This is a working draft that led to an article publication. A reference to this work should always be done using the following citation:


This material is presented to ensure timely dissemination of scholarly and technical work. Copyright and all rights therein are retained by authors or by other copyright holders. All persons copying this information are expected to adhere to the terms and constraints invoked by each author's copyright. In most cases, these works may not be reposted without the explicit permission of the copyright holder.
Chapter *

A comparative study of in-store mobile commerce applications and feature selection, targeted at enhancing the overall shopping experience

Electra Safari
Department of Product & Systems Design Engineering
University of the Aegean, Syros Greece
dpsd08066@syros.aegean.gr

Dimitrios Zissis
Department of Product & Systems Design Engineering
University of the Aegean, Syros Greece
dzissis@aegean.gr

1 Introduction

In recent years we have witnessed the explosive growth of a previously non-existent market. The widespread use of personal computers and the introduction of high speed internet connectivity made the process of sharing business information, maintaining business relationships, and conducting business transactions by means of telecommunications networks a reality. Since the 1990s, a new type of electronic commerce conducted through handheld devices has been rapidly gaining momentum, mostly due to developments in communication technologies and portable computing. This subset of e-commerce, labeled mobile commerce, is attracting significant attention and is shifting the way we conduct business from a wired to a wireless environment, using simply our handheld terminals anytime and anywhere (Ngai and Gunasekaran 2005). Due to its characteristics (amongst others ubiquity, personalization, flexibility) mobile commerce promises businesses unprecedented market potential, great
productivity, and high profitability (Siau et al. 2003). The number of mobile phone users is rising continuously as the market of mobile technologies is promising speed and convenience. Currently an overall of 10% of global website views are from mobile devices (smart phones and tablets). On Christmas day 2012, more than 50% of online activity came from mobile devices (Mixpanel 2012). Mobile technology in Japan currently accounts for 35 percent of all e-commerce transactions. In five years’ time, more than 50 percent of all transactions will be through smartphones (IPC 2012).

Various kinds of mobile applications have emerged as a result of these advances and are penetrating our everyday life, changing human behaviors, and generating important social and economic impacts (Xu et al. 2008). Among these efforts, mobile applications for shopping come at the intersection of ubiquitous computing and electronic commerce, and are gaining attention from both communities (Xu et al. 2008). Prior work though, has mostly focused on the transactional functions of mobile phones and information consumption on-the-go and less on the experiential aspect of shopping and how this can be improved via the use of wireless devices (Xu et al. 2008). Nowadays, there is a fundamental blurring of the boundaries between online and offline shopping (Gish 2012). Smartphones are fundamentally changing how people shop, browse, use coupons, find locations and enter local and near field promotions. Shopping behavior is changing and show rooming and snacking (shopping in a spare five minutes) are increasing (Gish 2012). The real and the virtual world are converging into a complete shopping experience. It is becoming typical user behavior for consumers when in stores, to go for their handheld devices in search of additional product information, better prices, location information in an attempt to speed up the overall shopping process and gain a better shopping experience.

Channels are blending and consumers are shopping wherever, whenever and however they want. According to Forrester, 50 percent of retail sales are influenced online (IPC 2012).
As part of its “Mobile path to Purchase” research, Nielsen and Telmetrics reported that a 46% of mobile users rely exclusively on their mobile device for retail pre-purchases in the stores while, interestingly, half of the audience does not need to do a PC research before buying (Sterling 2013).

However, current retailers do not seem to be tuning successfully into this new trend. While in “wired” settings, we have accumulated the necessary knowledge to design and develop commercial systems effectively, the field of m-commerce presents unique opportunities but also challenges. It faces a number of business, technical and legal challenges that differ from traditional e-commerce, specifically in relation to location-based services (Tsalgatidou et al. 2000). A thorough analysis of the design space of in store shopping is a necessity, in addition to the way that mobile device interaction can get embedded in the shopping experience in benefit of the customer (Xu et al. 2008). Moreover, factors that influence actual adoption of mobile shopping applications, such as value creation, user acceptance and entertainment must be examined in detail, so that we gain an understanding of the mobile customer’s requirements.

