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USABILITY ISSUES IN MOBILE COMMERCE

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Abstract

Usability is critical to user adoption of mobile commerce. Still in its infancy, mobile commerce has not yet generated the expected user demand. Many factors contribute to the latent user demand; these include current wireless infrastructure, business models, and usability for handheld devices and applications. A number of factors - such as the limitation in screen display, connectivity, and the mobility of data, users, and user tasks - affect usability and could hinder user adoption of wireless commerce. This paper describes a research project in progress that examines the applicability of e-commerce usability guidelines in the wireless environment. Expert reviewers will be used to conduct heuristic evaluation and cognitive walkthrough of fifteen wireless sites across three form factors - PDA, WAP phone and pocket PC. The results of this study are expected to affect wireless user interface design, usability guidelines, and the coordination of Web-based and wireless application development.

Keywords: Usability, E-commerce, mobile commerce, wireless technology, user interface

Introduction

Mobile commerce refers to using wireless technology and mobile Internet to facilitate transaction, information search and user task performance in consumer-oriented, business-to-business, and intra-enterprise communications. Still in its infancy, mobile commerce has not yet generated expected user demand. Many factors contribute to the latent user demand; these factors include current wireless infrastructure, business models, and usability for handheld devices and applications. Users are confronted with infrastructure concerns such as inconsistent standards for wireless communication, multiple platforms, limited bandwidth and poor connectivity. Currently only limited wireless services for commerce are available, mostly in the travel, news and financial services industries, and for Internet portals. Potential users are also discouraged by the poor usability of handheld devices and WAP phones. These devices have limited presentation capability and functionality, as their applications have not adequately considered the unique characteristics of wireless technology and the mobile users.

Our current research focuses on the usability issues, including the deployment of mobile services across different form factors and the usability of these applications. We have reviewed existing usability guidelines for e-commerce and will investigate their applicability for the wireless environment. We intend to use two methods - heuristic evaluation and cognitive walkthrough - to compare wireless services offered by a selected group of Websites across three form factors -- PDA, WAP phone, and pocket PC. A further comparison of the Web-based and wireless versions of each site - in terms of content presentation, information search, functionality and navigation - will allow us to identify issues concerning user interface design for the two environments.

Usability for E-Commerce

Usability for e-commerce has attracted increased attention as many companies recognized the high cost for doing business on the Web and the fierce competition for impatient customers in the cyberspace. Boston Research Group (2000) reported that in 1999 customer acquisition costs per customer was $82 for dot-coms as compared to $12 for multi-channel companies. Poor usability of these e-commerce sites may have contributed to such a high cost. As users become more experienced with Internet, they are less willing to wait for slow download or to spend time learning a site's organizational structure (Georgia Tech GVU Center, 1998; Ernst & Young, 1999; Nielsen, 2000). If a Website cannot provide instant gratification, users may leave and never return. Confusing navigation and irrelevant search can also lead to poor sales. Reports have shown that approximately 65 percent of

shopping carts were abandoned before purchase, representing a significant lost sales and highlighting the need to improve the design of the shopping and checkout process (Boston Consulting Group, 2000).

Usability Guidelines

Since the use of wireless devices in commerce is anticipated to increase, usability will become a critical issue. Although many design guidelines have been proposed for Website design of e-commerce (e.g., Nielsen, et. al, 2000), there were only a few formal usability studies. Henderson, Rickwood, and Roberts (1998) found that in an electronic supermarket enjoyment in using the system and peer-group norms contributed significantly to the intention to use the system in the future. Hodkinson, Kiel, and Mccoll-Kennedy (2000) proposed a conceptual framework for the diagrammatic representation of external (inter-site) information search behavior for researchers to holistically interpret information search data and search styles. A study by Kim and Moon (1998) indicated that it is possible to manipulate the visual design factors of the customer interface in order to induce a target emotion, such as trustworthiness. Kim and Yoo (2000) found that the combination of NBR (Neighborhood), TOP, and IND (index) generated the optimal link structure, thus increasing the degree of shopping pleasure and convenience. Miles, Howes and Davies (2000) described e-commerce technologies in four dimensions: front end, criteria management support, marketplace, and comparison support. Finally, Zhang, et al. (1999) used Herzberg's motivation-hygiene theory to identify features in the Web environment that contribute to user satisfaction.

These formal studies focused on specific tasks or specific user behaviors. Design guidelines recommended by usability practitioners cover a broader range of user responses to a site's product offerings, detailed product information, search capabilities, checkout and registration (Nielsen, et al., 2000). However, there does not exist a coherent set of guidelines that address the user interaction with an e-commerce through three phases of consumer mercantile process (Kalakota and Whinston, 1997). This process involves the conversion of a customer from activities for pre-purchase information search and price comparison, to order placement, payment, and to repeated purchases and support services. How wireless applications can support this process deserve investigation.

