Interface Design Issues for Mobile Commerce

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INTRODUCTION

Effective interface design for mobile handheld devices facilitates user adoption of mobile commerce (m-commerce). Current wireless technology poses many constraints for effective interface design. These constraints include limited connectivity and bandwidth, diverse yet simplistic devices, the dominance of proprietary tools and languages, and the absence of common standards for application development.

The convergence of mobile Internet and wireless communications has not yet resulted in major growth in mobile commerce. Consumer adoption of m-commerce has been slow even in countries such as Finland, which have broadly adopted wireless technology (Anckar & D'Incau, 2002). An international study of mobile handheld devices and services suggests that mobile commerce is at a crossroads (Jarvenpaa, Lang, Takeda & Tuunainen, 2003). The enterprise and business use of wireless technology holds greater promise, but it demands the transformation of business processes and infrastructure. Poor usability of mobile Internet sites and wireless applications for commerce activities stands out as a major obstacle for the adoption of mobile solutions. For example, even with the latest 3G phones in Japan, consumers still find the small screen display and small buttons on these devices difficult to use (Belson, 2002).

BACKGROUND

Mobile Commerce

Mobile commerce broadly refers to the use of wireless technology, particularly handheld mobile devices and mobile Internet, to facilitate transaction, information search, and user task performance in business-to-consumer, business-to-business, and intra-enterprise communications (Chan & Fang, 2003). Researchers have proposed several frameworks for the study of m-commerce. Varshney and Vetter's framework (2001) presents 12 classes of m-commerce applications, ranging from retail and online shopping, auction, mobile office, and entertainment to mobile inventory emphasizing the potential of mobile B2B and intra-enterprise applications. The framework by Kannan, Chang, and Whinston (2001) groups mobile services into goods, services, content for consumer e-commerce, and activities among trading partners.

Waters (2000) proposes two visions for the potential and opportunities of m-commerce. One perspective argues that the mobile, wireless channel should be viewed as an extension of the current e-commerce channel or as part of a company's multi-channel strategies for reaching customers, employees, and partners. The second, more radical view suggests that m-commerce can create markets and business models.

Recent development in m-commerce has substantiated the first perspective. Major e-commerce sites have implemented their mobile Internet sites as an extension of wired e-commerce to support existing customers (Chan & Lam, 2004; Chan et al., 2002). Consumers have shown relatively low willingness to use m-commerce, but adopters of e-commerce are more likely to embrace this new technology (Anckar & D'Incau, 2002). Furthermore, perceived difficulty of use can affect consumers' choice of m-commerce as a distribution channel (Shim, Bekkering & Hall, 2002). These findings suggest that in a multi-channel environment, m-commerce *supplements* e-commerce instead of becoming a *substitute* for e-commerce.

Enterprise and business applications of m-commerce technologies seem to hold greater promise, because it is easier for companies to standardize and customize applications and devices to enhance current work processes. An Ernst & Young study (2001) of the largest companies in Sweden shows that, except for the retail industry sector, most industries have viewed m-commerce as being vital for growth and efficiency strategies, but not necessarily for generating new revenue. However, integrating the wireless platform in an enterprise requires significant structural transformation and process redesign.

Research on Wireless Interface Design

Several recent studies have examined interface design for mobile applications using handheld devices. Researchers have found that direct access methods were more effective for retrieval tasks with small displays (Jones, Marsden, Mohd-Nasir, Boone & Buchanan, 1999). Novice WAP phone users perform better when using links instead of action screens for navigation among cards, and when using lists of links instead of selection screens for single-choice lists (Chittaro & Cin,

2001). Ramsay and Nielsen (2000) note that many WAP usability problems echo issues identified during the early stage of Web site development for desktop computers, and could be alleviated by applying good user interface design. Such design guidelines for WAP applications include: (1) short links and direct access to content, (2) backward navigation on every card, (3) minimal level of menu hierarchy, (4) reduced vertical scrolling, (5) reduced keystrokes, and (6) headlines for each card (Colafigi, Inverard & Martriccian, 2001; Buchanan et al., 2001). Buyukkokten, Garcia-Molina, and Paepcke (2001) have found that a combination of keyword and summary was the best method for Web browsing on PDA-like handheld devices.

Diverse form factors have different interface requirements. The study by Chan et al. (2002) of 10 wireless Web sites across multiple form factors reveals that user tasks for the wireless sites were designed with steps similar to the wired e-commerce sites, and were primarily geared towards experienced users. Many usability problems, such as long download and broken connections, information overload, and excessive horizontal and vertical scrolling, are common to three form factors—WAP phone, wireless PDA, and Pocket PC. Interface design flaws are platform independent, but the more limitations imposed on the form factors, the more acute the design problems become.

Mobile users access information from different sources and often experience a wide range of network connectivity. Context factors have a particular impact on the usability of mobile applications. Based on a usability study conducted in Korea, three use context factors—hand (one or two hands), leg (walking or stopping), and co-location (alone or with others)—may result in different usability problems (Kim, Kim, Lee, Chae & Choi, 2002). Therefore, the user interface design has to consider various use contexts. Researchers also suggest a systems-level usability approach to incorporating hardware, software, "netware," and "bizware" in the design of user-friendly wireless applications (Palen & Salzman, 2002). Perry, O'Hara, Sellen, Brown, and Harper (2001) have identified four factors in "anytime anywhere" information access for mobile work: the role of planning, working in "dead time," accessing remote technological and informational resources, and monitoring the activities of remote colleagues.

Multimodal interfaces are gaining importance. The MobileGuiding project developed in Spain is aimed at building a European interactive guide network on a common, multimodal, and multilingual platform in which contributors will provide leisure information and cultural events in their locations (Aliprandi et al., 2003). Furthermore, there has been a study conducted in Finland that addresses the design and evaluation of a speech-operated calendar application in a mobile usage context (Ronkainen, Kela & Marila, 2003).

MAIN THRUST OF THIS ARTICLE

Five issues are essential to the interface design for mobile commerce applications, including: (a) technology issues, (b) user goals and tasks, (c) content preparation, (d) application development, and (e) the relationship between m- and e-commerce.

Technology Issues

Limitation of Bandwidth

Most mobile communication standards only support data rates that are less than 28.8 kbps. Connections to the wireless service base stations are unstable because signal strength changes from place to place, especially on the move. These constraints limit the amount of information exchanged between device and base station. Indication of the download progress and friendly recovery from broken connections are necessary to help users gain a better sense of control.

Form Factor

Mobile commerce services are accessible through four common platforms: wireless PDA devices using Palm OS, Pocket PCs running Microsoft Windows CE/Pocket PC OS, WAP phone, and two-way pagers. Within the same platform, different form factors may offer different functionalities. A developer should consider the form factor's unique characteristics when developing m-commerce applications.

User Goals and Tasks

Mobile users can spare only limited time and cognitive resources in performing a task. Services that emphasize mobile values, and time-critical and spontaneous needs, add more value for m-commerce users. These mobile services may include the ability to check flight schedules, check stock prices, and submit bids for auction (Anckar & D'Incau, 2002). In addition, mobile tasks that demonstrate a high level of perceived usefulness, playfulness, and security are the ones most likely to be adopted by users (Fang, Chan, Brzezinski & Xu, 2003).

Content Preparation

Constraints in bandwidth and small screen size demand different design guidelines. Most design guidelines for e-commerce (e.g., Nielsen, Farrell, Snyder & Molich, 2000) support the development of rich product information sets and a complete shopping process. In contrast, wireless Web sites have to simplify their content presentation.