In this chapter, we focus on the type of mobile commercial applications that consumers use when shopping in large retail stores or shopping halls, so as to speed up the shopping process and gain an ideal shopping experience. More specifically, we are concerned with the non-transactional functions of commercial applications that can offer convenience and fun during the shopping process. The chapter is structured as follows: we first attempt to define the boundaries of our research by accurately defining the problem space, evaluating the benefits and detriments but also the inherent complexities of designing and developing such applications. Within this scope, we perform a literature review with the purpose of eliciting requirements for m-commerce applications. Requirements elicitation, is recognized as one of the most critical, knowledge-intensive activities of software development; poor execution of
elicitation will almost guarantee that the final project is a complete failure (Gottesdeiner 2002, Hickey and Davis 2003). The process of requirements capturing can be broken down into discovery (elicitation), analysis, modeling and documentation, communication, and validation (Schedlbauer 2011). The volatile nature of m-commerce requires we perform a validation of collected requirements; we employ methods such as interviews, surveys and on-site interaction to effectively validate the requirement set. Additionally we perform a comparative study of available in-store commercial applications in a contextual setting, with classification based on user acceptance, in an attempt to identify the characteristics and design features of such an application. From these, a design framework stems, with guidelines and recommendations of considerations that can assist designers and developers of mobile onsite shopping applications with the ultimate goal of designing a better overall shopping experience.

2 Mobile commerce in the shopping field

Mobile electronic commerce (Tsagaltidou et al. 2000) has recently emerged as a subset of e-commerce and refers to those activities that rely solely or partially on mobile e-commerce transactions. It operates in a different environment than e-commerce, which can be viewed as conducted in the fixed desktop Internet metaphor, mostly due to the different characteristics and constrains of mobile devices, constraints of wireless networks and ultimately the context, situations and circumstances in which people use their hand-held terminals.

Advances in telecommunication of the last decade have made mobile commerce one of the main channels for purchasing products. Its features, like ubiquity, reachability, localization and dissemination (Siau et al. 2003) combined with the recent advanced capabilities of mobile devices have provided the consumer with a great device for decision-making. Due to this we are witnessing a shift from electronic shopping and in-store shopping to a crossbred
shopping experience that includes in store shopping using a mobile device for every step of the shopping process.

Shopping behaviour is changing. Channels are blending and consumers are shopping wherever, whenever and however they want (Gish 2012). According to Forrester, 50 percent of retail sales are influenced online (IPC 2012). The consumer has found in m-commerce a better way for conducting shopping “on the go” in a more convenient, time-saving and pleasurable way, while simultaneously benefiting from a more personalized service. But mobile commerce benefits are not strictly consumer driven. Businesses can increase their market potential, productivity and profits, through managing smartly this upward trend (Siau et al. 2003). Retailers now have the chance to influence consumers in a more direct way, by identifying the mobile shopping space and adjusting their services to it. By exploiting mobile commerce capabilities they are able to track their customer’s location and promote special discounts, e-coupons, and messages, identify their special needs and inform about desired products, direct them inside the store till the point of purchase.

Despite the benefits of mobile commerce for consumers and retailers, there are many constrains induced by the characteristics of wireless communications, the devices and the context of mobility itself (Tsagatidou et al. 2000). Wireless communication constraints are attributed to the quality of service of the networking infrastructure consisting of various wireless networks (LAN, WAN, satellite services etc.) and other protocols, standards and technologies. This complex networking system is responsible for the efficiency of mobile commerce activities and must be taken into account when designing an m-commerce system so that problems like frequent disconnection, loss of data, slow download rate and others are eliminated.

The design and development of mobile applications is highly complex and challenging (Charland and Leroux 2011). It concerns developing for a number of different operating
systems and devices with various characteristics, in a diverse set of programming languages. In such a fragmented field, designers and developers have to comprehend the restrictions of the technology (e.g. small screen, memory, CPU) and the particular technical characteristics of mobile operating systems (e.g. iOS, Android, Windows phone, etc) (Forman 1998). In addition, mobile devices are characterized by a unique synthesis of interaction affordances that can actually transform the user experience when compared to desktop platforms including: gesture-based, multi-touch interaction with digital content; location awareness and subsequent service and content adaptation; advanced sensing capabilities (with embedded devices like: accelerometer, gyroscope, GPS, camera etc.); multimedia (photos, sound, video) capturing and sharing (Ferreira et al. 2012, Corey 2010, Reddy et al. 2010). Therefore, mobile application development requires a whole new way of thinking in respect to interaction design and HCI, as well as to software development. Device constrains are enhanced mostly due to the nature of the devices themselves; especially their portability. To be easily carried around, mobile devices are light and small. As a result they have smaller screens, keypads, memory, disk capacity and processing power, combined with high power consumption. Mobility constrains are related to the continuous switch of locations of a mobile user and the various scales of bandwidth networks he/she may connect from. User device location tracking can often be interrupted because of often movement and unavailability of networks. Mobility also raises complex security and authentication issues (Tsalgatidou et al. 2000).

