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Natt Leelawat

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TABLETS VS SMARTPHONES: DIFFERENCES IN M-COMMERCE APPLICATION DESIGN

Natt Leelawat, Tokyo Institute of Technology, leelawat.n.aa@m.titech.ac.jp

ABSTRACT

Since the world is moving to the era of mobile Internet computing, the business conducting over the mobile devices became popular. Not only smartphones, but tablet computers also present a variety of new opportunities for business with their technological ability. The research question of this paper is “What are the differences in M-Commerce application between tablet computers and smartphones?”. Three comparison case studies of M-Commerce applications show the differences in the design for tablets and smartphones. The paper contains the introduction, the literature review, the information of current devices in market, the comparisons of M-Commerce applications, the discussions, and conclusions.

Keywords: Mobile Commerce, Mobile Application, Smartphone, Tablet Computer, User Interface.

INTRODUCTION

Era of Mobile Internet Computing

It has been predicted that mobile applications and media tablets are going to bring us to the era of mobile Internet computing as it can be seen in Gartner report [17] that they are the second strategic technology area for 2011, following only the Cloud Computing. While tablets are entering various other markets such as PCs, e-readers, and game handhelds, one-third globally view a tablet as an additive device or a signal for the broader technology market [30].

Tablet Computer

By definition, a tablet computer is a general-purpose computer contained in a single panel [38]. Morgan Stanley research [30] found that, tablets are accelerating the adoption of the mobile Internet in three vital aspects: (1) two-thirds of companies expect to allow tablets on their networks within a year; (2) consumer interest in tablets is even greater outside of the USA; and (3) the users are moving beyond web surfing, e-mail, games, video, and applications to content creation. Tablets are additive to the broader computing market.

Smartphone

A smartphone is a cellular telephone with built-in applications and Internet access.

Smartphones provide digital voice services as well as text messaging, e-mail, web browsing, video cameras, MP3 player, video viewing, and often, video calling [37]. It can be said that it is the product of convergence of regular mobile phone and personal digital assistant (PDA). The key drivers for its adoption are convenience, ease-of-use, security, privacy, and reliability [12].

Research question

Because most of the tablets and smartphones use quite similar operating systems, for example, Apple iPad and Apple iPhone use iOS, etc., and both of them are mobile devices that can be used for mobile commerce, this research came up with the main research question, what are the differences in Mobile Commerce application design for tablet computers and smartphones?

LITERATURE REVIEW

The emergence of broadband wireless infrastructure, through third-generation (3G) wireless connectivity and wireless LANs has broadened aspiration for delivering multiple types of mobile services [41]. There are many researches focusing on mobile commerce. This research reviewed some mobile commerce related technologies such as location based services, mobile advertising, and user interface design. As the trustworthiness is the important element of mobile commerce, it is reviewed in this part also. And finally, the Apple Mail application is selected to show the difference between its tablet computer version and the smartphone version.

Mobile Commerce

The main drivers of smartphones that enable convenient and secure mobile commerce services are electronic wallet application, electronic payment application, 3G Internet broadband access, high computing and communication performance, multimedia contents, etc. [12] There is a limited number of researches about mobile commerce specific on tablet computers, however, since most tablet computers apply the similar technology as smartphones, especially the operating system, all of the drivers are assumed to cover the mobile commerce on tablet computer also. There are many mobile commerce applications published in various mobile portals, which serve for each

platform, such as Android Market (for Android), App Catalog (for webOS), App Store (for iOS), App World (for BlackBerry OS and BlackBerry Tablet OS), Ovi Store (for Symbian), Windows Phone Marketplace (for Windows Phone), and other third party portals such as Amazon AppStore (for Android), etc. When developing mobile commerce applications, attention is recommended to the usefulness and the navigation [36].

Location Based Services

Location plays a key role in determining the type and nature of human activity [41]. Location Based Services are services enhanced with and depend on information about a mobile station's position [60]. Foursquare is an example of the location based marketing. Shopkick and Groupon are examples of location based shopping business [57]. One major type of consumer demands relates to information about location and navigation; the second type is related to usable, personalized information delivered at the point of need; and the third type is the niche consumer applications [41]. Some critical success factors for the adoption of the LBS are identified as the protection of mobile user privacy, easiness of usage, and non-intrusive way of location based service operation [60].

Mobile Advertising

Mobile advertising is an integral part of mobile commerce [60]. There are many types of mobile advertising such as Banner: a graphic or animation banner which is the attractive click button; iAd: an interactive advertisement on iOS platform; Branded Apps: an advertisement whose targets are brand awareness or customer engagement; Mobile Display Advertising; Mobile Search Advertising; Advertisement during the idle screen, etc. [40].

