Improving M-Commerce Services Effectiveness with the Use of User-Centric Content Delivery

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ABSTRACT

Advances in wireless communications and information technology have made the Mobile Web a reality. The Mobile Web is the response to the need for anytime, anywhere access to information and services. Many wireless applications have already been deployed and are available to customers via their mobile phones and wirelessly-connected PDAs. However, as communications and other IT usage becomes an integral part of many people's lives and the available products and services become more varied and capable, users expect to be able to personalize a service to meet their individual needs and preferences. The involved sectors have to meet these challenges by reengineering their front-end and back-end office. This article will examine the interaction requirements regarding a friendlier, personalized and more effective multi-channel services environment. It will present the mobility challenges and constraints implemented into the business sector, investigating the current m-commerce situation and the extended user characteristics presenting a high level user-centric m-commerce architecture.

Keywords: please provide

INTRODUCTION

The Internet revolution has brought about a new wave of conducting business and proved to be an important marketing tool for all sorts of business fields that found this new means as convenient as it is creative. With the emergence of wireless and mobile technologies, new communication platforms and devices, apart from PC-based Internet access, are now emerging,

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making the delivery of services available through a variety of multi-channel mediums without loosing their integrity or quality of their content (Germanakos et al., 2005a). Inevitably, this increases user requirements, which are now focused upon an "*anytime, anywhere and anyhow*" basis. Moreover, the explosive growth in the size and use of the World Wide Web as well as the complicated nature of most Web structures may lead in orientation difficulties, as users often lose sight of the goal of their inquiry, look for stimulating rather than informative material, or even use the navigational features unwisely. To alleviate such navigational difficulties, researchers have put huge amounts of effort to identify the peculiarities of each user group and design methodologies and systems that could deliver an adapted and personalized Web content. Challenges therefore range not only on adapting to the heterogeneous user needs and user environment issues, such as current location and time (Panayiotou, & Samaras, 2004), but also on a number of other considerations with respect to multi-channel delivery of the applications concerning multimedia, services, entertainment, commerce, and so forth. That is why, when the next big thing in technological gadgets, the mobile phone flooded the market, offering cheap SMS services using the GSM technology and enabling the extremely successful i-Mode and mobile Internet, various business institutions felt they couldn't stay away from this new rising opportunity.

Relevant channel and distribution strategies are critical for future advancement of m-commerce services to achieve accessible, customer-focused and responsive services. Following the growing user demands and requirements as well as the rapid development of the technological advancements and infrastructure capabilities, the development of m-commerce services should not only focus on making the service available on the Internet, but also examine the different delivery platforms. Indisputably, this is the vision of an interoperable, transparent and secure continent whereby multi-channel service delivery integration is considered fundamental.

This article emphasizes the proliferation of m-commerce services delivery starting with a reference to multi-channel delivery characteristics of user-centric services and the investigation of the m-commerce status and dimensions in various application areas (market fields). The adaptation and personalization considerations with regards to new user requirements and demands is also analyzed emphasizing the significance and peculiarities of user profiling for providing a more personalized m-commerce services result. It further presents a high level architecture for personalizing m-commerce services, introducing a comprehensive user profiling that incorporates intrinsic user characteristics such as user perceptual preferences (visual, cognitive and emotional processing parameters), on top of the "traditional" ones (such as name, age, education, etc.).

SERVICE REQUIREMENTS AND DELIVERY

To struggle against the amplification of the digital divide and therefore to think 'user interaction' whatever the age, income, education, experience, and the social condition of the citizen. (Europe's Information Society, 2004)

The specific theme above reveals exactly the need for user-centric m-government services development and personalized

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content delivery. In many ways, the new technology provides greater opportunities for access. However, there are important problems in determining precisely what users want and need, and how to provide Web-based services content in a user-friendly and effective way. User needs are always conditioned by what they already get, or imagine they can get. A channel can change the user perception of an m-government application: when users have a free choice between different channels to access an application, they will choose the channel that realizes the highest relative value for them. However, separate development of different channels for a single service (multi-channel delivery) can lead to inconsistencies such as different data formats or interfaces. To overcome the drawbacks of multiple-channel content delivery, the different channels should be integrated and coordinated.

Since successful m-government service delivery depends on a vast range of parameters, there is not a single formula to fit all situations. However, there have been reported particular steps (IDA, 2004) that could guide a provider throughout the channel selection process. Moreover, it should be mentioned that the suitability and usefulness of channels depends on a range of factors, out of which technology is only one element. Additional features that could affect the service channels assessment could be: directness, accessibility and inclusion, speed, security and privacy and availability. To realize their potential value though, channels need also to be properly implemented and operated.

The design and implementation complexity is rising significantly with the many channels and their varying capabilities and limitations. Network issues include low bandwidth, unreliable connectivity, lack of processing power, limited interface of wireless devices and user mobility. On the other hand, mobile devices issues include small size, limited processing power, limited memory and storage space, small screens, high latency, and restricted data entry (Germanakos et al., 2005a).

AN OVERVIEW OF M-COMMERCE/M-MARKETING THEORETICAL FRAMEWORK

It is generally agreed that m-commerce is the use of mobile or handheld devices for communication and commerce transactions without any formal conceptualization of the term currently in existence, due to the continuous technological evolution. Therefore, there is no clear, inclusive and broad definition of all the aspects it might include (Balasubramanian et al., 2002).