In mobile commerce we also identify several requirements that are not available to traditional electronic commerce and that should be considered in the development of m-commerce systems and applications. Influenced by Varshney and Vetter’s (2002) proposed framework for mobile commerce application implementation, we identified three important areas of interest for m-commerce applications from which several requirements derive. Those are:
1. Software (mobile interface and mobile middleware)

2. Hardware (mobile hand held devices such as PDAs, mobile/ smart phones) and

3. Wireless Network (wireless mobile network infrastructure)

We developed a diagram that summarizes the most significant requirements and constraints resulting from each one of the above areas (Figure 9.1). Software requirements can be classified (ISO/IEC JTC1/SC7 N4098) according to the assigned and inherent (existing or permanent characteristics or features) properties of a software product. Moreover, inherent properties can be classified as either functional properties or quality properties. Functional properties determine what the software capable of. In our case these domain specific functional properties include basically the functions of a mobile commerce system that we want to examine (e.g. locating an item, searching for prices etc.). Quality properties determine how well the software performs. In other words, quality properties indicate the degree to which the software is capable of providing and maintaining specified services. Hardware requirements derive from the nature of mobile devices and their capabilities. Networking properties refer basically to constraints and challenges related to connectivity and bandwidth issues (Varshney and Vetter 2002). Varshney and Vetter (2002) categorized networking requirements for m-commerce applications into five groups, such as location management, multitasking support, network dependability, quality-of-service and roaming across multiple networks.
A number of classes of m-commerce applications can be identified, including mobile financial applications, mobile advertising, mobile inventory management, product locating and shopping, proactive service management, wireless re-engineering, mobile auctions or reverse auctions, mobile entertainment services and games, mobile offices, mobile distance education, and wireless data centres.

In our research we focus on “Product locating and shopping” class (PLS) which includes applications that locate an item in a particular area or location. This also concerns finding an item with certain specifications and its availability across stores (Varshney and Vetter 2002). Although m-commerce activities include trading of goods and services of economic value, this is not strictly limiting; thus our research does not deal with the transactional aspect of mobile shopping. We are more concerned with the experiential aspect of shopping via hand-held mobile devices aiming at simplifying several consumers’ tasks. Within this context we attempt to identify the set of requirements, which should be met when designing
an m-commerce application; this set will lead to the specific (design) principles of a m-commerce application targeting at improving the shopping experience. In the next step of the related literature review, we attempt to specific design requirements related to our class of applications’.

3 Consumer Behaviour

Today’s shoppers generally find the shopping experience at existing retail stores satisfying on the dimensions of convenience, product quality, value provided and product selection. However, they express their dissatisfaction with the speed of shopping, level of service, available product information, fun of shopping, security and privacy (Burke 2002). In the last decade, technology has appeared as a viable solution to many of the previous requirements. Mobile phones tend to become a growing shopping channel, filling in gaps in the shopping experience, while providing a better, more convenient and efficient overall way to shop.

Currently, consumers search several stores to find an item of a certain brand, size and characteristics to fit their preferences, required features and price. Using a hand-held device and an online product information service, a user is capable of navigating to the exact location of a store or a certain product (Varshney and Vetter 2002). In the case of large shopping stores and malls, consumers attempt to use their mobile devices in store, to speed up the shopping process (using indoor maps for tracking and navigating) so as to gain a pleasant, convenient and efficient visit in the shop and even avoid staff’s “sales pressure”.

Chuck Martin, the CEO of Mobile Future Institute, stated recently that mobile is turning “path to purchase on its head” (2013). Shopping is becoming an iterative rather than a serial process. Consumers no longer go shopping, they always are shopping, he continues. Peter Hackbert (2012) indicates that the phenomenon is growing especially among smartphone users, which he calls “app-happy”. In his research he found that 56% of
Smartphone owners have at least one shopping-related app installed on their phones and 15% have more than six shopping apps currently on their phones.

4 Choice of Comparative Study and Environment

In order to create a useful design framework for mobile in-store shopping applications we conducted a three level study, consisting of a literature review, an online survey and an on-site comparative study. The research is organized as follows:

First we perform an extended literature review with the purpose of eliciting requirements for m-commerce applications. Requirements elicitation is recognized as one of the most critical, knowledge-intensive activities of software development; poor execution of elicitation will almost guarantee that the final project is a complete failure (Gottesdeiner 2002, Hickey and Davis 2003). The process of requirements can be broken down into discovery (elicitation), analysis, modeling and documentation, communication, and validation (Schedlbauer 2011). The volatile nature of m-commerce requires we perform a validation of collected requirements.