User Interface Design

Design is a process that turns a brief or requirement into a finished product or design solution [2]. User Interface Design is very important and should be considered since the start period of application development. Interface design helps in increasing number of user adoption to the application. Because of the universal interface design for mobile devices, it facilitates user adoption for mobile commerce. It can be adopted by anyone regardless of the demographic differences [43]. Grid system is suggested to manage layout of e-Commerce design [27]. The design process seeks to generate a number of possible solutions and utilizes various techniques or mechanisms to think outside the box in the pursuit of creative or

innovative solutions [2], as many applications succeeded. Apple iPad is the first tablet computer runs on mobile operating system. According to the survey of YouGov [62], even though the largest group of the Apple iPad owners is between 25-34 years old, but the owners that are older than 45 years old (39%) are also not a small portion. Thus, we should also consider about the older adult users. On small displays, text sizes can indeed how well information is remembered. The users should be able to modify the displayed text size to minimize scrolling whenever possible. It is suggested that the option to adjust the text size should be available through adaptive zooming or navigation behaviors [52]. Fisk et al. [16] suggested that the use of attention-grabbling techniques should be minimized. The screens display with many different elements in a variety of attention-catching formats such as flashing and scrolling text and images in the periphery, are problematic for older adults trying to read text background, and text less able to ignore distractions. It is recommended that a display with a realistic background, and text is larger than 18-point font avoiding colored text, is preferred over the other combination of design variables [52]. At the perceptual level, object features such as salience and color can catch attention [56]. Bartram et al. [10] found that motion has several advantages as a notification mechanism. It is significantly better than static screen. The users can detect moving objects more than the peripheral targets. And the animated banners and popping images are not comfortable visual elements on a screen. Other than the Rayport and Jaworski [42]'s 7C for e-Commerce: Context, Content, Community, Communication, Collaboration, Connection, and Commerce; Lee and Benbasat [28] identified 2 new elements: Mobile setting and Mobile device constrains; as a framework for mobile commerce interfaces. Mobile setting is described as diverse shopping environments in term of time, place, and context, which often involves distraction or peripheral tasks, limiting user's attention. And the mobile device constraints are about to become portable, and employ fewer resources. Moreover, Oinas-kukkonen [36] mentioned that while usefulness is mainly a strategic matter, the navigation is a matter of systems design. And Chan et al. [11] mentioned the problems of design mobile commerce applications that should be aware as the long downloads and broken connection; vertical and horizontal scrolling; information overload, depth of site structure, and search issue.

Trustworthiness

Since trust is seen as a highly valuable element

of business relationships [14], it should be concern in mobile commerce. Egger [14] mentioned three principles: (1) Trustworthiness can be communicated before customers have accessed the web site (Branding); (2) Trustworthiness can be communicated during the online interaction (User Interface and User Experience); and (3) Trustworthiness can be communicated after the online interaction (Customer service and fulfillment). The affective design of e-Commerce user interface must be placed in the wider context of user interface and customer experience strategies.

Example application: Apple Mail

It can be understood some differences between application for tablet computer and smartphone from the example of Apple Mail application. Apple Mail is an STMP-POP3-IMAP-Protocol e-mail application, developed by Apple Inc., included in Mac OS X (for Apple computers) and iOS (for Apple iPad and Apple iPhone). Apple [5] mentioned about the differences between Mail in iPad and iPhone as the aspect of different users experiences of each device. Mail of iPhone is designed to help mobile users handle their e-mail while they are standing in line or walking to a meeting, while Mail on iPad is efficient enough for people to use in the go, but its rich experience also encourages more in-depth use. The vital differences of Mail in iPad are expanded support for device orientations; increased focus on message content; a flatter hierarchy; reduced full-screen transitions; and realistic messages.

CURRENT TABLET COMPUTERS AND SMARTPHONES

Devices in market

This research surveyed the current available tablet computers and smartphones in the market regardless the region. The releasing dates of the devices are during April 2010 – July 2011 (See Table 1 & 2 in the Appendices). The research found that the tablet computers have various display sizes from 5 to 12.1 inch diagonally and resolution from 800x480 to pixels, while 3.2 to 4.5 inch display size with 480x360 to 960x640 resolution pixels are available in the smartphone category. The display screen of tablet computers is averagely larger than smartphone by 2 times. From this point, it can be assumed that the users can enjoy richer information, larger area of touch screen (for the purpose of typing, writing, drawing, etc.), and more graphically contents on the tablet computers.