What needs to be taken into account is what m-commerce means for an organisation belonging to a specific market field and which definition is more close to the needs of these institutions. Therefore, Easton's (2002) approach could be more descriptive, simple and close to what these organisations need to know about the m-commerce term. Easton claims that: (a) m-commerce is the purchase of a product or a service through wireless devices; (b) there is a number of physical limitations to the above devices indicating to the end-user that it is more convenient to sign up to mobile services by using the traditional interface of the PCs; and (c) the models used by the organisations in the case of m-commerce are more close to "click and mortar" paradigm. For example, in a theatre context the users will receive information about the performance and the box office contact details through mobile commerce and then they will purchase the ticket at the box office, or payment of the

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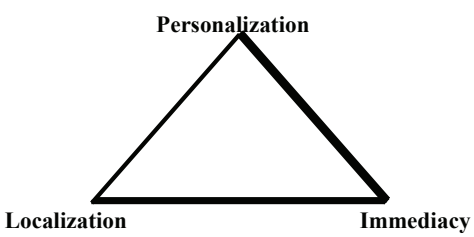
ticket will be done wirelessly with various methods, but still the transaction will be fulfilled when the purchaser attends the performance at the theatre.

Furthermore, what someone should be interested in is not the mobile Internet itself, "the representation of the physical world" in the wireless devices, but rather the mobile marketplace in which different kinds of transactions take place: communication services and wireless purchase. The mobile marketplace covers three dimensions (see *Figure 1*): personalisation according to local position of the holder and the relevance of information to his preferences, localization through the local based services, and immediacy (Lindgren, Jedbratt, & Svebsson, 2002).

As literature indicates, mobile phones are a communication medium that keeps people connected at any place, wherever they go and any time. Therefore, it is accounted as the most effective tool of direct marketing, while wireless marketing involves reaching and servicing customers and developing relationships with them through premium services (Bayne, 2002). Towse & Elgew (2003) describe marketing as "the process whereby the organisation's goals for its products and services are strategically developed and implemented to meet carefully reached price, product, place and promotion preferences of targeted customer groups." In this mentioned marketing mix (5Ps: product, place, promotion, price and, for arts organisations, people) it is clear that the mobile phone sets a new spectrum of marketing applications.

Figure 1. M-marketplace dimensions



The infrastructures to support great financial transaction through mobile devices are still under development and consequently the mobile phone is used more closely to marketing applications. Therefore, the greater part of analysis in this article mainly concerns the modern m-marketing services era and dedicates a narrower part to the transactional nature of the medium. However, m-marketing is included by definition in the term of "m-commerce," and in the article the terms are used according to each case.

Under the term "m-marketing," two main methods are analyzed: push and pull marketing. Pull marketing method involves the consumers pulling what interests them toward themselves, either the product or information itself. Here the messages are sent instantly after a personal request of the recipient. In the case of push marketing method the marketer sends—or better—pushes the message to the consumers, but in this case the message is sent massively to the subscribers of such service. Another term that is under the umbrella of push marketing is "location-based services" (LBS) or "mobile location services" (MLS). These are "applications that utilize information related to the geographical position of their users in order to provide value-added services to them" (Giaglis et al., 2003).

Mobile Related Technological Aspects

The present technologies used in telecommunication are GSM (générale système mobile/global system for mobile communications), WAP (wireless application

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protocol), and GPRS (general packet radio service), which, accompanied by the third generation mobile devices (3G), offer to the end-user a broad variety of capabilities. Mobiles can hardly replace computers due to device limitations such as the screen and the low memory. Even processing capabilities were quite low in the beginning of the 3G development. The first services offered were mostly data services like text alerts for news and entertainment. These alerts are closely related to the wider used form of communication, text messages or else SMS. Text messages are enriched in the later version of the 3G devices with graphics, videos or picture launched as the MMS (multimedia message services) services (Paavilainen, 2002). The services that are slowly launched in the telecommunication markets are the location-based services, which are closely related to the global positioning system (GPS), cell identification and Bluetooth. With these technologies each mobile is detected according to its exact location (Giaglis et al., 2003). With Bluetooth it will be easier to receive text alerts customized to the geographical location, for example, information about the nearest theatre, or receive a promotion alert when the user is near to a theatre house.

The Role of New Media in Modern Society

It would be inadequate to examine the use of mobile commerce and marketing by the various business institutions without presenting the general context of the modern era and what has led to the decision of following this innovative technology. Subsequent to the suggestions that technologies should not be seen without being connected to other processes and factors that set the frameworks, we present an overview to the social and economic tendencies that lead to the spread of m-commerce (Hesmondhalgh, 2002).

The use of mobile is not just a technological trend that needs to be followed. Practice has shown that society accepts technological developments not just for the sake of fashion but when they offer an advanced solution to the needs of each era. The social and economical index change continuously and the market itself decides which technology will spread and survive. The next step is the high penetration of video phones with high resolution screens or i-mode services whose music portals and ringtone downloads have created havoc to the networking marketplace. Therefore, it is the market that allows ideas and technological visions to become part of the everyday consuming life (Knell, 2003). In *Table 1* that follows, we refer to the main issues rising in the modern digital era (Hesmondhalgh, 2002; O'Connor, 2001; Postma, 1999).

Taking into account all these factors, the business institution has to face a number of challenges in modern life. As consumers live in a multimedia and cross-cultural environment, they demand combinations of forms and new delivery methods, the marketers should keep in mind that they have to satisfy these needs in order to keep their audiences close to their institution.