Following this, we employ methods such as interviews, surveys and on-site interactions with customers to effectively validate the requirement set. We conducted an online survey audience so as to confirm which of the above identified requirements were actual consumer needs or could be considered as constraints and identify new ones.

The third part of our work included the comparison of several features in existing mobile applications as well as the evaluation of the requirements gathered in the second step, in real-time conditions. To do this, we chose an on-site field study so as to identify additional usability and interaction issues, as well as measure user satisfaction throughout the whole shopping process. We conducted our study in the “Public” store located in the center of Athens, Greece. The store is structured as a large showroom with multiple floors organized by
product category. Its purpose is to encourage people to walk in, experience the various products and ask questions. We have chosen several existing mobile shopping applications and an appropriate number of users that cover a range of ages and both genders. These applications support in-store shopping activities such as:

- Creating and managing shopping list
- Checking product prices and discounts
- Locating a product in nearby stores
- Finding product information and customer reviews through scanning (Barcode, QR code, Image Recognition)
- Comparing product features
- Sharing a product with friends

Some of the applications contained transactional functions like purchasing a product online or mobile payment via a credit card. However, we excluded these features from our research as security and privacy issues could be raised.

4.1 Requirements Elicitation

When designing mobile applications that contribute to the convenience of the shopping process for consumers, there are a number of specific requirements that should be considered, as the shopping experience is related to meeting specific consumer’s needs and pleasuring the customer. System and application design alike should be approached from the point of entertainment service provision (Roussos et al. 2003). Roussos G., Kourouthanasis P. and Moussouri T. (2003) examined this retailing entertainment or “retailtainment” aspect of m-commerce by developing a grocery shopping system. In the first step of their research they collected several user requirements conducting a field study of a target audience. The study revealed a number of user required features, including features supporting a constant aware-
ness of total shopping costs, access to complete and accurate product descriptions, comparison of value of similar products, personalized and targeted promotions, in-store navigation and smart checkout. In the second stage of their research real-time user scenarios were conducted so as to evaluate the system. Participants claimed that using the system transformed the shopping experience into a less stressing experience. However, several privacy constrains were identified. Participants were especially concerned about collection and storage of personal data, even though data protection policies were confirmed.

When shopping in a large store e.g. a shopping mall or supermarket, user requirements are amplified, as customers’ needs grow. Corresponding applications are expected to provide additional functions that can transform the uncomfortable and often disorienting mall experience, into a pleasant, convenient and friendly visit. Some of these additional requirements relate to features such as customer in store guidance and “to-product” guidance. In this context, Asthana, Cravatts and Kryzanowski (1994) developed a wireless personal shopping assistant based on the capabilities of customers’ wireless communication devices. In their work, they support that such a personalized nature of service, can add not only to customer’s convenience, but could also be a source of direct and indirect revenue for the shopping center. The system must be simple and help the customer navigate within the store and inquire about items. In some cases, it may even track the customers shopping history so as to provide relevant information to them. Asthana, Cravatts and Kryzanowski, as did Roussos et al., identified several constrains that are following the implementation of this system and its functions such as privacy issues, or the size, weight, power consumption and frequency bandwidth for the handheld device.

Xu Y., Spasojevic M., Gao J. and Jacob M. (2008) also tried to explore the experiential aspect of mobile shopping in their design approach of a vision-based mobile interface for in-store shopping. After conducting a one-month long diary study they formulated a list of
design principles for mobile shopping applications. Firstly, they support that these applications should not demand a high and continuous level of attention, so as not to interfere with the shopping experience itself. Secondly, the portability of the mobile phone platform and its connection to other resources, need to support the shopping activity over a longer term and across different locations. Moreover, mobile shopping applications need to simplify access to product information (in comparison to desktop usage) and provide highly relevant content in relation to location, time and personalization opportunities. Mobile shopping applications need also to focus on supporting organizational and communicational functions, as these are considered important by consumers. Lastly, they mention that online and in-store shopping experiences, need to be bridged as the user’s cognitive load of shopping tasks, when switching from one context to the other, should be minimized. Interestingly, after examining their application via a number of user real-time scenarios, they also found that participants were more than interested in sharing and saving functions such as “adding a product to a wish list” and “send to a friend” functions.