COMPARISON OF M-COMMERCE APPLICATIONS

Case studies

In this research, the author selected three cases in the mobile commerce applications based on the condition of the same developer companies; and they are available on both tablet computer and smartphone. The case studies consist of Showcase and Amazon JP; Rakuten Ichiba Ranking and Rakuten Ichiba; and eBay for iPad and eBay Mobile. The first pair can represent the international applications that are localized to the local users. The second pair represents the local applications. And the third pair represents the international application. In addition, they were mentioned in many researches [3, 4, 15, 20, 56, 59]. All of them are the free iOS mobile application available in Apple App Store in Japan. The study was conducted on Apple iPad 3G/WiFi 32 GB for the tablet's applications and Apple iPhone 4 16 GB for the smartphone's applications in Japan.

Showcase VS Amazon JP

They are developed AMZN Mobile LLC. They provide the secure environment e-Commerce environment as its PC site, Amazon.co.jp. The user interface of Showcase and Amazon are shown in Fig. 1 and 2, respectively.

Showcase. An Amazon's Windowshop application is named in Japanese language as Showcase. It is the first ranked application of Top Free Lifestyle application in the App Store Japan, with 4 stars voted (on July 25, 2011). Amazon promoted it as "Discover" a new online shopping way [8]. The user interface is shown in Japanese. There are top bar menu providing Home button, Category button, Search box, Menu button, and Cart button. The users can find the content by scrolling vertically in the content area. The categories can be changed by scrolling horizontally. Amazon member can purchase and add items into the cart, and buy them. The product page is a window appears over the previous screen with the closed button. The most related products stay as the option for the users to select in the vertical axis. The product page shows the product name and zoom-able photos. The left side menu consists of image, description, review and other 12 recommended products that the person who bought this product also bought.

Amazon JP. It is the seventh ranked application of Top Free Lifestyle application in the App Store Japan, with 2.5 stars voted (on July 25, 2011). It is fixed portrait interface, shown in Japanese. The bottom area of the screen provides

5 icons: Top, Search, Cart, Wish List, and Others. In the others, there are Recommended products, Photo search, Wish list search, Amazon point, Account service, Help, Fashion information, and Contact customer services. The top page changes to 3 recommended products according to the user's shopping history. More 50 recommended products can be found by scrolling vertically in the recommended product page. The information and sub-information in the product page consists of (1) photo: zoomed photo; (2) name & price: description; (3) number of other retailers sell new/used products; (4) customer review: comments; (5) recommended products which the person who bought this product also bought: 25 products; (6) Buy button; (7) Put into cart; and (8) Insert to wish list. All the steps can be easily finished by using only one hand.

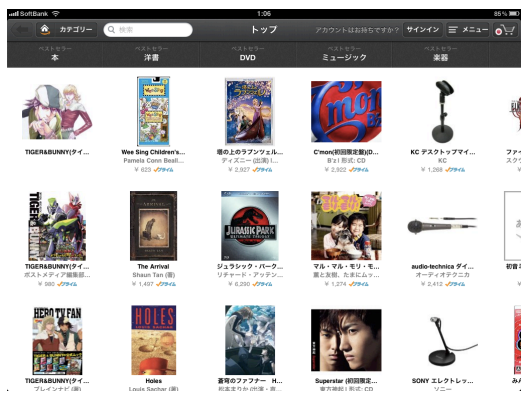


Fig. 1 Showcase user interface (on iPad)



Fig. 2 Amazon JP user interface (on iPhone)

Rakuten Ichiba Ranking VS Rakuten Ichiba

Rakuten, Inc., the biggest online shopping mall in Japan, developed many Japanese mobile applications such as Rakuten Ichiba, Rakuten Books, Rakuten Recipe, Rakuten GORA (Photo Gallery), Rakuten Infoseek News, and Rakuten Blog. The user interface of Rakuten Ichiba Ranking and Rakuten Ichiba are shown in Fig. 3 and 4, respectively.

Rakuten Ichiba Ranking. It is the eighth ranked

Top Free Lifestyle application in App Store Japan, with 2.5 stars voted (on July 25, 2011). Ichiba means Market in Japanese. The user interface is shown in Japanese. On the interface, there are three columns with five rows in the portrait position and 4x4 in the landscape position. Each column is independent movable. The columns are the categories of the products except the first and the second columns (Rakuten Staff Recommend and Top Rank). The row is arranged by ranking. Each column contains 100 products.

