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Understanding MOBILE HANDHELD DEVICE USE AND ADOPTION

Without device adoption, there is no mobile commerce.

THE EMERGENCE OF M-COMMERCE HAS GENERATED CONSIDERABLE EXCITEMENT AMONG BOTH PRACTITIONERS AND ACADEMICS. THE MASS MEDIA CONTINUALLY EXTOLS EACH SEEMINGLY NOVEL IDEA ABOUT M-COMMUNICATION, M-COLLABORATION, AND M-COMMERCE, AND PRESENTS MANY SPECULATIONS REGARDING THE ENDLESS POTENTIAL OF WIRELESS TECHNOLOGY [7]. MANUFACTURERS ALSO CONTINUE TO PRODUCE WIRELESS HANDHELD DEVICES BASED ON THEIR OFTEN ABSTRACT CONCEPTIONS OF WHAT THE “GENERALIZED” MOBILE USER¹ MIGHT VALUE AND DESIRE. WHAT APPEARS TO BE MISSING, HOWEVER, IS A CLEAR UNDERSTANDING OF THE MOTIVATIONS AND CIRCUMSTANCES SURROUNDING MOBILE DEVICE USE AND ADOPTION FROM THE PERSPECTIVE OF THE CONSUMERS THEMSELVES. RECOGNIZING THAT M-COMMERCE CANNOT FULFILL ITS POTENTIAL WITHOUT WIDESPREAD PROLIFERATION OF

¹The terms “user,” “consumer,” and “individual” are used interchangeably in this article.

TWO BROAD factors affecting the implementation and acceptance of wireless phones emerged: Interface characteristics and network capabilities.

wireless devices and related applications [5], there is a clear need to comprehend how and why individuals (potential m-commerce consumers) adopt such devices.

Here, we describe the results of an ongoing

However, rather than merely instantiating existing theories in a new context, which could potentially ignore unique issues associated with mobile devices, we take an approach grounded in practice and in the points-of-view of actual users. Based on the study,

we offer a framework providing an integrative view of the key issues related to mobile device use and adoption by individuals. We believe the framework, as represented in the figure on the next page, will not only sensitize practice-oriented readers to pertinent factors but also provide researchers with a map that can help motivate empirical studies on this topic.

The framework is structured as an I-P-O (Input-Process-Output) model, and consists of: *Inputs* such as User characteristics, Message/task characteristics, Technology characteristics, Modality of Mobility, and the Surrounding Context; *Process*, consisting of two interacting use subprocesses of Exploration and Experimentation, and Assessment of Experience; and *Output*, referring to the

outcome of the use process, specifically, the actual Adoption Decision/Behaviors.

Inputs: Factors Influencing Use

Individual Characteristics. Various factors such as demographics, technology-related skills, and culture were identified as important determinants influencing the implementation and acceptance of wireless handheld phones; three of the most prominent follow.

The age of the potential adopter, which often can predict whether or not an individual is likely to use mobile technology, especially its data features. Age, or stage in life, seemed to influence the manner in

Study Conducted in: A large rural public university setting in the U.S.	
Participating Individuals (Total 21 participants)	Group #1 consisted of 5 (out of 7) officers of a large student club in the university (the "MIS Club"). All members were from the U.S.
	Group #2 consisted of 5 members, all of whom were exchange students visiting from a Northern European country (Norway).
	Group #3 consisted of 5 members, all of them being from the Asian-Pacific region (3 from Thailand, 1 from China, and 1 from S. Korea).
	Group #4 consisted of 4 members, who were also team members for an e-commerce course term project. All members were from the U.S.
	Group #5 consisted of all 7 officers of a large student club in the university (the "MIS Club"). All members were from the U.S.
Period of Participation	3 weeks (Data collection involving Groups 4 and 5 was initiated at the conclusion of the study of Groups 1, 2, and 3).
Technology, service, and training provided	<ul style="list-style-type: none"> •Device: Samsung SPH-N300. •Sprint service that allowed voice communication, and well as use of other data features. •90-minute training session on voice features, WAP browsing, text-messaging, connection to Internet services, conducted by the research team.
Data Collection and Analysis	<ul style="list-style-type: none"> •30-minute (approx.) interviews with participants each week; all interviews were transcribed. •Researchers adopted an interpretive stance during the study. •Multiple researchers involved in each interview. •Sometimes multiple interviewees in the same session. •Analysis followed the <i>spirit</i> of coding procedures recommended in the Grounded Theory Methodology (GTM). <ul style="list-style-type: none"> o <i>Open coding</i>, wherein transcripts are read and important concepts were identified. o <i>Axial coding</i>, wherein concepts were organized into meaningful categories. o <i>Selective coding</i>, wherein all other categories were linked to the core category of mobile technology use.