EVALUATING M-COMMERCE IN RELATION TO VARIOUS MARKET FIELDS

It is quite clear so far that the literature offered on the subject of m-commerce is quite narrow and even sometimes inadequate. In the past five years there were a number of managerial handbooks analyzing the new mobile era either for commerce or marketing. The initial stimuli derived from the book of Turban et al. (2002) where

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Table 1. Challenges of marketing in digital era

Frameworks	Trends
Globalisation	1. global market
	2. global brands, i.e., Tate
	3. Global organizations, i.e., Guggenheim
Society	1. cash rich, time poor → materialistic hedonism
	2. increased leisure time, "the hurried leisure class"
	3. increased technology ownership (mobile, PCs, PDAs)
	4. Individualism
Technology	1. digitalistion of cultural products and data compression, i.e., musical pieces in Mp3 formats, films in DVD
	2. Internet → development of peer-to-peer transactions, e-commerce
	3. rise of Internet → growth of commerce
	4. Information, easy access o data
Virtualisation of digital channels	1. development of new channels, i.e., mobile phones and virtualization of products/services
Virtualisation of payments	1. plastic cards with magnetic stripe/ chip & pin (debit, credit, loyalty cards)
	2. Smart cards
	3. electronic cash/ electronic wallet
	4. Micropayments
Media trends	1. from mass messages to individual
	2. From generic to specific
	3. from print to electronic
	4. from passive to interactive
	5. from plenty of time to fastest way of communication
	6. 24 hours a day/ 7 days a week, global presence
Law	1. Issues of privacy and security
	2. Data Protection Act
	3. Intellectual Property issues
	4. fraud

the authors dedicate the last chapter to mobile commerce as a natural evolution of e-commerce through a new portable medium. The m-commerce is perceived as a follower of e-commerce (Easton, 2002) as long as mobile Internet is developed and so the consumers are able to use portable devices to purchase items. Mobile phone is seen by many authors as the physical transformation of the Internet and the leader of the new media (Stafford et al., 2004; Candace, 2005).

Paavilainen (2002) introduces the mobile Internet as the alternative of desktop

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Internet. Mobile advertising, text alerts and mobile commerce models are described through different case studies from the commercial sector. Mobile entertainment, that is, ringtones, downloads and text alerts, is rich with cases from music and film industries, as sector journals like the New Media Age show. Although someone would think that this marketing trend would hardly expand in other forms of the business institutions, like culture, there is a release by the DigiCULT (2004) scheme that proves the opposite. Mobile devices applying location-based services (LBS) can be integrated in a museum or gallery exhibition giving the option to be another communication channel after the audio guides and the information kiosks. Moreover, scenarios like booking tickets through mobile, receiving text alerts for the latest exhibition or information how to get to an art gallery are becoming more obvious examples in the cultural sectors. The referred applications are included according to Mahatanankoon et al. (2005) in two modes of m-commerce: (i) the content delivery mode and (ii) the transaction mode.

Mobile Marketing

As part of the new strategies, the use of the mobile as a marketing and communication tool plays mainly an important role. With the introduction of text messaging boom marketers were totally influenced and seized the SMS as a new advertising chance. Haig (2002) describes the history of SMS and introduces various applications of mobile devices in marketing like the text alerts. With the introduction of the third generation mobile phones (3G) the capabilities of the devices to support image, sounds and movie clips grow, increasing the number of applications. Marketers find themselves holding a powerful interactive and totally personal marketing tool. However, there are still a great number of barriers which limit the widespread of the medium and its success according to Scharl et al. (2005), and they have to do either with the technological features of the devices, the transmission process or customer behaviour itself.

Customer Behaviour

Kleijnen et al. (2004) used the Technology Acceptance Model (TAM) to examine a number of factors that influence the quicker penetration of mobile technologies in the market in order to explain this trend of text messaging. Factors like cost of the devices and services, the value they offer to the end-user as well as the easiness of use are important in order to make special mobile services apart from voice mail more acceptable. Moreover, Brumer & Kumar (2005) also introduced the influential factors of utility, convenience and fun, which are the most interesting point, for example, for an arts organisation. An innovative and entertaining way of advertising, promotion or ticket booking could be critical in order to catch the customers' attention and make them act. This last factor mainly influences the mobile advertisements (m-advertisement), toward which the attitude of consumers is more positive than toward traditional advertising, as Tsang et al. (2004) claim. What influences the attitudes of the end-users apart from the entertaining way of presentation is the content of the provided advertising services and its amount of information.

A key concept that should be looked into is the limitation of the irritation caused by interfering and unwanted messages. Therefore, it is important for organisation using the mobile services to ask for permission to deliver them to customer. Permission

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marketing is the term that should be closely related to any action of direct marketing.

Permission Marketing and Trust

Godin's book "Permission Marketing" (2002) is the most common reference in the literature under the subject of mobile marketing (Kavassalis et al., 2003) and there is no critical point suggested by other authors toward what it claims. The introduction of permission in marketing tactics, especially in direct promotions, comes in contraposition to the traditional way of advertising—interruptive marketing, as explained later.

Additionally, trust, security and privacy are the emerging issues for m-commerce. The fear of manipulation of personal data is the main limit in the consumer's shift to positive attitude. Good sources of information about privacy policies are the independent protecting bodies set to protect the end-users [for example, the Data Protection Act of 1998 is followed by the majority of the cases and the organisations show great respect to its lines, the Wireless Location Industry Association (WLIA) declares an adopted privacy policy by its members and so did the Mobile Marketing Association (MMA) with a relative declaration]. It must also be said though, that in cases of transactions through mobile phones, the risk of hacking is lower than that of the Internet due to the evolving technologies and the use of high standard encryption.