Adelmann (2007), in his study on mobile phone interactions with everyday products, claims that the existence of a good middleware is the solution for a fast and convenient interaction between the handheld devices and the products. He supports that “when being on the go, a simple and fast user interaction is essential”. For succeeding in this, he states that a good recognition rate must be provided by the application. Most of the times recognition conditions are bad because of limited lighting, low camera resolution, possible hand movement when scanning or even the quality of the image. When in the shopping field users have neither the convenience to scan products appropriately so that the system will return them the related information, nor the time to manually enter data into their phone. As a result a mobile shopping application should ease and accelerate the interaction process, relying mostly on
tag-based interaction whenever possible and using good recognition algorithms that can cope with complex lighting conditions (Adelmann 2007).

None of the above published works and in the overall field literature, less attention is paid to the role of aesthetics as being an influential factor in the use of mobile commerce applications. Cyr D., Head M. and Ivanov A. (2006) tried to explore the possibility of visual design aesthetics leading to “mobile loyalty” of users. They discovered that an aesthetic design could significantly impact perceived usefulness, ease of use and enjoyment all of which ultimately influence user’s loyalty towards a mobile service. User acceptance of new and well-designed technologies and interface is crucial to the adoption of mobile commerce systems.

Stemming from our review of relative articles we made a list with the specific design requirements for mobile shopping applications below:

- should not demand a high, continuous level of attention
- should minimize cognitive load of shopping tasks
- have simple and fast interaction, hands-free operation, minimize data entry whenever possible
- have an aesthetically pleasing design
- support organizational and communicational functions (create lists, sharing functions)
- provide an accurate item recognition and interaction function
- calculate the total shopping cost constantly
- provide access to product information and descriptions
- locate a product’s specific position
- navigate the customer inside the store
- compare value of similar products
• provide personalized and targeted product promotions

• provide smart checkout method

Many constraints and restrictions identified in the relative research were related to privacy and security issues, pointing to a lack, but also to the necessity of trust between the customers and commercial institutions. Additionally issues that derive from the nature of handheld devices and wireless communications were mentioned, such as the size, weight, power consumption, frequency bandwidth, coverage area and connectivity.

4.2 Communication & Requirements Validation

We identified m-commerce requirements for shopping applications and within this context we performed an investigation, using online questionnaires and onsite interviews, to validate the requirements set and identify any additional unique requirements. The methods selected for this survey included user feature testing, questionnaires and wrap-up interviews with customers at a shopping mall in Athens, Greece.

The questionnaire comprised of a total of thirteen (13) questions: the first five (5) were demographic, and the rest focused on requirement identification and validation. We conducted our questionnaire online directed to 158 people of ages between 10 and 70 enquiring about their experience with wireless devices, their usage of electronic or mobile commerce, if they had ever tried an m-commerce application while shopping in a store and what exact functions they had used during their shopping trip. We also asked participants to propose any features they believed would improve their shopping experience, but also identify elements that could deter it.
A total number of 158 participants took part in this survey; they were between 10-70 years of age: 66.46% of users were between 16-24, 29.75% of users were between 25-45 and 3.80% between 46-70%. As expected a huge number of the audience (75.95%) were smartphone users and a 15.19% also used tablet devices (Figure 2). We enquired about device ownership and attempted to identify market fragmentation (Figures 3 and 4). It was interesting to see that even in a small fragment of the overall market, device fragmentation percentages seem to be very close to other published reports (Android as a market leader, followed by Apple and Windows).
To examine their history with electronic commerce we asked them if they ever purchased an item from the Internet (Figure 5). A large percent responded positively as having shopped occasionally at popular commercial websites such as eBay.com (52.90%), Skroutz.gr (31.16%), Amazon.com and E-shop.gr (39.13%) and other. Interestingly, only 40 users out of 158 have ever used their mobile devices to perform electronic shopping, either by visiting a related website, by downloading a mobile shopping application or both (Figure 6).
We then asked them if they had ever used a mobile shopping application to simplify their shopping experience and if not what were the reasons (Figure 7). A 25.95% claimed to have used a shopping application while inside a store so as to compare prices or products with similar features (65.96%), create a list with products (42.55%), calculate total shopping cost (27.66%), check product availability in the store’s stock (25.53%), find discounts (25.53%) and search for the same product in nearby stores (23.40%) (Figure 8). However, a large part of the audience that responded negatively in the previous question claimed to often use the Internet to research certain products before visiting a traditional store or did not know that such was possible. Some of the respondents also commented that most of these applications are time consuming and can get frustrating due to continuous network disconnections; thus prefer using a desktop or laptop before visiting a shop. Others of course supported that mobile applications are a more fun and entertaining way of shopping. A big drawback identified by a large number of users was that many stores do not always provide free internet access for customers.
We also asked the audience to identify which feature was more important for a mobile shopping application in their opinion (Figure 9). Functions like comparing prices and product features, checking stock availability, searching product in nearby stores, finding discounts and calculating total cost were most highly rated. Instead, interestingly, activities such as locating a product and navigating in the store, purchasing a product and sharing product/list/purchase with friends or creating a shopping list, did not attract so much interest. Some of the respondents also suggested that the system should provide customer reviews and information about the country of origin, product guarantees, history of purchases in that store or even recommend to them related products that can be used in the same way with the one they are searching for. It is interesting to view the differences between most used and required features for m-commerce in shop applications. Although comparing product features remains the top choice in both occasions, finding discounts and products in other stores are the second top required features.
Enquiring about what features customers find more important in relation to mobile shopping, respondents preferred simple and easy interactions, accuracy and speed in results provided, good visual design and the elimination or automation of steps to result (provide a wide range of search features, accept speech input instead of manual data entry, not to surpass 4 steps otherwise it gets tiring). They also found important not having to download another application so that the first will be in the position to operate (this is often required by application using external libraries for QR code or other image recognition capabilities). Some respondents commented that the application should be able to save their preferences so that they do not need to repeat them next time and to use their 3G connections wisely in case the store does not provide free Wi-Fi.