Rakuten Ichiba. It is the seventh ranked Top Free Lifestyle application in App Store Japan, with 3 stars voted (on July 25, 2011). It is a fixed portrait interface, shown in Japanese. It allows taking a photo of product barcode to find it in Rakuten market. In the top page, there are other special menus such as Search box, Barcode function, Favorite, Time sale, etc. The bottom menu consists of Home, Search, Ranking, Cart, Others (Favorite bookmark, My item, Help, Setting, Share, Member service, Group service, App service, etc.). The product page shows the product name, price, photo, detail, review, share function (to twitter, facebook, and mixi), and reviews.

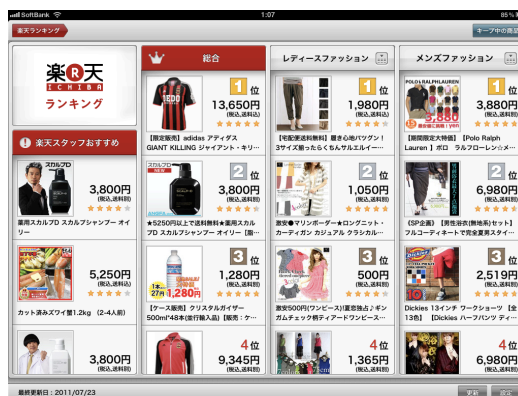


Fig. 3 Rakuten Ichiba Ranking user interface (on iPad)



Fig. 4 Rakuten Ichiba user interface (on iPhone)

eBay for iPad VS eBay Mobile

They are developed by eBay Inc. They are online auction and shopping applications. The user interface of eBay for iPad and eBay Mobile are shown in Fig. 5 and 6, respectively.

eBay for iPad. It is 3 stars voted (on July 25, 2011). It is rotatable to both portrait and landscape seamlessly. The interface is shown in English. It is different from the previous applications for the home page, which provides eBay Deals in the format of only one row in landscape and two rows in portrait. The users can view and scroll independently each row. After browsing into category and sub-category, the catalog shows on screen, initially, sorted by best match.

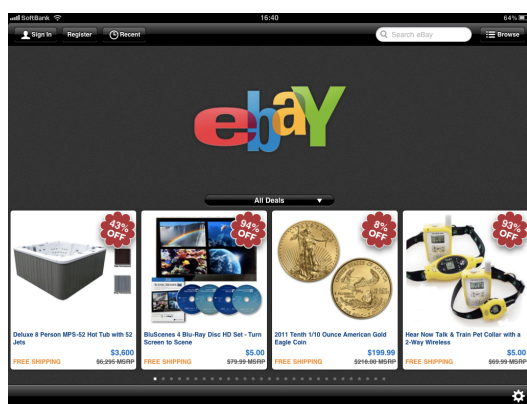


Fig. 5 eBay for iPad user interface (on iPad)

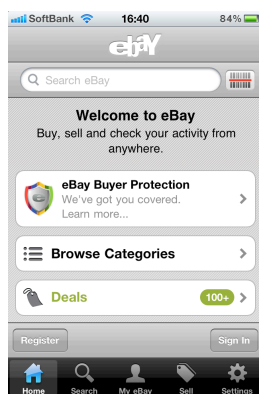


Fig. 6 eBay Mobile user interface (on iPhone)

eBay Mobile. It is 3.5 stars voted (on July 25, 2011). It is fixed portrait interface, shown in English. At home page, the upper part has search box and barcode function; the middle area contains eBay Buyer Protection, Browse categories, Deals Register button, and Sign In button; the bottom menu bar consists of Home, Search, My eBay, Sell, and Setting. In the product page, there are product name, zoom-able photos, description, time left (for auction), buy it now price, condition, location, shipping fee, ship-to location, Buy It Now button, Payment

method, Seller, Category, Item code, Share this item button (to Facebook, Twitter, Email) and Sell button.

DISCUSSIONS AND CONCLUSIONS

Discussions

While ICT evolves very fast, the potential of mobile applications should not be considered only with the limitations of the current wireless devices in mind. The general design principles are needed instead of technology-specific ones [36]. As the visual chaos is a usability barrier and obviously affected the aesthetic quality [27], the simple design is preferred. The developers should pay attention to text alignment, layout, font size, and color. As all of our selected applications' design, they provide simple user interface with easy-to-read content, and mostly white color background. For the age issue, it is not convenient to design for both age range sets, older and younger users, because there are high levels of the satisfaction. Therefore, the application should be targeted to a specific population. However, in order to make it suitable for everyone, the developer should design the easy-to-use user interface, and the best solution is the customization option [52], for example, the ability to zoom in the photo or text, etc.

