LiLiPUT: Lightweight Lab Equipment for User Testing in Telecommunications

Peter Fröhlich; Peter Reichl; Raimund Schatz; Lynne Baillie; Wolfgang Weinberger; Florian Hammer
Telecommunications Research Center Vienna (ftw.), Donau-City-Straße 1, 1220 Wien, Austria
{froehlich, reichl, schatz, baillie, weinberger, hammer}@ftw.at

User testing in mobile HCI is still mostly conducted in stationary labs, even though the importance of field data is widely acknowledged. Starting from related work and a set of six key requirements for more successful and widespread field-based user testing, we present our Lightweight Lab Equipment for User Testing in Telecommunications environment ("LiLiPUT").

Keywords: LiLiPUT, mobile usability, mobile HCI, methodology, laboratory equipment

1. INTRODUCTION

Recent research has clearly demonstrated that standard stationary lab testing is not sufficient for mobile usability evaluation and HCI research. First, users engaging in mobile situations tend to have focuses other than the device in front of them, a situation quite different compared to an indoor laboratory setting [1]. Thus, in order to obtain ecologically valid results, usability tests for mobile devices should be conducted in typical usage situations outside the lab. Second, whenever mobile context factors matter for design or research questions (e.g. amount of interruptions or the input modality depending on the situation), field studies need to be conducted [2]. Third, some mobile interaction types such as spatially aware services simply cannot be evaluated satisfactorily indoors.
Different kinds of field research methods have been proposed in order to better understand and better match the nature of mobile contexts: ethnographic field studies, diaries and experience sampling [3]. However, such studies "in the wild" are still quite rare; the vast majority of mobile usability tests and also many HCI research experiments for mobile applications are still carried out in stationary labs. One important reason for this is the additional effort required for test execution in an outside environment and the complexity of (manually prepared) data analysis required for most field research methods. Furthermore, the amount and reliability of collected data (e.g. video, audio, and observer annotations) tends to be lower than in stationary user studies.

2. REQUIREMENTS FOR FIELD-BASED USER TESTING EQUIPMENT

We have defined the following lab equipment requirements to enable more successful and widespread field-based user testing of telecommunications systems:

1. **Portability** (adequate size, power consumption for mobile equipment, etc.)
2. **Data richness and accuracy**: The collected data should be of a comparable level (e.g. comprehensiveness and accuracy) to that of a stationary lab (recorded handheld screen capture, video and audio data to document the test situation)
3. **Workflow efficiency**: The required workload for the research or consultancy team should not be higher than that of a traditional lab study. The data organisation and analysis should not consume more labour resources than when using a traditional lab.
4. Mobile **contextual data capture** (weather conditions, surrounding physical environment, gestures and emotional expression, etc.)
5. **Natural and seamless interaction**: Users should be able to move normally e.g. for example make telephone calls whilst engaging with the mobile device without any hindrances. To this end, they also should not feel uneasy or inhibited due to cables, obtrusive cameras or the surrounding team of observers
6. **Coverage** of all relevant mobile telecom application areas (not only mobile HCI, but also human-human communication and related QoS (Quality of Service) issues)

3. RELATED WORK

Mobile HCI research has only recently tried to meet some of the requirements outlined above. The most advanced solution in this regard was proposed by Roto et al [4]. In essence, 1 microphone signal and 4 camera signals are mixed and recorded on a DV recorder located in the user's backpack. The cameras capture the mobile device display, the user's face, the user's front (from the user's shoulder), as well as the user from the perspective of the observer (from a wireless camera on the observers shoulder. The proposed solution fulfils requirements 1-3 to a high degree, enabling a reasonable amount of mobility, data richness and accuracy, as well as a very high workflow efficiency (there is only one observer and the data is ready to be coded after the test). Furthermore, the video of the user's front partly helps to meet requirement 4, i.e. capturing mobile context. However, the obtrusive cables and cameras, mounted on the mobile device, may considerably hinder naturalness and seamlessness (req.

5). Also, coverage of all relevant telecom application areas, namely making telephone calls (req. 6) would be impossible.

3. THE LILIPUT APPROACH

The system presented by Roto et al [4] inspired us to develop the environment "LiLiPUT" (Lightweight Lab Equipment for User Testing in Telecommunications). In particular we were interested in meeting more closely the requirements of naturalness and seamlessness, whilst ensuring high standards in terms of data quality and accuracy. Therefore, we decided to develop a strictly wireless system, which relieves the user from carrying the cables and a backpack (see figure 1 below).