We finally asked the audience what usually prevents them from using a mobile application. Most of the respondents agreed that the time they have to wait and the number of steps (interactions) required before getting to the necessary result is an important barrier when “on the go”, while the price of an application (in case it is not available for free), the amount of power consumed, screen size, keyboard size, security and privacy issues remain important. A smaller percentage of responses referred to issues such as limited network capa-
ilities and frequent disconnections or the frustration caused by having to change networks when moving between locations. Some respondents added that the time spent, the complexity of such systems and the memory consumption are not worth using such applications most of the times.

Comparing the survey results with the requirements and constrains gathered in the first stage of our study we formulated a new list with the most important functional, quality and networking objectives of a mobile shopping application system:

Functional objectives

- Check product prices/discounts
- Find additional information about a product (characteristics, country of origin, guarantees)
- Compare value of similar products (provide product reviews and suggest similar products)
- Calculate total shopping cost
- Check availability of a product in the store’s stock
- Search for the same product in nearby stores
- Locate a product in the store
- Purchase a product (provide checkout method)
- Create and manage shopping list (create a list, save item to wish list)

Quality objectives

- Simple and fast interaction, ease of use and search, automate or eliminate tasks
- Interface design compatible with the size and capabilities of wireless device
- Information accuracy (high recognition rate, broader database search)
- Speed in providing results (high recognition algorithm, quick database search)
- Should not demand the installation of another application so as to operate
- Aesthetic interface design
- Security and privacy of personal data
- Minimize power consumption
- Minimize memory consumption
- Support organizational and communicational functions (create list, save products and past findings, share information)

**Networking objectives**

- Maximum connectivity
- Maximum frequency bandwidth
- Maximum coverage area
- Efficient location-based services
- Availability of resources provided in mobile devices

Stemming from the above, a design framework can be formulated (Table 2) presenting features that attempt to address predefined user requirements. This will be evaluated during the onsite evaluation.

<table>
<thead>
<tr>
<th><strong>Functional Requirements</strong></th>
<th><strong>Features</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Check product prices/discounts</td>
<td>Scan the barcode or the whole product / say or type the name/code of the product</td>
</tr>
<tr>
<td>Find additional product information</td>
<td>Scan, say or type product to find information about its characteristics, guarantee, country of origin, etc. via an automated database search</td>
</tr>
<tr>
<td>Feature</td>
<td>Description</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Compare value of similar products</td>
<td>Compare a product with a list of similar ones/ provide consumer reviews / suggest similar products</td>
</tr>
<tr>
<td>Calculate total shopping cost</td>
<td>Automate calculation of total cost of selected products e.g. scan product to add prices/ calculate existing price discounts</td>
</tr>
<tr>
<td>Search product in nearby stores</td>
<td>On map location tracking of nearby stores that sell the same product in different prices</td>
</tr>
<tr>
<td>Check product availability in the store’s stock</td>
<td>Scan, say or type product to check via the store’s database if it is available in the store’s stock</td>
</tr>
<tr>
<td>Locate product in the store</td>
<td>Indoor searchable store map</td>
</tr>
<tr>
<td>Purchase product</td>
<td>Scan and store loyalty cards, create an account that collects data of past purchases</td>
</tr>
<tr>
<td>Create and manage shopping list</td>
<td>Provide features like “create new list”, “edit current list”, “add to wish list”</td>
</tr>
</tbody>
</table>

Table 1: Mapping functional requirements to design features

4.3 Onsite Evaluation & Comparative Study

In an attempt to evaluate if the objectives gathered above were met in existing high ranking mobile shopping applications and to identify additional characteristics and design features, we performed an onsite evaluation of such application features in a contextual setting. For this purpose we chose to conduct an onsite study in the “Public” store, located in the “The Mall Athens” shopping centre (a large shopping mall in Athens, Greece). We selected a number of applications based on user ratings, availability and features so as to cover as many as previously identified (Table 1). We interviewed a number of customers (20 customers) and
provided a device for them to interact with features of selected applications. Free internet access was available by the store.