Recommendation for Tablets

For the tablet computers, the application is displayed on the large area screen; however, the space should be designed effectively. To beware of confusion, the developer should design the application simple and reliable. Instead of all-in-one screen, the elements should be put only when they are needed. Using grid view seems to be a nice alternative to let the users see the whole picture before focusing on each detail. Nevertheless, the design and relationship setting for the grid arrangement should be careful, especially, for the initial users. As the benefit of large area, showing as catalog style is also possible. Designing the application with both portrait and landscape interface is suitable for the tablet computers, but it should work seamlessly.

Recommendation for Smartphones

For the smartphones, as the nature of the devices, the mobile commerce applications tend to display less image or photos than the tablet computer's, but focusing more on text. The category can be shown by the slide menu or drop down list that let the users tap until they can find the products. The detail with photo may be shown in the final product page. The application should not require the users to remember items

[11]. Therefore, the design should be focused on text and hierarchy (the number of touch-on-screen to finish the transaction) since one of the usage aspects is doing transaction while handling other activities. However, since good organization of information is critical for achieving greater efficiency, a flat hierarchy is recommended [11]. The portrait seems to be suitable for mobile commerce application of smartphones.

In addition, there are other issues to be concerned as the current constraints for the effective interface design such as the limited connectivity and bandwidth in some areas, diverse devices and operating systems, dominance of proprietary tools and languages, and the absent of common standards for mobile application development [43]. Since location can determine consumers' information needs and their product and service choices [41], the location-based services might be applied into the mobile commerce application if suitable. Finally, the developers are challenged to design the applications that accommodate both expert and novice users [11]. As one of the software development steps, after designing the application, the prototype should be tested by the users before launching.

Limitations and future works

There are presences of several limitations in this paper. Firstly, the comparisons are conducted on only one operating system, the iOS. Secondly, despite several mobile commerce applications are available, the particular applications are selected as the case studies. As further studies, other platforms, devices, and applications can be applied in the study. And the validation should be applied in the analysis.

ACKNOWLEDGEMENTS

The author would like to extend his heartfelt gratitude to Prof. Junichi Iijima and Iijima Laboratory for all the assistance and chance to do this research, and to MEXT for the scholarship.

APPENDICES

Table 1: Display of tablet computers

OS/Device	Display (inch)	Resolution (px)
1. iOS		
1.1 iPad	9.7	1024x768
1.2 iPad 2	9.7	1024x768

2. Android		
2.1 Vega	7	1024x600
2.2 EeePad Transformer	10.1	1028x800
2.3 Streak 5	5	800x480
2.4 EVO View 4G	7	1024x600
2.5 Flyer	7	1024x600
2.6 Optimus Pad	8.9	1280x768
2.7 Xoom	10.1	1280x800
2.8 Adam Tablet	10.1	1024x600
2.9 Galaxy Tab	7	1024x600
2.10 Galaxy Tab 10.1	10.1	1280x800
2.11 gTablet	10.1	1024x600
3. BlackBerry Tablet OS		
3.1 PlayBook	7	1024x600
4. webOS		
4.1 TouchPad	9.7	1024x768
5. Windows		
5.1 Eee Slate	12.1	1280x800

Source: [1, 6, 13, 21, 24, 29, 33, 35, 44, 50, 51, 53, 61]

Table 2: Display of smartphones

OS/Device	Display (inch)	Resolution (px)
1. iOS		
1.1 iPhone 4	3.5	960x640
2. Android		
2.1 Nexus S 4G	4	800x480
2.2 Droid Incredible	3.7	800x480
2.3 Evo 3D	4.3	960x540
2.4 Optimus 2X	4	800x480
2.5 Atrix 4G	4	960x540
2.6 Droid 2	3.7	854x480
2.7 Galaxy S	4	800x480
2.8 Infuse 4G	4.5	800x480
2.9 Galapagos 0003SH	3.8	800x480
2.10 Xperia Play	4	640x480
2.11 myTouch 4G	3.7	800x480
3. BlackBerry OS		
3.1 Torch 9800	3.2	480x360
3.2 Bold 9650	3.2	480x360
4. webOS		
4.1 Pre 2	3.1	480x320
5. Symbian		
5.1 E7	4	640x360
6. Windows Phone		
6.1 Venue Pro	4.1	800x480
6.2 Focus	4	800x480
6.3 Quantum	3.5	800x480

Source: [7, 9, 18, 19, 22, 23, 25, 26, 31, 32, 34, 39, 45, 46, 47, 48, 49, 54, 55, 58]

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