Effectiveness

How could effectiveness be defined in a very unstable context? This is the main question underlying this subject. It is quite difficult to find research on the effectiveness of the new medium due to the very recent introduction of mobile commerce in the market. The given difficulty still rises given the peculiarities of the various market fields. More specifically, for an arts organisation, for example, it is even more difficult to define effectiveness, as this can be meant under totally different aspects depending on what aims each cultural institution has set. Drucker (1995) and Heman & Renz (1999) also briefly referred to the effectiveness in non-profit organisations.

The factors that can make mobile an effective new media for organizations were examined in depth. A good attempt to measure the wireless marketing results by introducing the Mobile Return of Investment (ROI) was also made by Bayne (2002) and that is a useful guide for any organisation which wishes to monitor its investment on this new technology. Moreover, Kavassalis et al. (2003) introduced more indicators of effectiveness in their empirical studies, while Frolick & Chen (2004) assess the mobile commerce applications.

The majority of the research converges to the same conclusion. No matter what the effects of the mobile practices are, which in each case can be totally different, what is important is the benefit that someone can gain by being the first in the market for using this new technology.

PRINCIPLE DRIVERS OF AN M-COMMERCE OPEN SERVICE INFRASTRUCTURE

The deployment of a m-commerce open service platform that could be shared by networked private and public institutions could be a promising approach with further insights on maintaining wireless service provision sustainability in a long-term perspective. Wireless technology is about extending the availability of an e-commerce infrastructure to mobile and wireless channels. It becomes more fully developed

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and, as bandwidth increases with the availability of "always on" connectivity, next generation applications and entirely new practices will arise different from those delivered over existing static networks (Caldow, 2001).

The large array of new communication technology opportunities and the rapid emergence and change of standards, as well as the variety of mobile channels, offer different technical capabilities for sustainable architectures and technology frameworks in order to meet critical requirements like broadband, interoperability, scalability, transparency, personalization, privacy and security (Germanakos et al., 2005a).

Extended User Requirements and the Personalization Problem

The user population is not homogeneous, nor should be treated as such. To be able to deliver quality services, m-commerce systems should be tailored to the needs of individual users providing them with personalized and adapted information based on their perceptions, reactions, and demands. Therefore, a serious analysis of user requirements has to be undertaken, documented and examined taking into consideration their multi-application to the various delivery channels and devices. Some of the user (customer) requirements and arguments anticipated could be clearly distinguished into (Germanakos et al., 2005c): (a) general user service requirements (flexibility: anyhow, anytime, anywhere; accessibility; quality; and security), and (b) requirements for a friendly and effective user interaction (information acquisition; system controllability; navigation; versatility; errors handling; and personalization).

Although one-to-one Web-based service provision may be a functionality of the distant future, user segmentation is a very valuable step in the right direction. User segmentation means that the user population is subdivided into more or less homogeneous, mutually exclusive subsets of users who share common user profile characteristics. The subdivisions could be based on: demographic characteristics (i.e., age, gender, urban or rural-based, region); socio-economic characteristics (i.e., income, class, sector, channel access); psychographic characteristics (i.e., lifestyle, values, sensitivity to new trends); individual physical and psychological characteristics (i.e., disabilities, attitude, loyalty).

The issue of personalization is a complex one with many aspects and viewpoints that need to be analyzed and resolved. Some of these issues become even more complicated once viewed from a moving user's perspective; in other words, when constraints of mobile channels and devices are involved. Such issues include, but are not limited to: what content to present to the user, how to show the content to the user, how to ensure the user's privacy, how to create a global personalization scheme. As clearly viewed, user characteristics and needs, determining user segmentation and thus provision of the adjustable information delivery, differ according to the circumstances and they change over time (Panayiotou & Samaras, 2004).

User Profiling Characteristics: A More Comprehensive Approach

One of the key technical issues in developing personalization applications is the problem of how to construct accurate and comprehensive profiles of individual users and how these can be used to identify a user and describe the user behaviour, especially if they are moving (Adomavicious & Tuzhilin, 1999). According to the Mer-

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riam-Webster Dictionary, the term profile means "a representation of something in outline." User profile can be thought of as being a set of data representing the significant features of the user, like preferences, characteristics, and activities, derived from a set of keywords that are compared against information items.

User profiling can either be *static*, when it contains information that rarely or never changes (e.g., demographic information), or *dynamic*, when the data change frequently. Such information is obtained either *explicitly*, using online registration forms and questionnaires resulting in static user profiles, or *implicitly*, by recording the navigational behaviour and/or the preferences of each user. In the case of implicit acquisition of user data, each user can either be regarded as a member of group and take up an aggregate user profile or be addressed individually and take up an individual user profile. The data used for constructing a user profile could be distinguished into: (a) the data model, which could be classified into the demographic model (which describes who the user is), and the transactional model (which describes what the user does); and (b) the profile model, which could be further classified into the factual profile (containing specific facts about the user derived from transactional data, including the demographic data), and the behavioural profile (modeling the behaviour of the user using conjunctive rules, such as association or classification rules). The use of rules in profiles provides an intuitive, declarative and modular way to describe user behaviour (Adomavicious & Tuzhilin, 1999)). Additionally, in the case of a mobile user, by user needs it is implied both the thematic preferences (i.e., the traditional notion of profile) as well as the characteristics of their personal device called "device profile." Therefore, here, adaptive personalization is concerned with the negotiation of user requirements and device abilities. As Web developers regard personalization as the best way to filter out unnecessary or irrelevant information for their users, some argue on issues like it may restrict the extent and the variety of information users receive, that people often do not have well-defined preferences, they need to answer detailed questions to personalize their Web pages, that the recommendation process is a black box for end-users and so on (Wang & Lin, 2002).