<table>
<thead>
<tr>
<th>Features</th>
<th>APP 1</th>
<th>APP 2</th>
<th>APP 3</th>
<th>APP 4</th>
<th>APP 5</th>
<th>APP 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check product prices/discounts</td>
<td>Barcode scanning/manual data entry for search</td>
<td>Barcode scanning/manual data entry for search</td>
<td>Image recognition</td>
<td>Manual data entry for search</td>
<td>Internet search</td>
<td></td>
</tr>
<tr>
<td>Give additional product information (size, weight, color, etc.)</td>
<td>Database search</td>
<td>Database search</td>
<td>Google search</td>
<td></td>
<td>Internet search</td>
<td></td>
</tr>
<tr>
<td>Share a purchase with friends</td>
<td>Share item or list via Facebook</td>
<td>Share item or list via email, Facebook, Dropbox, etc.</td>
<td>Share item via Facebook, Facebook, Dropbox, etc.</td>
<td></td>
<td>Share item via Facebook, twitter or email.</td>
<td></td>
</tr>
<tr>
<td>Compare product features (get customer reviews, suggest similar products)</td>
<td></td>
<td></td>
<td></td>
<td>Item comparison through database search of similar items</td>
<td>Item comparison through database search of similar items</td>
<td></td>
</tr>
<tr>
<td>Calculate total shopping cost</td>
<td></td>
<td></td>
<td></td>
<td>Calculator feature (add items’ prices)</td>
<td>Online credit card account or gift card</td>
<td></td>
</tr>
<tr>
<td>Purchase product</td>
<td>Scan and store loyalty card</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Locate product in nearby stores</td>
<td>On map location of local stores</td>
<td>On map location of local stores</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create and</td>
<td>Shopping</td>
<td>Shopping</td>
<td>Shopping</td>
<td></td>
<td>Shopping</td>
<td></td>
</tr>
</tbody>
</table>
At first we required that the customers download the specific applications to their own smartphones and spend some time using each feature except from functions like “add to cart” or “purchase product”. During the overall process we interacted with the users, asking various questions and observing user patterns. Answers collected approximately matched the questionnaires results. Participants were mostly interested in features such as checking online product prices, finding discounts and reviews or local stores that were selling the same product inside the mall, as they supported that it is the only thing that the staff can not actually answer. They were also equally satisfied by either having to scan the barcode of a product or the product itself as the recognition was most of the times accurate and fast. However, they negatively commented on the fact that some applications still required a manual entry of the product’s name e.g. the title of a book. Finding details for a product was one of the features that did not gain much attention, as participants claimed that the store had a very good description of every product in the show room.

When questioned about the “create a list” feature, most of the participants replied that it could be really useful as they tend to forget their shopping notes at home or loose them. They also found it useful to be able to save some products in a new list which they could organize later. A participant commented that “I would definitely use it when window shopping for Christmas presents, so as to make a remember-to-buy list for later”. Possibly this feature could be used at later time to review product information on a personal computer and find bargains.

<table>
<thead>
<tr>
<th>manage shopping list</th>
<th>list feature (save to wish list, create new list)</th>
<th>list feature (save to wish list, create new list)</th>
<th>list feature (name a new list/add items)</th>
</tr>
</thead>
</table>

Table 2: Feature Testing in on site study
Most of the participants though found the “share to friends” feature not that interesting, supporting that they would not want to share information regarding a personal purchase on Facebook or other social sites, but they would rather like to share a product with a specific friend so to get his opinion (possibly by email). They did not seem to make use of the “total calculation cost” as they believed it would require too many steps to be completed.

None of the selected applications gave us the chance to test features like “check product availability” and “product location tracking” so we asked participants if they would possibly use one of these features. Interestingly one of the participants answered that “I would be amazed to have the chance to find if a product is available in stock, as sometimes staff lies if it is on bargain or offer”. Most of the participants found location tracking an interesting feature, as long as it is used for finding a product available in the shopping centre.

