

Early-Stage Evaluation of Ubiquitous Computing Applications

Principle Investigator: Jennifer Mankoff

EECS Department

University of California at Berkeley

jmankoff@cs.berkeley.edu

Sponsoring Corporations: Intel,

Microsoft, Hewlett Packard

Campus: Berkeley

Abstract: Technology in different forms is available ubiquitously throughout much of the world. The study of Ubiquitous Computing (UbiComp) is concerned with enabling a future in which the most useful applications of such technology are feasible to build, and pleasing to use. One of the hardest problems that UbiComp application developers face today is the difficulty of evaluating UbiComp applications. Evaluation is crucial at all stages of design, and the best designs include evaluations that involve users in the design process repeatedly throughout a series of design iterations. However, the impact of involving users is typically greatest at the early stages of design, and because of this, we focus on evaluation methodologies appropriate for those early stages in this proposal.

Evaluation is difficult for the following reasons: (1) UbiComp systems may break the assumptions of single user, productivity oriented tasks that underlie most of the commonly used evaluation techniques. This means that those techniques may not be applicable, or may require modifications in order to be effective. (2) Evaluation techniques for early-stage design, such as Heuristic Evaluation, and paper-based prototyping may not easily scale to the number of devices and scenarios in which UbiComp systems are typically designed. (3) UbiComp systems are still very difficult to build, and it is rare for them to be used outside of a laboratory setting. This makes it difficult to iterate quickly, and difficult to get real use data using later-stage evaluation technique.

We propose to develop a suite of evaluation techniques and related tools in support of UbiComp application design. For this proposal, we will focus our effort on inexpensive, early phase evaluation techniques. In particular, we will adapt Heuristic Evaluation and the technique of running user studies with paper-based user interfaces to Ubiquitous computing. This will require a combination of tool development (for simulating things that cannot be done simply with paper) and methodology modification (identifying guidelines for what sort of tasks can be supported on paper, how to simulate sensing, recognition and so on). We will explore evaluation in the context of existing UbiComp application development work: First, we have an ongoing research project in the design of peripheral displays in which we regularly build and evaluate applications. Second, we are in the process of building an augmented communication system for wheelchair users, and a food consumption tracking system. Both applications will be a test bed for our evaluation work.

Our work will be of practical use to anyone developing UbiComp applications. For example, both an industry firm (AmbientDevices) and two research organizations (Intel Research Seattle and FX Pal) have recently told us that they plan to use the results of our work with heuristic evaluation in their next design efforts. Previously, those developers had no formal or validated approach to testing early phase designs. Additionally, the applications we are developing have social value in their goal of providing support for people with disabilities, and healthier food consumption habits. This project itself is directly (financially) supported by Intel Research Berkeley, HP Labs, and Microsoft.

Keywords: Ubiquitous Computing; User Centered Design; Evaluation; Prototyping