But, could the user profiling be considered complete incorporating only these dimensions? Do the designers and developers of m-commerce applications take into consideration the real users' preferences in order to provide them with really personalized Web-based service content? Many times this is not the case. How can a user profiling be considered complete, and the preferences derived optimized, if it does not contain parameters related to the user perceptual preference characteristics? We could define *user perceptual preference characteristics* as all the critical factors that influence the visual, mental and emotional processes liable of manipulating the new information received and building upon prior knowledge that is different for each user or user group. These characteristics, which have been primarily discussed in Germanakos et al. (2006), determine the visual attention, cognitive and emotional processing taking place throughout the whole process of accepting an object of perception (stimulus) until the comprehensive response to it (Germanakos et al., 2005c). The proposed comprehensive user profiling could be considered as the main raw content filtering module of an m-commerce personalization architecture. To our

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knowledge, nowadays, there is not research that moves towards the consideration of user profiling incorporating optimized parameters taken from these research areas in combination.

AN OVERVIEW OF M-COMMERCE PERSONALIZATION ARCHITECTURE

Based on the above-mentioned considerations, an m-commerce personalization architecture is overviewed trying to convey the essence and the peculiarities encapsulated. The current system, depicted in *Figure 2*, is composed of a number of interrelated components, as detailed below:

Entry Point

It is the user access interface of the system. It accepts multi-device (enables the attachment of various devices on the infrastructure, such as mobile phones, PDAs, desktop devices, etc.) identifying the characteristics of the device and the preferences as well as the location of the user (personalization/location-based) and multi-channel (due to the variety of multi-channel delivery, for example, over the Web, telephone, interactive kiosks and so on, this module will identify the different characteristics of the channels) requests. It is directly communicating with the "content filtering" component exchanging multi-purpose data.

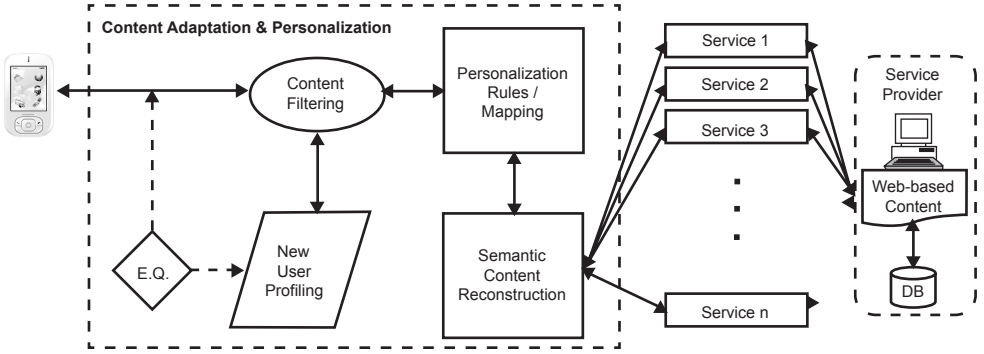
Content Filtering

This component is considered the main link of the "entry point" with the "'new' user profiling" and the "personalization rules/mapping" components of the architecture. It actually transmits the data accumulated both directions and it makes the filtering of the content, according to the personalization processing characteristics, delivering the adapted and personalized service. The whole processing varies from security, authentication, user segmentation, service content identification, "new" user profiling characteristics and so forth.

"New" User Profiling

This is the main component of the architecture and it is called "'new' user profiling" component. At this component all the requests are processed. It is responsible for the custom tailoring of information to be delivered to the users, taking into consid-

Figure 2. An m-commerce personalization architecture



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eration their habits and preferences, as well as, for mobile users mostly, their location ("location-based") and time ("time-based") of access (Panayiotou & Samaras, 2006). It also keeps the user logs and retrieves data according to user login to the system. This component accepts requests from the "entry point" component and, after the necessary processing and further communication with the "content filtering" component, either sends information back or communicates with the next component ("personalization rules/mapping") accordingly. This component is comprised of the following two elements:

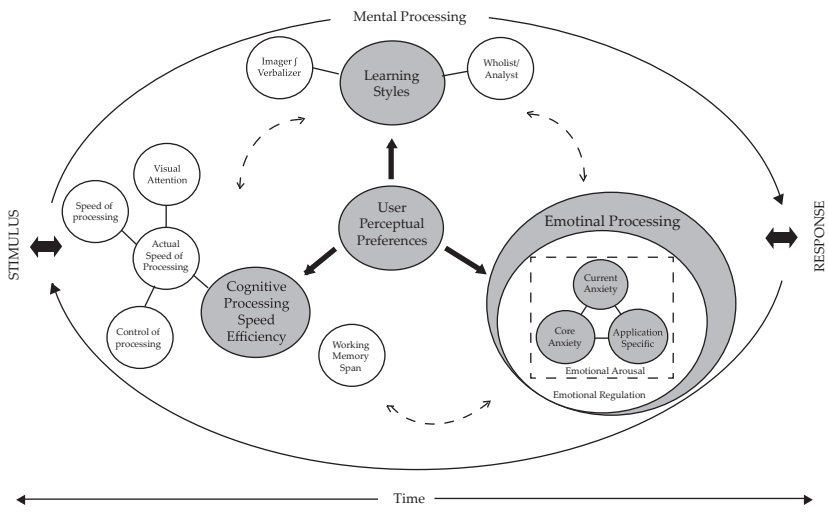
The "Traditional" User Profile

It contains all the information related to the user necessary for the Web personalization processing. It is composed of two elements: the (a) user characteristics (the so-called "traditional" characteristics of a user: knowledge, goals, background, experience, preferences, activities, etc.), and (b) the device/channel characteristics (contains characteristics referring to the device or channel the user is using and contains information like: bandwidth, size, connectivity, power processing, interface and data entry, memory and storage space, battery lifetime, etc. These characteristics are mostly referred to mobile users and are considered important for the formulation of a more integrated user profile, since it determines the technical aspects of it). Both elements are completing the user profiling from the user's point of view.

