A Game-Based Methodology for Collaborative Mobile Applications

Michael Massimi
University of Toronto, Canada

Craig H. Ganoe
The Pennsylvania State University, USA

John M. Carroll
The Pennsylvania State University, USA

INTRODUCTION

Mobile computing, perhaps more so than traditional desktop computing, requires methods for allowing application designers to try ideas, create prototypes, and explore the problem space. This need can be met with rapid prototyping. Rapid prototyping is a technique that permits members of a design team to iterate through several versions of their low-level designs (Thompson & Wishbow, 1992). During each cycle of each prototype, the design team identifies critical use cases, verifies requirements are being met, and gathers both subjective and objective data regarding usability. Because "shallow" or low-fidelity prototypes can be quickly created, used, and thrown away (Sefelin, Tscheligi, & Giller, 2003), the team can explore many options and designs with less effort than it would take to create "deep" or high-fidelity versions of each prototype (Rudd, Stern, & Isensee, 1996).

Rapid prototyping techniques are especially valuable when the application is intended for a mobile user. This is for three primary reasons. First, the mobile user is likely to be simultaneously attending to a dynamic or unpredictable environment. This environment taxes the user's cognitive abilities. Users must navigate to their destinations, avoiding obstacles and responding to changing conditions. Non-technical aspects can change, like weather or available routes. Many times, the user must "make place" in order to use the system, stopping to seek out an area to use the software (Kristoffersen & Ljunberg, 1999). Technical aspects of the system, such as network availability and power levels, can also be difficult to accurately predict and may require complex adaptation algorithms (Noble et al., 1997; de Lara, Kumar, Wallach, & Zwaenepoel, 2003; Welch, 1995). Compared to a stationary environment, the number of things that can go wrong seems to skyrocket.

Second, interpersonal communication changes when a dimension of mobility is introduced. When working collaboratively on a task, users require awareness of the tasks their collaborators are performing (Ganoe et al., 2003) in order to prevent redundancy and achieve an equitable distribution of work. When users are mobile, however, awareness is no longer simply *what* other people are doing, but also *where* they are doing it. This introduces a need for additional application support for mobile collaborative systems.

Third, heterogeneity of devices results in different interaction styles. Mobile phones provide an excellent example of this problem. Each manufacturer repositions buttons based on hardware and space constraints. Even within a manufacturer's own product line, multiple key configurations occur. This is to say nothing of the variety of mobile devices available—PDAs, tablet PCs, wearable computers, and so on. Some of the large manufacturers, like Palm, provide human interface guidelines to third-party developers (Ostrem, 2003). Most do not.

In terms of evaluating systems, Abowd and Mynatt (2000) argue that our current methods are not sufficient. The traditional task-based evaluation methods no longer apply in a world where we cannot always experimentally control the environment, and where there is not a clear, single indicator of task performance. There are not established tests that can be performed to determine the effectiveness of deployed systems, mainly because there are not many of them in the world yet. Because we do not have a base of knowledge regarding how to design for mobile interaction, early affirmations of whether the application will serve a human need are critical, and Abowd and Mynatt state that we should "understand how a new system is used by its intended population before performing more quantitative studies on its impact" (p. 47).

Mobile systems need fast, inexpensive ways of prototyping and gathering usability results. This entry describes previous work in rapid prototyping for mobile systems. We then contribute a novel rapid prototyping methodology for mobile systems, which we call "Scavenger Hunt." It is anticipated that this methodology will be useful not only for those interested in rapid prototyping and design methodologies, but also for design teams with real deadlines to meet. Finally, we identify future trends in prototype evaluation of mobile systems.

Copyright © 2007, Idea Group Inc., distributing in print or electronic forms without written permission of IGI is prohibited.

BACKGROUND

Games

Our prototype evaluation methodology is based on a game—specifically, a Scavenger Hunt. The basis for this choice stems from success with using games as a tool for design and testing for non-mobile applications.

Twidale and Marty (2005) used a "game show" format during a conference, wherein contestants found usability problems in software, cheered on by an audience. They argue that "it is worth exploring the power of rapid, lightweight methods to catch relatively uncontroversial and easily fixed usability flaws." Scavenger Hunt does this as well, although the focus of the participant is not on the actual discovery of the flaw, but on completing a higher-level task.

