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INTERFACE DESIGN *for Mobile Commerce*

UNDERSTANDING THE
UNIQUE CHARACTERISTICS
OF M-COMMERCE TO
ENHANCE AND IMPROVE
THE USER INTERFACE.

THE RAPID GROWTH OF MOBILE
TELEPHONY HAS PROVIDED A
FOUNDATION FOR M-COMMERCE,
NAMELY, E-COMMERCE ACTIVITIES
CARRIED OUT VIA A MOBILE
DEVICE, SUCH AS A CELL PHONE

OR PDA [8]. PROPONENTS OF M-COMMERCE CLAIM ITS
GROWTH AND SCALE WILL EXCEED THAT OF E-COMMERCE.
SUCH INCREASES, HOWEVER, APPEAR SLOWER THAN PRE-
DICTED FOR VARIOUS REASONS, INCLUDING DELAYS IN
TECHNOLOGY STANDARDIZATION, LIMITED MOBILE INTER-
NET COVERAGE, AND POOR SERVICE QUALITY.

Technology development is seriously challenged when users are slow to adopt the new technology; therefore, among the many cited reasons for slow growth, we focus here on the consumer perspective. We investigated the distinct characteristics of m-commerce in order to discover its strengths and vulnerabilities and are able to offer design prescriptions to enhance the interactivity of the interface, hence encouraging

users to adopt m-commerce.

Two characteristics of the mobile Internet and its devices define consumer purchase patterns: the mobile setting and the mobile device constraints. While consumers enrich their shopping experience by taking advantage of instant Internet access (mobile setting), current mobile devices also constrain consumers, due to their slow CPUs and limited processing power,

7Cs		E-Commerce	M-Commerce	
			Mobile Setting To support consumers' limited attention	Mobile Device Constraints To complement the insufficient display of mobile devices
Context	Focal Point	<ul style="list-style-type: none"> How a Web site is delivered Aesthetic and functional look and feel 	<ul style="list-style-type: none"> Linking structure that connects pages seamlessly but efficiently. 	<ul style="list-style-type: none"> Section breakdown that organizes information in separate pages
	Interface Implementation	<ul style="list-style-type: none"> Color and visual themes Layout (linking structure, section breakdown, and navigation tools) Performance dimensions (speed, reliability, and usability) 	<ul style="list-style-type: none"> Menu structured in a shallow rather than a deep hierarchy Layered sequential process rather than field selection process 	<ul style="list-style-type: none"> Summary and keywords that give a whole picture of information separated over pages.
Content	Focal Point	<ul style="list-style-type: none"> What a Web site presents to users Text, audio, pictures and video that sites contain 	<ul style="list-style-type: none"> The adaptive supply of product information and promotional messages to a user's setting 	<ul style="list-style-type: none"> Multimedia mix to utilize both visual and audio channels
	Interface Implementation	<ul style="list-style-type: none"> (a) Offering mix (the mix of product/service information), (b) appeal mix (the mix of promotional messages), (c) multimedia mix (the choice of media), and (d) content type (the degree of time-sensitivity) 	<ul style="list-style-type: none"> Proximate selection method that makes nearby located-objects easier to choose (gas stations, bank accounts) 	<ul style="list-style-type: none"> Conversion of visual information to audio format Use of non-speech sound
Community	Focal Point	<ul style="list-style-type: none"> User-to-user communication 	<ul style="list-style-type: none"> Interactive communication by connecting the people with similar needs 	<ul style="list-style-type: none"> To accelerate interactive information exchange despite inferior input/output devices
	Interface Implementation	<ul style="list-style-type: none"> (a) Interactive (chat, instant messaging, message boards) and (b) non-interactive communication (public member pages) 	<ul style="list-style-type: none"> Connection to shopping companions who share interests in common 	<ul style="list-style-type: none"> SMS, and graphics describing products, transferred through a user's phone book
Customization	Focal Point	<ul style="list-style-type: none"> The site's ability to tailor itself or to be tailored by each user 	<ul style="list-style-type: none"> Tailoring enhanced by information on users' mobile setting 	<ul style="list-style-type: none"> Filtering unnecessary information, so that a small screen contains only information that is highly useful
	Interface Implementation	<ul style="list-style-type: none"> (a) Personalization (log-in registration, personalized email account), (b) tailoring (based on past user behavior) 	<ul style="list-style-type: none"> Proximate selection method that emphasizes the object of interests, by combining a user's mobile setting (location, time, and resource) with his or her personal interests 	<ul style="list-style-type: none"> Personalized service based on known user profile (content and layout configuration without a need of log-in registration)
Communication	Focal Point	<ul style="list-style-type: none"> The dialogue between the sites and their users 	<ul style="list-style-type: none"> Broadcast messages relevant to a consumer's environment 	<ul style="list-style-type: none"> Alternative methods for interactive communication that overcome text typing with awkward input devices.
	Interface Implementation	<ul style="list-style-type: none"> (a) Broadcast (one-way information exchange), (b) interactive (two-way communication), and (c) hybrid (a combination of the two) 	<ul style="list-style-type: none"> Targeted advertising suitable at the point-of-purchase 	<ul style="list-style-type: none"> Customer feedback in multiple-answer or multimedia formats
Connection	Focal Point	<ul style="list-style-type: none"> Formal linkages between sites 	<ul style="list-style-type: none"> Pathways that present Web sites relevant to users' changing environment 	<ul style="list-style-type: none"> To reduce the probability of feeling lost given pathways provided
	Interface Implementation	<ul style="list-style-type: none"> Outsourced content, percent of home site content, and pathways of connection 	<ul style="list-style-type: none"> Adaptive map that shows the information about nearby stores 	<ul style="list-style-type: none"> The icon that gives a link to the starting page with one-click of 'cancel' button
Commerce	Focal Point	<ul style="list-style-type: none"> The shopping tools that support sales of goods 	<ul style="list-style-type: none"> Secure payment method demanding minimal cognitive attention 	<ul style="list-style-type: none"> Condensed checkout process
	Interface Implementation	<ul style="list-style-type: none"> Shopping cart, security, order tracking and delivery options 	<ul style="list-style-type: none"> Insertion of authentication into mobile phones 	<ul style="list-style-type: none"> One-click checkout process made available by storing a consumer's address, payment method, preferred delivery options