User Perceptual Preference Characteristics

This is the new component/dimension of the user profiling. It contains all the visual attention, cognitive and emotional processing parameters that completes the user preferences and fulfils the user profile. User perceptual preference characteristics could be described as a continuous mental processing starting with the perception of an object in the user's attentional visual field and going through a number of cognitive,

Figure 3. User perceptual preference characteristics—three-dimensional approach



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learning and emotional processes giving the actual response to that stimulus, as depicted in *Figure 3*. These characteristics have been primarily discussed in Germanakos et al. (2006) and Germanakos et al. (2005a).

As can be observed, its primary parameters formulate a three-dimensional approach to the problem.

The first dimension investigates the visual and cognitive processing speed efficiency of the user, the second his/her learning style, while the third captures his/her emotional processing during the interaction process with the information space. All the above dimensions have specific characteristics and implications into the information space based on which the personalization rules in the "personalization rules/mapping" component will be constructed. Suggestively, we present in *Figure 4* the data implications diagram of the learning styles chosen.

For a better understanding of the three dimensions' implications and their relation with the information space a diagram that presents a high level correlation of these implications with selected tags of the information space (a code used in Web languages to define a format change or hypertext link) is depicted in *Figure 5*. These tags (images, text, information quantity, links – learner control, navigation support, additional navigation support, and aesthetics) have gone through an extensive optimization representing group of data affected after the mapping with the implications.

The particular mapping is based on specific rules created, liable for the com-

Figure 4. Riding's learning styles characteristics and implications

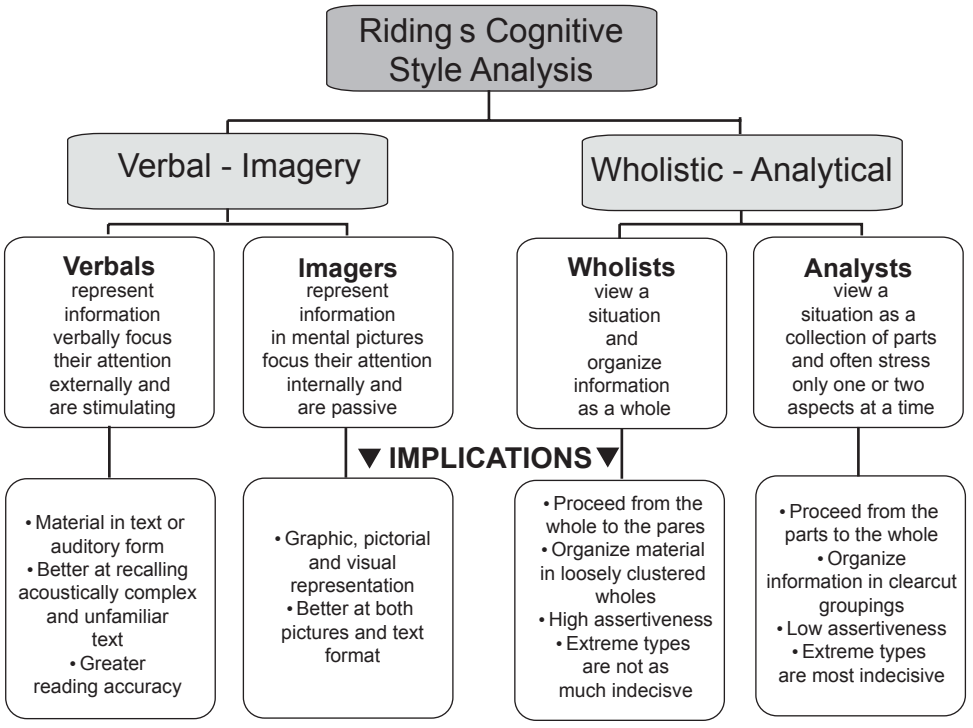

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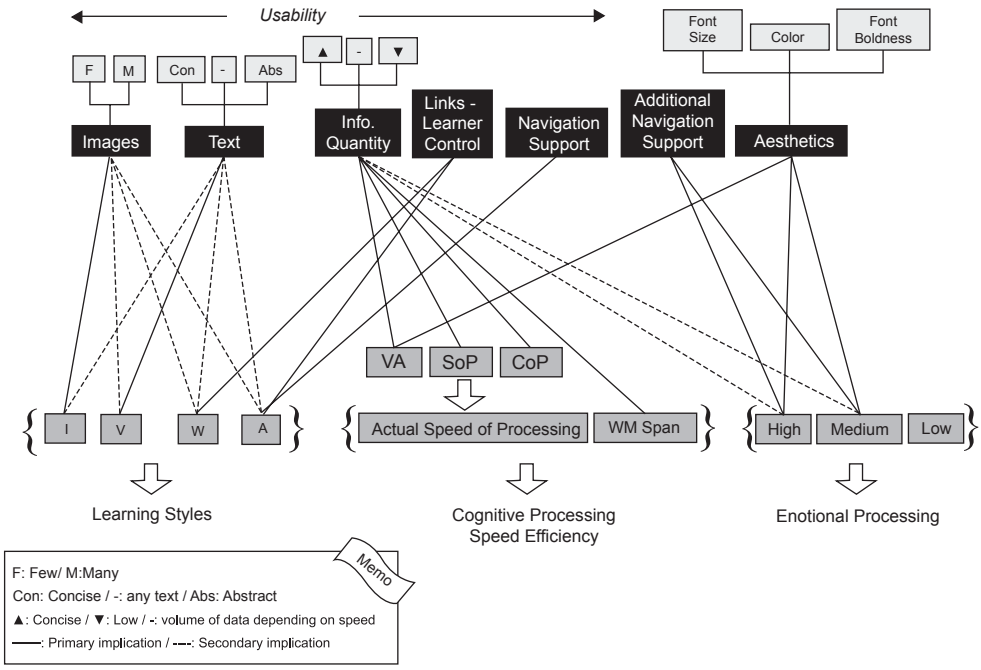
Figure 5. Data: Implications correlation diagram