Some methodological details about the exploratory study.

exploratory research project (see the table here for details about the study) designed to unearth the key factors affecting the use

and adoption of handheld hybrid mobile devices (devices offering both voice and data features). It is useful to mention initially that well-established perspectives exist, such as the Technology Acceptance Model and Diffusion of Innovation framework, which offer factors such as "ease of use and usefulness," "relative advantage," "compatibility," "complexity," "communicability," and "triability" [3] that can, in very general terms, help explain the adoption of technologies (including, perhaps, mobile devices).

which the mobile device users balanced the expenses and convenience associated with mobility.

Technology self-efficacy, which refers to an individual's degree of confidence in using high-tech devices, was observed an important predictor of use and adoption behaviors. Interestingly, those with prior exposure to other mobile devices were found to encounter difficulties in switching from their existing technological frames [8], which included different sets of features, sequences of keystrokes to accomplish a task, and expectations of performance in comparison with other devices.

Cultural origin frequently plays a role in defining individuals' patterns of usage of mobile technology. In particular, the symbolic meaning of text messaging over a mobile device can be different across cul-

ture, depending on "power distance." For example, in high power distance cultures such as Korea, text messaging to individuals such as work supervisors was seen as a serious offense. In contrast, users from lower power distance cultures such as Norway did not see text messaging as being offensive, though some did indicate that text messaging could be potentially unsuitable for formal communication with someone unfamiliar due to the frequent use of abbreviations and slang terms.

you will find something under. And before you can browse the submenus on the Web you have to get on the Web" or "there is just too much going on [in] the messaging system.. if you send a message [it should be] two presses away... you go on the menu, it says 'message'; you go in there, you type it, you send it, that's it."

Network capabilities: Poor network characteristics acted as severe inhibitors to use and adoption. For example, the lack of coverage in many areas tended to reduce the sense of freedom and safety in many subjects' minds. The limited reach of mobile technology due to lack of (or limitations in) capability to communicate across networks (such as Sprint and Verizon) also dampened the use process and enthusiasm for adoption. Finally, the lack of reliability and reduced responsiveness of the network (downtime) contributed significantly toward eroding the users' trust in (and, thus, their interest in using) wireless technology.

Communication/Task Characteristics. As mobile device features are introduced, new potential applications are discovered and use practices continue to evolve. Nevertheless, a number of currently observable use-patterns, particularly related to mobile text messaging, are worthy of discussion.