low bandwidth, and awkward input/output devices (mobile device constraints).

The mobile setting comprises three aspects: spatiality, temporality, and contextuality [4]. Spatiality encompasses the mobility of both users and devices by referring to the ability of consumers to roam anywhere while carrying their mobile devices. Temporality means mobile users can access the Internet instantly, even while engaged in a peripheral task. Contextuality is concerned with the milieu in which users conduct their mobile tasks, such as the degree of interaction with others. In order to provide task-relevant services, a context-aware application utilizes information on consumers' mobile settings, including the user's location and the people and resources nearby [11]. The fact that consumers shop in diverse contexts requires special attention [9]. While involved in a peripheral task (listening for a bus driver to announce the next stop), the consumer's cognitive resources assigned to the mobile transaction (purchasing a concert ticket) are limited. The multi-tasking nature of consumer behavior requires m-commerce interfaces designed to support users' limited attention.

Mobile device constraints are a function of the mobile setting. Small enough to be portable, mobile devices employ fewer resources than desktop computers [2]. As mobile technology improves, the features of mobile devices will become equivalent to those of desktop computers, except for the screen size. Some mobile devices, such as the Nokia 9290 communicator, have larger screens, but even these remain much smaller than the smallest desktop display. Thus, the m-commerce interface should be developed to compensate for the limited visual display of the devices. The mobile setting and device constraints suggest successful e-commerce interface design does not necessarily translate to successful m-commerce design. It is therefore imperative to improve the design elements of m-commerce interfaces to foster consumer adoption.

The seven design elements of the m-commerce customer interface.

Elements for Effective M-Commerce Interface Design

To develop effective m-commerce interfaces, we need a reference framework that informs us on how customer interfaces are shaped. We chose the seven

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design elements of the customer interface (7Cs) because they provide a comprehensive framework for analyzing m-commerce interfaces [10]. According to the 7Cs, a customer interface in e-commerce is composed of: context, content, community, customization, communication, connection, and commerce (see the table here). In the design of the 7Cs, prescriptions for each element need to be considered within the environment brought about by the mobile setting that increases the user's cognitive burden and the mobile device constraints that demand careful deliberation on structuring the content appropriate to small screens. To do this, we describe what each element connotes in e-commerce, then, how it should be adapted to accommodate the characteristics of m-commerce.

Context captures how Web sites are developed, consisting of functionality and aesthetics [10]. Given the mobile setting, the linking structure that connects pages seamlessly but efficiently should be provided, so that even distracted consumers can easily navigate through the material. Structuring a menu in a shallow (fewer levels but more choices per level) rather than a deep hierarchy (more levels but fewer choices per level) is recommended because a deep hierarchy increases the cognitive burden by forcing more choices over more levels [6]. Another alternative is adopting a layered sequential selection process employing sub-menus linked to the tasks users are most likely to proceed to. This differs from a field selection process requiring users to return to the main menu to move on to the next process [9]. Insufficient display space requires partitioning information into separate pages, thus making the issue of section breakdown important. Users must scroll up and down more often to read the separate pages and the resulting increase in their navigation activity significantly lowers their performance [3]. If a page is

provided containing a brief summary with key content, users can better understand a body of information fragmented over separate pages [2].

Content focuses on what a site presents, comprising the offering, appeal, multimedia mix, and content type [10]. The mix of product information (offering mix) or promotional messages (appeal mix) can be adapted according to consumers' purchase environment by virtue of context-aware applications. The proximate selection method makes the nearby located-objects emphasized or easier to choose [11]. Such located-objects include a non-physical service routinely accessed from particular locations (such as bank accounts) or the set of places users want to know about (gas stations or restaurants, for example) [11]. Multimedia mix is recommended to overcome limitations due to the lack of output screens. By converting some part of content into audio format, the output space can be saved [7]. Non-speech sound is also advised, given its language-independent and fast nature [1].