bination of these tags and the variation of their value in order to better filter the raw content and deliver the most personalized Web-based result to the user. As it can be observed from the diagram, each dimension has primary (solid line) and secondary (dashed line) implications on the information space altering dynamically the weight of the tags.

Therefore, we include in the learning styles dimension Riding's Cognitive Style Analysis, which applies in a greater number of information distribution circumstances, since it deals rather with cognitive than learning style. Henceforth, for example, the number of images (few or many) to be displayed has a primary implication on imagers, while text (more concise or abstract) has a secondary implication. An analyst may affect primarily the links – learner control and navigation support tag, which in turn is secondary affected by high and medium emotional processing, while might secondary affect the number of images or kind of text to be displayed, consequently. Actual speed of processing parameters (visual attention, speed of processing, and control of processing), as well as working memory span, is primarily affecting information quantity. Eventually, emotional processing is primarily affecting additional navigation support and aesthetics, as visual attention does, while secondary affects information quantity.

A practical example of the Data – Implications Correlation Diagram could be as follows: a user might be identified that is: Verbalizer (V) – Wholist (W) with regards to the learning style, has an actual cognitive processing speed efficiency of 1000 msec,

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and a fair working memory span (weighting 5/7), with regards to his/her cognitive processing speed efficiency, and (s)he has a high emotional processing. The tags affected, according to the rules created and the Data – Implications Correlation Diagram, for this particular instance are the: images (few images displayed), text (any text could be delivered), information quantity (less info since his/her cognitive speed is moderate), links – learner control (less learner control because (s)he is Wholist), additional navigation support (significant because (s)he has high emotional processing), and high aesthetics (to give more structured and well defined information, with more colors, larger fonts, more bold text, since (s)he has high emotional processing).

At this point it should be mentioned that in case of internal correlation conflicts primary implications take over secondary ones. Additionally, since emotional processing is the most dynamic parameter compared to the others, any changes occurring at any given time are directly affecting the yielded value of the adaptation and personalization rules and henceforth the format of the content delivered.

Personalization Rules/Mapping

At this component all the calculations such as the user categorization and mapping, content reconstruction and content adaptation takes place. In order for the current component to run properly, Web-based semantic services content is conveyed in the form of metadata from the "semantic content reconstruction" component. Once the provided content is adjusted based on the developed rules to the user characteristics it returns the corresponding adapted and personalized result to the "content filtering" component.

Semantic Content Reconstruction

This component is based on metadata and it is responsible for describing the content (data) available from the "service provider" (service 1, service 2, …service n). In this way a common understanding of the data, that is, semantic interoperability, openness, is achieved. The data manipulated by the system is described using metadata that comprises all needed information to unambiguously describe each piece of data and collections of data. This provides semantic interoperability and a human-friendly description of data. This component is also directly related to the "personalization content reconstruction" component providing the altered Web-based metadata service content. It is consisted of two elements:

- Perceptual provider characteristics: It identifies the provider characteristics assigned to the Web-based services content. They are involving all these perceptual elements that the provider has been based for the design of the content.
- Semantic content properties: This element performs the identification and metadata description of Web-based services content based on predetermined ontologies. It is implemented in a transparent manner removing data duplication and the problem of data consistency.

Service Provider

This is the last component of the architecture and is directly connected to the "semantic content reconstruction" component. It contains transition mechanisms and the databases of Web-based services content as supplied by the provider without being through any further manipulation or alteration.

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CONCLUSION

Indisputably, by implementing mobile commerce and mobile marketing a business institution attains a leading image of an organisation close to the technological trends and the needs of modern audiences. It differentiates itself in an era when each institution competes for a share of market and a share of heart not only through its work but also its marketing tactics. The healthy image of an innovative and avant-garde organisation can only work for the benefit of its long-term viability. It is hard to predict what the future will bring. Surely there will be an increasing number of organisations adopting the mobile services. However, the future is nearer than generally estimated while the circumstances rapidly change. There can be futuristic scenarios which one day might become reality, but what is of more importance is always to know what the end-users finally need. The various institutions need to keep close and open to any kind of evolvement, not only to technological developments but also to how their audiences respond to them.

On these grounds, this article made a reference to the m-commerce content delivery investigating multi-channel delivery characteristics of user-centric m-commerce services and the adaptation and personalization considerations with regards to new user requirements and demands. It analyzed the current situation of m-commerce services, ranging from theoretical considerations to technological parameters, and it underpinned the significance of the user profiling, introducing the comprehensive user profiling that incorporates intrinsic user characteristics such as user perceptual preferences. It has finally presented an overviewed m-commerce personalization architecture that considers cognitive learning styles as its main personalization filter, in an attempt to provide the user with the most personalized m-commerce content result.

