Developing the User Experience in Ubiquitous Commerce

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ABSTRACT
In this position paper we attempt to explore some of the possible effects on the consumer experience due to the introduction of ubiquitous computing systems in retail. We argue that ubicomp technologies may potentially transform the role of particular activities in fundamental ways. Our starting point is a recent study on consumer behavior carried out during the trials of a prototype ubiquitous retail system for grocery shopping. We have observed that novel shopping opportunities, enabled by ubicomp infrastructures can provide a more entertaining and stress-free shopping trip compared to conventional shopping, and thus transform a utilitarian activity into an opportunity for entertainment. We discuss how this shift affects consumer experience design.

Keywords
User experience design, ubiquitous commerce

RATIONALE
During the annual ECR Europe Conference which took place in Glasgow (2001), the Coca Cola Research Group presented its vision on how traditional supermarkets will operate in the near future. In effect, this presentation revealed that several trends will demand a revolution in nowadays food retailers' core business processes. Indeed, competition in the fast moving consumer goods (FMCG) sector is growing and evolving forcing retailers to continuously lower their profit margins. At the same time, the socio-demographic changes in nowadays consumer market (such as increased number of dual-income, single-parent and technology-familiar households) have significantly altered shoppers' expectations, demands and spending patterns during their traditional shopping experience (Kim, 2002). A recent survey identified that the "traditional family" has declined dramatically (Carter et al, 2003). In effect, it is estimated that by the year 2021 the average household size will comprise of 2.21 members (compared to an average of 2.7 on 1981) while there will be an increase of 30% of one person households (and a subsequent decrease of 33% for married couples). Moreover, the share of total retail expenditure accounting to groceries and food will decrease to 40% by 2004 compared to 50% in 1984. The presentation concluded with the remark that forging stronger consumer relationships and establishing consumer retention will become increasingly important thus, the selection of the appropriate consumer relationship strategy will be the fundamental building block for the successful economic future of tomorrow's food retailers.

This observation becomes more important if we take into account that the overall consumer shopping experience is affected by a number of store-related factors which include - but are not limited to - ambience (temperature, scent, music and so on) (e.g. Baker et al, 1986), service quality within the store (e.g. Aylott et al, 1998), store image (e.g. Levy et al, 2001) and situational elements (such as crowding, time and budget availability by the consumers and so on) (e.g. Donovan et al, 1982). All these lead to consumer dissatisfaction mainly through the form of increased levels of stress for the supermarket shopper (Aylott et al, 1998) and may result to create a new form of supermarket shopper: apathetic shoppers; people who have no interest in, or actively dislike, shopping and appear to endure rather than enjoy the whole experience (Reid et al, 1996).

The heart of the matter is that the traditional levers of price, selection and location – although still important - are no longer sufficient in order to achieve competitive differentiation. As a result, retailers should concentrate on enhancing the end-to-end shopping experience aiming to win customer loyalty by inventing innovative ways of satisfying customer needs. According to retail management theory, a shopping experience can be driven toward the maximization of efficiency or toward entertainment (Lewison, 1997, p. 138). It is therefore imperative that the retail value chain stakeholders should jointly discover the actual consumer needs and implement new shopping experiences.

The rapid evolution of new technologies presented both opportunities and risks for those retailers thriving to innovate. It should be emphasized that traditionally, the retail sector is very technology oriented, constantly experimenting with new technologies promising to streamline and optimize core operations within the store or the warehouse and communication within the entire value chain. Indicative examples include the introduction of Electronic Data Interchange (EDI) to standardize the ordering process between the supplier and the retailer, and the introduction of barcode scanning at check-out. Still, decades after the introduction of sophisticated information

systems in production and logistics control, significant inefficiencies remain in modern retail supply chains affecting retail operations efficiency (ECR Europe, 2001). Upstream inefficiencies refer to ineffective information sharing among retail stakeholders resulting to high inventory levels (mainly anticipatory), high out-of-stock conditions, high returns rate, and long lead times amongst others. Downstream inefficiencies refer to limited supply chain visibility resulting to low demand forecast accuracy, inaccurate promotion planning, and low on-shelf availability. Nowadays, the latest developments in wireless network infrastructure (mainly deriving from the wide deployment of Wireless LANs and the forthcoming 3G networks), interactive TV, mobile and wireless devices and automatic data capturing techniques (namely Radio Frequency Identification - RFID) lay the foundation for the deployment of ubiquitous commerce information systems; integrated environments capable to enhance the total shopping experience in such a way that the shopper is feeling understood, supported, and consequently, delighted.