Community concerns interaction between users, including interactive and non-interactive communication. Shared information regarding mobile setting enhances interactive communication between users: they can connect to other users who reside nearby, or to those who have useful knowledge about products. Since consumers sometimes feel more satisfied when shopping with friends, interactive communication enabling opinion exchange about products is beneficial. Such capability can be realized with information exchange methods available on a small screen (for example, Short Messaging Service (SMS) or graphics describing products transferred through a user's contact list).

Customization refers to a site's ability to tailor itself (tailoring) or to be tailored by users (personalization) [10]. Information on a user's mobile setting

enables the automatic adaptation of the mobile interface (tailoring), and some part of such tailoring is associated with content. Customization reduces information load by filtering unnecessary information, thus alleviating the constraints of the limited visual display. Moreover, m-commerce provides potential for personalization, because mobile devices always carry the user's assigned identity.

Communication is defined as dialogue between sites and users: broadcast, interactive, and hybrid [10]. Targeted advertising through SMS or video mail is worth consideration. Time and weather changes are useful cues for selecting a message to be broadcast (selling skiing equipment when it snows, for example). Alternatives to the limited keypad input devices are needed to promote consumer feedback, such as multiple-choice answers or multimedia formats, such as voice and video mail transfer.

Connection refers to the extent of formal linkages between sites, consisting of outsourced content, percentage of home site content, and pathways of connections [10]. In mobile settings, pathways to other sites provide users with information needed in dynamic settings. The adaptive map linked only to the Web sites of nearby stores reduces the number of alternative pathways. A continuing concern is that consumers may still feel lost while navigating along these pathways, as the limited display makes it difficult to utilize navigation aids, such as a brief site map that helps users identify their locations. Accordingly, placing an icon that leads to the starting page with one click of cancel button is recommended.

Commerce is concerned with interfaces related to sales of goods and product services, such as a shopping cart and order tracking [10]. A secure payment method demanding minimal attention is required in the distracting mobile setting. By inserting a certificate of authentication into mobile phones, three parties—consumers, financial service providers, and m-commerce retailers—conduct mutual authentication [5]. Condensing a set of processes across several steps into a one-click checkout process becomes available by taking advantage of the known user profile containing a user's name, address, and a preferred delivery option.

Conclusion

Our primary motivation has been a desire to reduce consumer reluctance in adopting m-commerce. We quickly realized one inhibitor is the intimidating existing m-commerce interface developed on the foundation of e-commerce designs. New interface design suggestions must be made that consider both a user's limited attention span and the device con-

straints. All the design elements listed in the table here are constructed to suit the two unique characteristics of m-commerce. The 7Cs associated with m-commerce interfaces emphasize the importance of instant access to the desired information and an easy and simple transaction process. Such changes will induce consumers to make more m-commerce-based purchases as they can make informed decisions in a more user-friendly environment. ■

REFERENCES

1. Brewster, S., Leplatre, G., and Crease, M. Using non-speech sounds in mobile computing devices. In *Proceedings of the First Workshop on HCI for Mobile Devices* (Glasgow, U.K., 1998).
2. Buyukkokten, O., Kaljuvee, O., Garcia-Molina, H., Paepcke, A., and Winograd, T. Efficient Web browsing on handheld devices using page and form summarization. *ACM Transactions on Information Systems* 20, 1 (Jan. 2002), 82–115.
3. Jones, M., Marsden, G., Mohd-Nasir, N., Boone, K., and Buchanan, G. Improving Web interaction on small displays; www8.org/w8-papers/1b-multimedia/improving/improving.html.
4. Kakahara, M. and Serensen, C. Mobility: An extended perspective. In *Proceedings of the 35th HICSS* (Hawaii, 2002).
5. Kalakota, R. and Robinson, M. *M-Business: Roadmap for Success*. Addison-Wesley, Reading, Mass., 1999.
6. Kim, J. Exploiting context in HCI design for mobile systems. In *Proceedings of CHI 2001*. (Seattle, Wash., 2001).
7. Kristoffersen, S. and Ljungberg, F. Designing interaction styles for a mobile use context. In *Proceedings of the International Symposium on Handheld and Ubiquitous Computing, (HUC 99)*, 1999.
8. Mennecke, B. and Strader, T. *Mobile Commerce: Technology, Theory and Applications*. Iowa State University, 2002.
9. Pascoe, J., Ryan, N., and Morse, D. Using while moving: HCI issues in fieldwork environments. *ACM Transactions on Computer-Human Interaction* 7, 3 (2000), 417–437.
10. Rayport, J. and Jaworski, B. *Introduction to E-Commerce*. McGraw-Hill, New York, 2001.
11. Schilit, B., Adams, N., and Want, R. Context-aware computing applications. In *Proceedings of the IEEE Workshop on Mobile Computing Systems and Applications*. (Santa Cruz, CA, 1995).

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