Presentation Type | <input type="checkbox"/> Business case study <input checked="" type="checkbox"/> How-to Discussion <input type="checkbox"/> Overview of a concept, philosophy or methodology <input type="checkbox"/> Presentation of design approach or guidelines <input type="checkbox"/> Other: _____ |
| Intended Audience: | <input checked="" type="checkbox"/> Everyone <input type="checkbox"/> Individuals New to Usability <input type="checkbox"/> Experienced Practitioners <input type="checkbox"/> Technical/Professional Leadership |
| Audio Visual Requirements | No additional AV will be needed |

ABSTRACT

This poster discusses the findings of a study comparing two different approaches for usability testing of mobile user interfaces: a computer-based mobile phone emulator inside the laboratory and a mobile phone linked to a wireless camera in the field. The results reveal that user performance and usability problem identification were similar for the two approaches.

GOALS FOR THE POSTER

- This study will help people more accurately analyze to what extent the context of testing influences the results of an evaluation of mobile devices. Many researchers evaluate mobile interfaces in a lab environment using emulators. On the other hand, other researchers claim that methods which ignore the context of use are not adequate for evaluating mobile devices and argue that the conventional usability laboratory cannot adequately simulate important aspects of the mobile context. However, we don't have a good understanding about how studies done in labs using emulators differ from studies in the field using actual mobile devices. The results of this experiment will be of interest to anyone designing a usability evaluation of mobile devices because it begins to shed light on the lab versus field controversy.
- Attendees will learn commonly used setups and methodologies for evaluation of mobile devices.

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- Attendees will be able to reproduce the wireless camera system created for this experiment for use in their own laboratory or field usability evaluations of mobile devices.

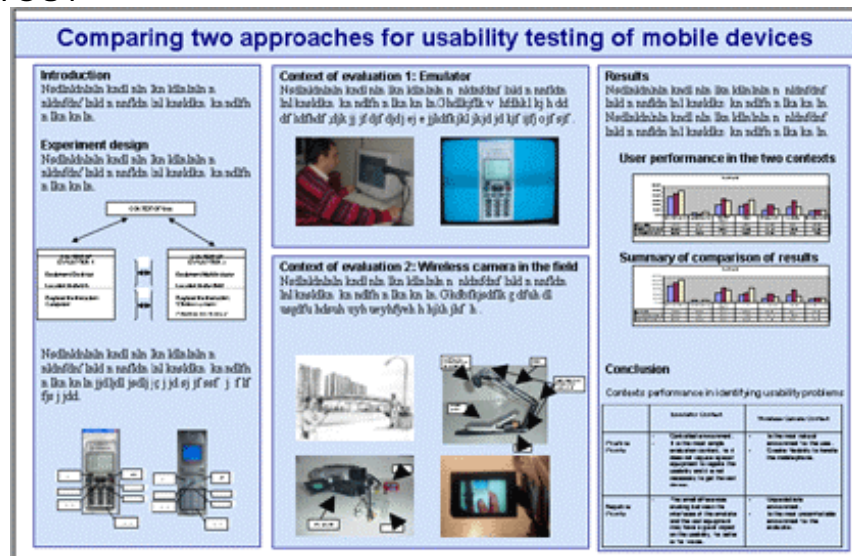
PREVIOUS PUBLICATION OR USE OF THIS MATERIAL

A more complete version of this material has been presented before in Portuguese at “VI Simpósio sobre Fatores Humanos em Sistemas Computacionais-Curitiba, PR, Brazil, October, 2004”. This UPA 2005 submission is more practitioner oriented. This is also the first time that this material will be published/presented in English.

YOUR BACKGROUND IN THIS MATERIAL

The author has worked as a HCI researcher and consultant for over 10 years. During the last five years she has concentrated her efforts on research concerning the usability of mobile devices. The primary focus of her PhD thesis was to compare different approaches for usability testing of mobile user interfaces. She has been working as a consultant and researcher for mobile phone UI design with a major mobile phone manufacturer and carrier.

POSTER LAYOUT



DETAILED DESCRIPTION OF POSTER CONTENT

Introduction

The traditional techniques of usability evaluation initially developed for desktop computers may need to be revised and adapted to consider the needs and characteristics of mobile users and their context of use. Measuring usability outside the lab, in more realistic situations, is considered important for the success of mobile products because usability practitioners assume that mobile device emulators or other lab methods cannot provide valid and reliable indications of real-world usability. However, limitations in time and in physical and financial resources may not always permit usability evaluations outside the lab. These limitations mean that traditional usability testing techniques continue to be used to evaluate mobile interfaces including the use of computer-based emulators. The purpose of this study was to compare the results of usability testing of mobile interfaces based on two different evaluation approaches: (i) using a computer-based mobile phone emulator in the laboratory (called the “emulator context”) and (ii) using a mobile phone linked to a wireless

camera in the field (called the “wireless camera context”), a situation closer to the actual context of use.

Experiment design

The usability tests were conducted for the purpose of evaluating the overall usability of the user interface of a Wireless Application Protocol (WAP) portal accessed through a mobile phone. Several models of mobile phones and various emulators were analysed with the purpose of finding the pair that presented the greatest number of similarities in terms of disposition and functionality of the keys, and also the visualisation of the application. Based on this criteria, it was selected an Openwave emulator with a standard phone mask and the mobile phone model BD4000 by LG operating in the 2.5G network in the CDMA 1X technology.