CONCEPTUAL SCENARIOS

Ubiquitous commerce should not be limited on embedding technology in the retail arena. On the contrary, it should be a major business undertaking focused to and driven by the customer. It is all about delivering innovation through enhanced shopping experiences. Ubiquitous commerce can be foreseen as the natural evolution of multi-channel retailing, namely reaching the consumer through alternate channels. In the supermarket environment, the shopper can pick up a wirelessly connected shopping cart equipped with a display device and an RFID sensor capable to scan the contents of the cart. She uses her loyalty card to log in the system, which welcomes her and presents her the shopping list she uploaded prior to her visit to the store. She can then start navigating within the store as usual, picking up products and placing them inside the shopping cart. Each time a product is placed in the cart, the display device shows its description, detailed information, price, and updates the total cost of the cart's contents. At the same time, the product is erased from the reminding shopping list. Moreover, at any time she can request for additional information about a product (e.g. nutritional value, ingredients and so on), get informed about the promotional activities running in the supermarket (fully personalized based on the shoppers' profile and past consumption patterns), and request for navigation assistance within the store. Finally, during check-out the system transmits the list of purchased products along with the total amount to the cashier which issues the receipt.

Moreover, in her household the shopper is fully supported by the ubiquitous commerce system, which is able to continuously monitor the home inventory and generate "out-of-stock" alerts when a product needs replenishment. The shopper can receive in her mobile phone (or other wireless device) the automatically generated alerts (accompanies with personalized promotion messages) and proceed, should she desires, to replenishment orders.

DEPLOYMENT CASE STUDY

The common strand in both scenarios is that technology plays a key role in the development of ubiquitous commerce systems. Nevertheless, ubiquitous computing researchers argue that the successful deployment, and consequently adoption, of such systems highly depends on their perceived value by their actual users (Davies et al, 2002). If the end users of ubiquitous commerce systems fail to identify the value offered to them they will simply not use them. Our experience in ubiquitous commerce systems derives from our involvement with MyGROCER, an EU-funded research project spanning two years (2001-2002) aiming at designing, developing, and testing innovative shopping schemes in supermarket environments taking into account leading edge technologies (namely RFID and wireless interconnectivity).

The MyGROCER concept followed the two scenarios described above. Our intention was to develop an integrated environment capable to support the shoppers throughout their entire supermarket visit as well as support them within their household in terms of monitoring the home inventory, receiving out-of-stock alerts and so on. From the beginning of the design phase we tried to incorporate the shoppers' actual requirements for such a system. Indeed, supermarket shoppers represent a target group that can't be easily profiled. In particular, they represent people with diversity in age, culture, values, familiarity with technology and so on. Therefore, the selection of the appropriate technology solutions would greatly influence the level of acceptance for MyGROCER. For the supermarket environment, we decided to implement a prototype shopping cart capable to automatically scan supermarket products while at the same time provide valuable information to the shopper through a display device thus, create a fully interactive shopping trip. Regarding the smart-home concept, we implemented a home server capable to store instances of the home inventory and at specific time frames (predefined by the shopper) transmit the current inventory level to the retailer's server through the Internet (using DSL, ISDN or a simple V90 modem). The server communicated through RS-232 with two RF-Readers which the shoppers used to register products "in" and "out" of the household. The shoppers could have access to their "home inventory" and "missing products" lists using the Internet or their WAP-enabled mobile phone. A detailed technical discussion of MyGROCER is included in Kourouthanassis et al, 2003 and Roussos et al, 2003.

We performed a two-phase evaluation of MyGROCER in order to ensure that the system incorporates the shoppers' perceptions and specific requirements, identify potential barriers of acceptance in all levels (social, legal, family, etc) and take timely corrective action should it was

required. MyGROCER received substantial interest and appealed to most respondents. In effect, most of the participants expressed the opinion that MyGROCER will constitute the "shopping of the future". The perceived benefits of MyGROCER on the participants' "traditional shopping experience" referred to conducting shopping faster, easier, and at better value for money. Elements that proved to be appreciated by the participants included the ability to constantly monitoring the contents and total cost of the products within their shopping cart (including an accurate description of each scanned product), the ability to compare the value of similar products simply by scanning them and receive personalized promotions during their shopping trip, the accurate in-store navigation system and the ability to bypass queues (smart check-out) and reduce waiting time. Nevertheless, the majority suggested that the system should empower the shoppers to select the level of personalization that the system offers including an option of anonymous usage in order to provide just an enhanced in-store shopping facility. Conclusively, protection of their privacy and personal data was of paramount importance to the survey participants. These observations led us to the redesign of MyGROCER in several ways, these changes wgere reflected in the deployed system.

The second evaluation of MyGROCER spanned over a two-week in-field trial during September and October 2002 (Athens, Greece - ATLANTIC supermarket). The aim of the trial was to understand how the new shopping method influences the shopping experience compared against the traditional supermarket environment. Members of the supermarket loyalty club were selected to participate to the study in order to prevent privacy issues from arising. For the trial a full aisle was modified, a representative sample of products was selected and equipped with RFID tags and wireless networking infrastructure was installed. The survey participants were demonstrated the functionality of the system, used it to conduct part of their shopping and filled a questionnaire comparing their experience using the system against traditional shopping.