Only a few usability studies in mobile commerce have been published. Jones et al. (1999) studied the usability impact of small displays for retrieval tasks and recommended directed access methods for effective small screen interaction. Kaasinen et al. (2000) developed a conversion proxy server which converted HTML-based Web contents automatically and on-line to WML. They demonstrated that with certain guidelines it was possible to make automatic conversion from standard HTML to WML. Both these studies did not test handheld devices based on appropriate tasks and they did not validate any framework or guidelines. A recent study of WAP usability by Ramsay and Nielsen (2000) has revealed that many usability problems resembled those identified during the early stage of Website development. Even though their study examined only WAP phones and their findings are limited by their research methodology, these authors did conclude that good user interface design could alleviate some of the usability problems for WAP phones.

Research Problems

The wireless environment is different from the conventional Web environment in the following aspects:

- *Form factor*. The size of the screen of handheld devices is significantly smaller than that of regular desktop and laptop computers. A smaller screen constrains both the quality and amount of displayable information. Yet, many handheld devices do not have the standard input devices available for regular computers such as mouse and keyboard. Design of these tiny input devices also calls for usability studies.

- *Access pattern*. When people interact with a Website via handheld devices, time is critical. Because of constrains of current bandwidth in the wireless environment, transferring information could take significantly longer time than regular Web access. Furthermore, when people use handheld devices, they are usually on the move and they have less time to secure the information via wireless connection. Consequently, some design paradigms for regular Websites may not apply to the wireless environment.

- *Different goals and tasks*. Due to the nature of handheld devices, people may perform a much narrower range of tasks, such as getting news and booking airline tickets.

Due to these significant differences, many design guidelines for regular e-commerce site design may not apply to the wireless environment. We are therefore seeking answers to the following questions:

* What is the most suitable information to be presented on handheld devices?
* How should information be organized in order to facilitate the searching process?
* What is the best format for presenting information on handheld devices? Text? Graphics? Or both?
* How should human limitations be considered in designing handheld devices? What is the best input method?
* How should a regular Web page be displayed on handheld devices? Is automatic conversion possible and suitable? Is it necessary to restructure the whole page?
* Which Web design principles, such as information architecture, are applicable for wireless applications? Which new design principles should be developed?
* How should Websites be designed for wireless access? How should the time factor be taken into account in designing the interaction between user and device?
* How should services and information presentation be deployed in the two environments in order to optimize user trust and efficient access? Which tasks are essential for mobile users and how information and user interface can be simplified in the wireless mode?

The objective of this study is to investigate how commercial Websites are handling these issues at current stage and what are the existing problems. Based on the findings, further study will be conducted to address existing problems.

Methods

This research will involve several expert reviewers to conduct a heuristic evaluation and cognitive walkthrough for reviewing fifteen wireless sites. The reviewers will critique wireless sites regarding user interface and overall design in order to determine their conformance with a short list of design rules. These rules are compiled based on generic guidelines of human-computer interface design, Web page design, and e-commerce design. Using the cognitive walkthrough method, expert reviewers simulate users walking through the interface to carry out assigned tasks, such as searching for and purchasing a book. The tasks for cognitive walkthrough analysis are the primary tasks that customers are expected to perform when using these sites. Cognitive walkthroughs encourage exploratory browsing which can help identify interface design problems (Warton, et al., 1994).

The fifteen wireless sites are the wireless extensions of a group of Websites selected from the top fifty ones ranked by Mediametrix (www.mediametrix.com). According to Mediametrix, an Internet media research company, these Websites are among those that have attracted the highest monthly traffic of unique visitors. We have tracked the readiness and deployment of wireless services by these fifty sites. Some of these sites provide online tutorial and instructions for downloading clipping applications for handheld devices; others rely on their wireless service providers to push the services. The fifteen wireless sites encompass a mix ranging from travel (e.g., Travelocity and United AirLines), retail (e.g., Amazon), financial services (e.g., e-Trade), news (e.g., ABCnews.com), to Internet portals (e.g., yahoo). Three form factors - PDA, WAP phones, and pocket PC - are used for usability evaluation. We will make comparisons across platforms, technology and connectivity services, because technical characteristics also influence the presentation and access of wireless sites.

Our preliminary observations indicate that the information architecture and design for many Websites have been replicated for the wireless environment. This results in excessive scrolling, overload of information, and confusion in navigation. Performance and access vary across different platforms and wireless service providers.

Contributions and Significance

This research will provide empirical evidence for ways to enhance usability for mobile commerce. On the basis of evaluating the existing usability guidelines, we will propose and validate new guidelines for wireless application development. Our findings will facilitate further research to address user concerns about effective coordination and access of commerce sites in both wired and wireless environments.

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