As we did not ask them to perform any transactional functions, we only requested their opinion about m-commerce transactions. We enquired if they would trust an application with their bank account or credit card details so as to electronically purchase an item. Responses were equally balanced. Some participants replied that they would have no problem as long as the application was certified by the store otherwise they would like to able to use a voucher or token bought from the store just for this purpose. Others although sceptical supported that paying without waiting in the queue would be an advantage.

During the interviews we noticed that most of the participants preferred those applications that offered the fewest functions or even one specific feature, as they were simpler to use. We enquired about the information architecture of each application, which one guided them better and if they where able to understand what they had to press. Most of them were disappointed by the general interface design of the applications at hand. They thought that some applications were better at providing information but had the “look & feel” of traditional websites as they had to do a lot of steps to get a result. Application interface design and
aesthetics was closely linked to store and brand quality. Consistency in functionality, information, and visualization across channels is important to customers (Song et al., 2013), but careful information design is necessary for mobile information outlets. One of the participants replied that “for almost all shopping related tasks three clicks (interactions) should be more than enough to get to the required result, as after that I am bored”. They instead liked those applications that had only one clear function and as a result not so much information screen cluttering. They commented on the fact that most of the applications required some experience before use, as their basic functions could not be easily detected when operating the application for the first time. A participant reported that “an application must ease your life rather than make it more complicated” after being asked about one of the applications. We finally asked them if the visual design played a role in spending more time using one application rather than the rest. Most of the participants commented that an aesthetic design would definitely prompt them to try the application (a person supported that the use of colours in an application was really helpful) but again the functionality and accuracy were the most important factors.

5 Conclusion

In this chapter, we presented our study of in-store mobile commerce applications and feature selection with the ultimate goal of designing a better shopping experience. We attempted to identify a complete set of requirements, which should be met when designing an m-commerce application; this set will lead to the specific (design) principles of an m-commerce application targeting at improving the overall shopping experience.

Considering the premature stage and the challenges faced in the field of m-shopping, we performed a three level research with the purpose of evaluating and discovering unique requirements. From the literature review we managed to collect a number of user require-
ments and several constrains deriving from related studies in the mobile shopping field. We then conducted an online survey to validate our findings according to the audiences’ preferences and needs, which resulted in a list of functional, quality and networking requirements. In an attempt to ensure if the objectives gathered are met in existing mobile shopping applications and to identify design features addressing these requirements, we performed an onsite evaluation of such application features in a contextual setting.

In addition to the functional properties, our study explored the aspect of middleware quality. The importance of good visual interface and efficient information architecture was indicated in the onsite comparative study, where consumers had to interact with the several application features. In the field study, the importance of simplicity and responsiveness was emphasized. Users tend to be satisfied from an application that returns accurate results fast and without complexity. They also prefer applications with clearly defined functions and an interface that provides straightforward navigation. As stated in Alqahtani and Goodwin (2012), the most important thing when designing mobile applications is to design the application in such a way that it does not distract the user from the main purpose of the application. Users also agreed that an aesthetic visual design, referring to colors, shapes, font types etc., actually influences them in choosing one application instead of the other and it could also be used for navigation purposes. However, in the end they based the value of mobile shopping applications in their capacity to simply offer required results on request.

References

Adelmann, R. 2007. Mobile Phone Based Interaction with Everday Products- On The Go. ETH Zurich, Institute Pervasive Computing, Zurich, Switzerland.


Cyr, D., M. H. 2006. Design aesthetics leading to m-loyalty in mobile commerce. Simon Fraser University, McMaster University, Canada, Management Information Systems/Information Systems/School of Interactive Arts and Technology, Canada.


Gottesdeiner, E. 2002. Requirements by Collaboration, Addison-Wesley


Ngai, E.W.T., A. G. 2005. A review for mobile commerce research and applications. The Hong Kong Polytechnic University/University of Massachusetts, Department of Management and Marketing, Department of Management, Hong Kong, Dartmouth.


**Figure Legend**

Figure 1: Mobile commerce requirements

Figure 2: User age group

Figure 3: User device of preference

Figure 4: Mobile device operating system fragmentation

Figure 5: Electronic purchasing

Figure 6: Percent of customers that have ever used their mobile phone/tablet to perform e-commerce related interactions

Figure 7: Percentage of users ever used an m-commerce application while in store

Figure 8: Most used/important features in m-commerce applications

Figure 9: Desired user features for in-store m-commerce applications

Table 1: Mapping functional requirements to design features

Table 2: Feature testing in onsite study