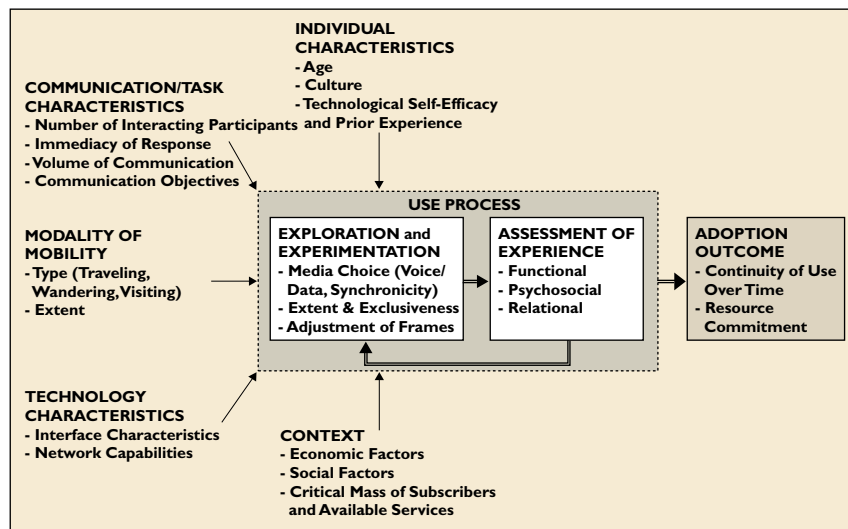
Number of interacting participants: Mobile devices appeared to be very suitable for accessing information unilaterally (reading email, checking stock quotes and news headlines), especially when the subject was seeking to fill a time slot that would otherwise be lost (during a short bus ride, while waiting in a line). Also, bilateral use of data features (such as through text messaging) was quite effective under many circumstances; however, simultaneous multi-lateral use was difficult, though not infeasible [2].

Technology Characteristics. Two broad factors affecting the implementation and acceptance of wireless phones emerged, as described here.

Interface characteristics: Users were usually quite forgiving of physical limitations of the device due to technological constraints, but were bothered by flaws in the logical interface of the devices, as seen in the following illustrative comments: "They need to make it easier for normal people to use, not just techno-geeks," or "you don't know which sub-menu

Immediacy of response desired: Examples include situations when an immediate confirmation of a message is desired due to urgency of the circumstances; where there exists a need for micro-coordination of activities due to the rapidly changing physical positions and schedules of communicators [6]; and where the value/relevance of an idea to the recipient is very time sensitive.

Volume of communication desired can influence use



patterns. For example, mobile text messaging was seen as suitable when short messages were sent/exchanged. Current constraints with respect to the device, especially the nature of the keyboard, made it virtually infeasible to participate in a high-volume text exchange.

Communication objectives may be classified as conveyance, convergence, and passive reception. Different media (voice, text messaging, and email) were viewed as suitable for different objectives, given a social context. For example, mobile text messaging seemed suitable for conveying a piece of informa-

tion, rather than when individuals needed convergence on a shared understanding of equivocal situations. Of course, creating a high level of synchronicity in communication through back-and-forth messaging could enable two individuals to reach some convergence [1].

Modalities of Mobility. Perhaps the most touted advantage of wireless technology is its ability to enable mobile communication, mobile collaboration, and mobile commerce. While descriptions of innovative applications of mobile technology and visions of future scenarios abound in the literature, the meaning of mobility, the types of mobility, and the implications of different types of mobility on wireless device use remain unclear. *Traveling, wandering, and visiting* were seen as three ways to qualify the essence of mobility [4]. Traveling is defined as “the process of going from one place to another in a vehicle” [4]. For example, a five-hour drive from one city to another could belong to this category of mobility. Wandering, on the other hand, refers to a form of “extensive local mobility” where an individual may spend considerable time walking around [4]. Finally, visiting refers to stopping by at some location and spending time there, before moving on to another location.

Different types and extent of mobility are associated with different motivations underlying use patterns. For example, safety was an important concern

for those traveling often, in contrast with the yearning for freedom expressed by those frequently wandering. Further, different characteristics of technologies were associated with different types and extent of mobility. For example, the optimal size of a device associated with wandering was necessarily lower than an acceptable device size when visiting or traveling, and one needed a larger reach of the technological network when traveling than when wandering.

Context. Undoubtedly, the surrounding socioeconomic context plays an important moderating

role on the effect of the factors discussed previously.

Economic factors and technological infrastructure: For individuals on a limited budget (such as college students), use patterns were highly influenced by economic considerations. Even though the advantages of being mobile were apparent and desirable, for many, the convenience was not worth the additional expense. Further, the pricing plans of various service providers were found to encourage and discourage different types of behavior. For example, the relative popularity of text messaging in Norway compared to Thailand was attributed to the relative costs associated with this form of communication in the two countries. The level of proliferation of mobile devices was also related to the existing quality and availability of traditional telecommunications infrastructure, and to the accessibility of public telecommunications facilities.