Spool, Snyder, Ballman, and Schroeder (1994) created a game where designers are placed onto teams and are given a time limit to create a UI. Then, test users move from design to design and must complete the same task on each one. The design with the quickest task completion time is the winner. Here, the goal is to teach designers how to create usable software by rewarding them in a game. In this study, the game is used educationally. The goal of the game is to teach the player how to create good designs, or how to use a particular evaluation method (e.g., heuristic evaluation). Instead, we use a game itself to *evaluate* the prototype. This game-based evaluation is designed to compliment other lightweight usability evaluation metrics like heuristic evaluations (Nielsen & Molich, 1994).

Pedersen and Buur (2000) created a board game to help participatory design teams conceptualize their sessions. The board, modeled after the industrial plant where the users worked, was populated with foam pieces representing artifacts and people. The design partners took turns moving the pieces to explain processes in the plant, and this opened the door to discussion about what should and should not occur during a particular process. The notion of turn-taking is especially noteworthy, as it allows design partners to offer their thoughts and obtain equal footing in the design process. We move from a board game to a "real-life" game in the SH process. In addition, we are interested in using a game as an evaluation tool rather than a design tool. Despite these differences, the past successes with games as parts of the design lifecycle are very encouraging.

Mobile Design and Usability

In experiments conducted by Virzi, Sokolov, and Karis (1996), it was found that testing with low-fidelity prototypes found almost as many usability problems as their high-fidelity counterparts. We argue, however, that paper prototypes will not be suitable for mobile interaction, and that low-fidelity computer-based versions of prototypes should be used instead.

SCAVENGER HUNT

Motivation

To gather usability metrics about mobile collaboration systems, we have developed a methodology we call "Scavenger Hunt" (SH). SH emulates the children's game where players are given a list of items that they must collect and bring to a pre-ordained location. In our methodology, the "players" are in fact target users, and each is equipped with the appropriate mobile device and prototype software under scrutiny.

By basing the rapid prototyping technique on a well-known game, the users can quickly be brought up to speed on how to complete the usability test. Further, they are motivated to "win" the game by completing all the tasks to the best of their ability. This combats the ennui that might otherwise set in when a user is simply asked to perform a series of artificial tasks. In fact, a savvy usability tester might pit two teams against one another to see who wins first and by what methods. Extreme use cases are more likely to emerge when users push the system to its boundaries to win.

Study Details

We conducted a pilot study wherein we used the SH method to evaluate a collaboration tool prototype. The specific details we have used to conduct this SH session follow and are meant to serve as an early model for future applications of this method. These details and parameters can, of course, be tailored to meet the needs of a particular design team, product, or schedule.

Software

In order to pilot the Scavenger Hunt method, we developed a Weblog prototype as the software under scrutiny. The Weblog (which we call SH Blog) allowed multiple people to add posts to it, edit each others' posts, and reorganize the ordering of the posts. We purposefully did not create a "polished" version of the software. The prototype was representative of a first pass through coding the system and was written in approximately five hours.

The prototype was written in PHP and HTML. Clients ran Microsoft Internet Explorer for Pocket PC and rendered pages from an Apache Web server running on Linux. Data was stored server-side in a MySQL relational database.

3 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/game-based-methodology-collaborative-mobile/17091

Related Content

Are Signals a Solution to Perceived Risk and Opportunism in Mobile Shopping?: Gender Differences and Similarities

Sonia San-Martín (2018). *Mobile Commerce: Concepts, Methodologies, Tools, and Applications (pp. 1365-1389).*

www.irma-international.org/chapter/are-signals-a-solution-to-perceived-risk-and-opportunism-in-mobile-shopping/183346

MagiThings: Gestural Interaction with Mobile Devices Based on Using Embedded Compass (Magnetic Field) Sensor

Hamed Ketabdar, Amin Haji-Abolhassaniand Mehran Roshandel (2013). *International Journal of Mobile Human Computer Interaction (pp. 23-41).*

www.irma-international.org/article/magithings/81285

Social Media for Health Communication: Implementation Issues and Challenges for Italian Public Health Authorities

Elisabetta Cioniand Alessandro Lovari (2014). *Social Media and Mobile Technologies for Healthcare (pp. 237-263).*

www.irma-international.org/chapter/social-media-for-health-communication/111588

Understanding User Experience

Camille Dickson-Deaneand Hsin-Liang (Oliver) Chen (2019). *Advanced Methodologies and Technologies in Network Architecture, Mobile Computing, and Data Analytics (pp. 1588-1599).*

www.irma-international.org/chapter/understanding-user-experience/214723

Adapting Web Page Tables on Mobile Devices

Yaswanth Potla, Ramakanth Annadi, Jun Kong, Gursimran Waliaand Kendall Nygard (2012). *International Journal of Handheld Computing Research (pp. 1-22).*

www.irma-international.org/article/adapting-web-page-tables-mobile/64362