REFERENCES

Adomavicious, G., & Tuzhilin, A. (1999). User profiling in personalization applications through rule discovery and validation. In *Proceedings of the ACM Fifth International Conference on Data Mining and Knowledge Discovery (KDD'99)* (pp. 377-381).

Balasubramanian, S., Peterson, R.A., & Jarvnpaa, S.L. (2002). Exploring the implications of m-commerce for markets and marketing. *Journal of the Academy of Marketing Science*, *30*(4), 348-361.

Bayne, K.M. (2002). *Marketing without wires*. Wiley.

Caldow, J. (2001). *E-gov goes wireless: From Palm to shining Palm*. Institute of Electronic Government, IBM Corporation.

Candace, D.P. (2005). *E-commerce and m-commerce technologies*. IRM Press.

Drucker, P.F. (1995). *Managing the non-profit organisation: Practices and principles*. Butterworth-Heinemann.

Easton, J. (2002). *Going wireless: Transform your business with mobile technology*. Harper Business.

Europe's Information Society. (2004a). *User interaction*. Retrieved from http://europa.eu.int/information_ society

Frolick, M.N., Chen, L.-D. (2004, Spring). Assessing m-commerce opportunities. *Information Systems Management*, pp. 53 -61.

Germanakos, P., Tsianos, N., Lekkas, Z., Mourlas, C., & Samaras, G. (2006). Capturing essential intrinsic user behaviour values for the design of comprehensive Web-based personalized environments. *Computers in Human*

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Behavior Journal, Special Issue on Integration of Human Factors in Networked Computing. (accepted)

Germanakos, P., Samaras, G., & Christodoulou, E. (2005a). Multi-channel delivery of services—the road from eGovernment to mGovernment: Further technological challenges and implications. In *Proceedings of the First European Conference on Mobile Government* (Euro mGov 2005) (pp. 210-220).

Germanakos, P., Tsianos, N., Mourlas, C., & Samaras, G. (2005b). New fundamental profiling characteristics for designing adaptive Web-based educational systems. In *Proceeding of the IADIS International Conference on Cognition and Exploratory Learning in Digital Age (CELDA2005)* (pp. 10-17).

Germanakos, P., Mourlas, C., & Samaras, G. (2005c). Considering the new user requirements for apt mobile Internet services delivery. In *Proceedings of the IADIS International Conference on WWW/Internet 2005* (pp. 148-152).

Giaglis, G.M., Kourouthanassis, P., & Tsamakos, A. (2003). Towards a classification framework for mobile location services. In B.E. Mennecke & T.J. Strader (Eds.), *Mobile Commerce: Technology, Theory, and Applications.* Hershey, PA: Idea Group Publishing. Retrieved from http://www.eltrun.gr/papers/mBook-classification.pdf..

Haig, M. (2002). *Mobile marketing: The message revolution*. Kogan Page.

Heman, R.D., & Renz, D.O. (1999). Theses on nonprofit organisational effectiveness. *Nonprofit and Voluntary Sector Quarterly*, *28*(2), 107-126.

Hesmondhalgh, D. (2002). *The cultural industries*. SAGE.

Interchange of Data Between Administrations. (2004). *Multi-channel delivery of eGovernment services*. Retrieved from http://europa.eu.int/idabc/.

Kleijnen, M., Wetzels, M., & de Ruyter, K (2004). Consumer acceptance of wireless finance. *Journal of Financial Services Marketing, 8*(3), 206-217.

Knell, S. (2003). The shape of things to come: Museums in the technological landscape. *Museum and Society*, *1*(3), 132-146.

Mahatanankoon, P., Wen, J.H., & Lim, B. (2005). Consumer-based m-commerce: Exploring consumer perception of mobile applications. *Computer Standards and Interfaces*, *27*, 347-357.

O'Connor, J., & Galvin, E. (2001). *Marketing in the digital age*. Prentice Hall.

Panayiotou, C., & Samaras, G. (2006). Mobile user personalization with dynamic profiles: Time and activity. In *Proceedings of On the Move to Meaningful Internet Systems 2006: OTM 2006 Workshops* (PerSys 2006). Part II (pp. 1295-1304).

Panayiotou, C., & Samaras, G. (2004). mPERSONA: Personalized portals for the wireless user: An agent approach. *Mobile Networks and Applications (MONET), Special Issue on Mobile and Pervasive Commerce*, *9*(6).

Paavilainen, J. (2002). *Mobile business strategies: Understanding the technologies and opportunities*. Wireless Press.

Postma, P. (1999). *The new marketing era: Marketing to the imagination in a technology-driven world*. McGraw-Hill.

Stafford, M.R., & Faber, R.J. (2004). *Advertising, promotion and new media*. M.E. Sharpe.

Towse, R. (Ed.). (2003). *A handbook of cultural economics*. Elgew Edward.

Tsang, M.M., Ho, S.-C., & Liang, T.-P, (2004). Consumer attitudes toward mobile advertising: An empirical study. *International Journal of Electronic Commerce*, *8*(3), 65-78.

Turban, E., King, D., Lee, J., Warkentin, M., Chung, H.M. (2002). *Electronic commerce*

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2002: A managerial perspective. Prentice Hall.

Wang, J., & Lin, J. (2003). Are personalization systems really personal? – Effects of conformity in reducing information overload. In *Proceedings of the 36th Hawaii International Conference on Systems Sciences* (HICSS'03) (p. 222c). IEEE Computer Society.

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