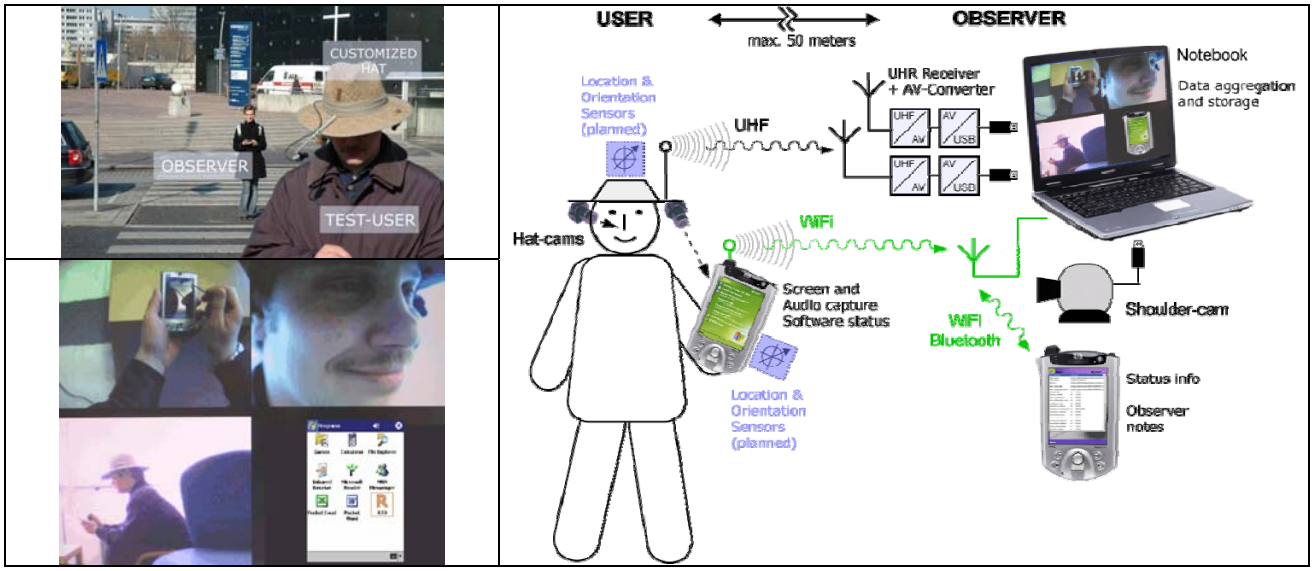

FIGURE 1: LiLiPUT System in the field (top left), captured video signals (bottom left) and system architecture (right). Features planned for the future are coded in blue.

The only part of LiLiPUT that the user is supposed to carry (apart from the mobile device of course) is a customised hat, on which two cameras, a microphone, wireless senders and batteries are mounted, which capture the user's line of sight and their face respectively. The face camera and its holder are removable for studies with strong requirements for seamlessness but without a special focus on facial expressions. The handheld screen display is captured via a remote display control software. The two wireless camera signals and the captured handheld display, as well as a web camera on the observer's shoulder are mixed and recorded on a notebook with software developed in-house running on it. In addition, the remote control software can be used to control the handheld display as required for undertaking Wizard-of-Oz studies.

4. ONGOING WORK AND OUTLOOK

As consequence of our first functional tests, we acquired a more powerful, waterproof notebook in order to achieve better recording performance and more versatile usage under different weather conditions. Initial user feedback that was informally collected during our functional tests, indicate that LiLiPUT seems natural and seamless to use, thus meeting req. 5. In the near future, we plan a systematic validation with regard to the requirements stated in this paper. We also aim to improve the automatic capture of additional mobile context data, such as time-stamped head and handheld orientation information gathered via embedded orientation and acceleration sensors.

5. ACKNOWLEDGEMENTS

This work is part of the project SUPRA funded by the Austrian competence centre programme Kplus. We would like to thank Antitza Dantcheva for her support with building up the hardware equipment.

REFERENCES.

[1] Baillie, L. & Schatz, R. (2005) Exploring Multimodality in the Laboratory and the Field
Seventh International Conference on Multimodal Interfaces, Trento, Italy, September, 2005, Published by the ACM.
[2] Brewster, S. A. (2002) Overcoming the Lack of Screen Space on Mobile Computers. (2002) Personal and Ubiquitous Computing, 6(3), 188-205.
[3] Consolvo, S. (2003) Using the experience sampling method to evaluate ubicomp applications. IEEE Pervasive Computing, Special Issue on Human Experience, April-June 2003, 24-31.
[4] Roto, V., Oulasvirta, A., Haikarainen, T., Kuorelahti, J., Lehmuskallio, H. and Nyyssonen, T. (2004) Examining mobile phone use in the wild with quasiexperimentation. HIIT Technical Report 2004-1, 2004. www.hiit.fi/publicationsMobile eyetracking.