MyGROCER services appeared to be highly appreciated by the survey participants. In effect, elimination of queues and continuous monitoring of the total shopping cart value appeared to be the most highly appreciated services while item price monitoring, in-store navigation and on-screen monitoring of the products they purchased were second runners. Moreover, participants expressed their perceptions of different aspects of the system including usefulness, usability, trust, intention to use and service quality. The majority regarded the new shopping method as a useful addition to current supermarket shopping options, expressed the view that it significantly improves the shopping experience and found the system to be user friendly and intuitive to use. Having resolved the issues of fair use of personal information by selecting members of the loyalty club no other significant issues relating to trust were raised and, in fact, a significant number of the participants stated that they would trust the system to do their shopping and that they would trust it more than another computer assisted shopping method such as the Internet or self-scanning in-store mechanisms.

The most interesting results related to the effects on the conventional shopping experience of the participants. The most striking response was that the new shopping scheme resulted to an entertaining (and even exciting for some participants) shopping trip. In addition, the participants stated that the use of the system reduces their stress level and sense of time pressure while shopping. It should be emphasized that the survey participants expressed their willingness to adopt and use the system even in its prototype form. However, several concerns were raised particularly regarding the use of the system by older or not familiar with technology people.

CONCLUSIONS AND DISCUSSION

Ubiquitous commerce is no longer a vision, but over the past few years it is gradually becoming a reality. This can be mainly attributed to the recent technological advances, which made the deployment of pilot initiatives technically and economically viable. In effect, 62 of leading retailers in North America and Europe have expressed their plans to deploy new IT-enabled convenience schemes for consumers (such as info-kiosks, RFID enabled check-outs, navigation assistance and so on) within the next 3-5 years according to a survey performed by IBM and the National Retail Foundation (IBM Institute for Business Value, 2003). It should be emphasized that over the past few months we have already observed an increasing number of retailers willing to embed innovative technological solutions and shopping schemes into their store environment. Price Chopper is planning to deploy self-service info-kiosks providing access to accurate product information; Wal-Mart is working with its top 100 suppliers to deploy new RFID tags for tracking crates and pallets in the supply chain beginning in January 2005; Marks & Spencer will install new self-checkout schemes in eight additional stores following a successful three-store pilot.

The benefits deriving from the deployment of ubiquitous commerce systems are apparent. Retailers will have a tool that enables them to "work with their consumers" making them an indistinguishable part of their operations and reaching them in a way that they become a real stakeholder, part of their vision for an optimized value chain. The direct benefits for the retail value chain deriving from the incorporation of leading edge technologies in the retail value chain include among others:

- Real-time information provision regarding the products' lifecycle within the value chain optimizing the forecasting process of future demand.
- Real-time information provision regarding the shopper's consumption behavior providing the ability to identify and model shoppers' emerging needs.

- Introduction of personalized marketing/promotional programs including accurate monitoring of promotions effectiveness.
- Elimination of out-of-shelf /out-of-stock conditions.
- Elimination of thefts within the store.

However, the most important benefit deriving from the deployment of ubiquitous commerce systems is the creation of new shopping experiences and consequently, enthusiasm for the consumers. This is particularly true especially in our era where recent advances in manufacturing, distribution and information technologies combined with the urbanization of modern society have created the so-called new consumer who is more knowledgeable about comparable product costs and price; more changeable in retail and brand preferences; showing little loyalty; self-sufficient, yet demanding more information; who holds high expectations of service and personal attention; and is driven by three new currencies: time, value, and information.

Although there are still several challenges to the wider deployment of such integrated shopping schemes - especially those relating to issues of personal identity, security and privacy but also standardization and engineering - the results of our prototype implementation indicate that consumers would accept the introduction of innovative information systems when they become commercially available. Our research revealed that the issue of trust and privacy is extremely important considering the fact that we constantly need information regarding the consumers' current location in-store, past consumption patterns, household information, demographic data and so on in order to provide fully personalized services. An initial critical appraisal of this situation would indicate that application designers must make some compromises on the extent they offer personalized services. Traditionally, data protection legislation in most EU countries prohibits the capture and storage of any person-related data and only allows exceptions for clearly defined purposes after which the data must be destroyed. In our case, we allowed consumers to deactivate the provision of personalized services and at the same time participate to the system without providing their full set of personal information. However, this is not the solution to the general problem of trust and privacy. We expect that users will eventually be willing to adopt such applications only if they perceive that they are getting better shopping experiences in return for letting go some of their privacy.

Finally, the full involvement of the end-users during the design and development of the ubiquitous commerce system ensures the adoption and actual use of it after its commercialization. Our experience from MyGROCER revealed that the production of mock-up demos (in the form of concept sketches and non-functional interface screenshots of selected system functionality) and their exposure to real supermarket shoppers helped us identify potential barriers of acceptance and provided us with the necessary feedback to redesign the system according to the actual user needs and expectations.

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