A total of 24 participants (12 men, 12 women) between 21 and 40 years, with different educational backgrounds and professions were split into two groups of 12 persons each. All participants were mobile phone users with at least one year of computer experience, but none of them had used WAP or the mobile phone model used in this study.

Each usability test took an average of 1½ hours and rigorously followed the same test script. The user was asked to accomplish seven independent tasks, concerning information search over the WAP portal. The tasks were chosen as being representative of frequent tasks in real WAP services and presented to the user in increasing order of difficulty.

The first group of participants performed the usability tests in the laboratory using a computer-based emulator (emulator context). Keyboard use (though permitted by the emulator) was removed so the user had to use the mouse to enter data by clicking on the keys of the mobile phone simulation on the computer screen. This procedure simulated real use of the mobile phone. All the user interactions with the interface and verbal comments were recorded on videotape.

The second group of participants performed the usability tests outside the lab, in a busy and distracting environment that reproduced several possible locations of usage context (wireless camera context). The system designed to record the interaction in an open environment was developed specially for this research. The recording system consisted of a wireless mini-camera (Figure 1) with a built-in microphone that communicated with a receiver (Figure 2) on a portable digital video camera. The camera was fixed to a support so that its movements would accompany the movements of the mobile phone. The camera support was specially designed so that the user could operate the mobile device normally while high-quality color images of the mobile device’s display and keypad, and the audio of the session were recorded.



Figure 1. Wireless camera



Figure 2. Receiver

The results from the emulator context and the wireless phone context were compared according to two criteria: (i) the user performance in each context, measured according to ISO9241-11 in terms of user effectiveness, efficiency and satisfaction in accomplishing the task, including the evaluation of the workload; (ii) the “context performance” which was

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measured by determining the number of usability problems identified in the lab and field, the severity of these problems, and the number of hours spent in performing the evaluations. The examination of context performance made it possible to determine a benefit/cost ratio for each context, which would indicate the severity of problems found per hour of evaluation.

Results

ANOVA tests revealed that there was no statistical difference when comparing user performance in the emulator context and in the wireless camera context. Regarding the workload, there were also no statistical differences in the results obtained from NASA TLX workload questionnaire for the two evaluation contexts either on overall workload or on the individual components of workload (mental demand, physical demand, temporal demand, effort, performance and frustration).

Table 1 presents a summary of the contexts performance in identifying usability problems. A total of 41 usability problems were identified, among which 32 were common to the two contexts. There were 6 usability problems identified exclusively in the wireless camera context and 3 usability problems identified exclusively in the emulator context. The benefit/cost ratio, which indicates the severity of problems found per hour of evaluation, was 8.79 for the wireless camera context and 7.49 for the emulator context.

| | Emulator | Wireless Camera |
|------------------------|----------|-----------------|
| Usability problems (%) | 85.4% | 92.6% |
| Severity degree | 229 | 296 |
| Benefit/cost | 7.49 | 8.79 |

Table 1. Contexts performance in identifying usability problems

Discussion

The emulator context is the simplest evaluation set-up since it does not require special equipment for recording the interaction and there is no need to use the real equipment (the mobile phone) in which the application will run. However the use of the emulator places a restriction on the choice of participants, since it is necessary for the participants to be computer users. If the participant is not a computer user, he/she may have difficulties with the use of the mouse and other devices for interaction. Generally speaking, the emulator context attained excellent performance rates in identifying usability problems. In the emulator context, we identified more than 85% of the total usability problems and three out of the four most severe problems. Also, there were no statistically differences for the user performance measures between the emulator context and the wireless camera context. This suggests that simpler laboratory approaches using emulators can be used for usability testing of mobile applications when resources are limited. However, the validity of the usability problems identified in the emulator setup and the user performance rates may depend on the similarity between the emulator and mobile phone interfaces.

The use of the wireless camera to record the interaction in the external environment was satisfactory, since it was capable of generating high quality images and did not hamper the participant's interaction with the mobile phone. We assumed that the wireless camera context would present the highest rates of workload, since the user was exposed to an

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outside environment, which would require more concentration on the tasks in relation to the environment in the lab. However, the test administrator found that the users in the field tests were completely at ease in the outside environment and concentrated on the tasks they were performing without facing greater difficulties in the interaction. This was confirmed by the workload questionnaire results which did not reveal significant differences between the lab and field conditions. So, although the external environment was busy and noisy, the users were not as susceptible to outside interference as we expected. The fact that the users knew that they were participating in an evaluation, that the test administrator was nearby, and that they could see the equipment used to record the interaction may have helped to increase their concentration in the tasks at hand.

The wireless camera context was an uncomfortable environment for the test administrator. The outside environment is a new location for some usability practitioners and totally unpredictable. In this environment the test administrator was exposed to external distractions that practically do not exist in the lab. Since the environment was public and very busy, at any moment a person on the street could come close to ask what was happening, interrupting the evaluation. We also had to set up the equipment for each session to fit the participant and make sure that the batteries didn't go dead during the test. The testing lab was more comfortable for the test administrator. It is a quiet location where the whole environment is prepared for evaluations and all the equipment connected and ready.

The results showed that it is possible to obtain satisfactory usability data from a mobile user interface using a computer-based emulator in a usability lab, provided the user interface simulation of the mobile device is defined to be very similar to the actual mobile user interface. The wireless camera system, developed especially for this research, proved to be an excellent solution to record the user's interaction with the mobile device, independently of where the evaluation takes place, either inside or outside the lab.