Social factors: The expectation of continuous availability and responsiveness associated with mobile device use appears to have a natural fit with cultures such as the U.S. that are fast-paced and rely on information for decision making in every aspect of life. Another interesting motivation for mobile device use, in the case of a major city in Thailand, was the fact that people are often stuck in their car due to frequent traffic jams, and social practice of engaging in “more or less meaningless conversation” as a leisure activity. Another related issue is that of

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symbolism, which refers to the meaning (beyond functionality) that members in the culture hold about possessing and using a mobile device. Societies where the penetration of mobile technology is not substantial may view these devices as “a young thing,” “a rich thing,” and “a cool thing,” and contribute to the users’ perception of an enhanced sense of self-importance.

Critical Mass: For an individual to use a wireless device, particularly its data features, a significant number of members of the subject’s social network needed to be users of the same features. Further, the availability of a sufficient number of mobile Web services (such as news or chat services) increased the use of data features and, subsequently, the chances of adoption.

The Use Process

The first step in the use process is Exploration and Experimentation, which involves the following.

Choice of appropriate medium of communication and the level of synchronicity: This refers to the medium used when communicating through a wireless device (for example, voice, text messaging, email) and the synchronicity of the medium chosen (the degree of delay involved in a bidirectional information exchange).

Choice of extent, mode, and exclusiveness of use: This is related to the frequency and volume of communicating with a wireless device, whether the participant primarily acts as an initiator, recipient, or both, and the extent to which such a device is utilized as compared to tethered devices for communication, coordination, and Web access needs.

Adjustment of cognitive frame regarding technology: This involves the process of reframing mobile technology as new motivations, modes, and consequences of applying the technology emerge over time. The adjustment of the cognitive frame also includes learning to improvise in order to bypass the current limitations of mobile technology that are being explored and experimented with. For example, through innovation in work practices and organization (socially configuring the group as a “ring network”), a group of subjects utilized a technology enabling one-to-one communication as a group collaboration technology.

The second step of the process can be labeled the Assessment of the Experience (that is, Exploration and Experimentation) with the device, which, in turn, recursively influences the manner in which the devices are utilized. Users appeared to assess their experiences on at least three dimensions: functional, psychosocial, and relational.

Impact on Functional Effectiveness and Efficiency, and on Interpersonal Relationships: Being reachable anywhere and at any time has obvious advantages, such as improved coordination and the elimination of wasted time when waiting for input from individuals who may be traveling, visiting, or wandering. This positive orientation to mobile technology is reflected in the view expressed by one of our subjects: “mobility means efficiency.” Given that wireless phones are carried around by users, they may be able to “fill” time, implying the users can call someone, check email, or send text messages in time slots between other scheduled activities, while wandering from one point to another on campus or while traveling from home to work. Sometimes, the filling of time is equivalent to the “killing” of time when the individuals use the mobile devices merely to keep themselves engaged or entertained in a free time slot (or in a time slot that should have been put to more productive use); otherwise, mobile devices can enable “shifting” of time, for example, by checking email and reading/sending short messages during time slots between scheduled activities.

Having access to a mobile device also enabled users to take care of various business and social obligations throughout the day, almost in real time as issues are confronted, rather than batching all the messages and responding later upon returning to one’s workstation. Benefits notwithstanding, there are a number of potentially negative effects on professional and social relationships, most arising from encroachment of personal/family time due to continuous interruption through the mobile device given the norm of constant availability, and from unmet expectations regarding responsiveness, as an individual switches off or ignores mobile devices to limit the uncontrolled intrusion of others on personal time.

Psychosocial outcomes: In addition to the more tangible impacts of mobile technology use discussed previously, a number of psychosocial impacts were observed: a sense of safety and security during traveling, elevated self-worth professionally or in a social group, a feeling of irritation with society’s predilection for mobile technology, and a sense of physical and cognitive attachment with the mobile device (users may feel “out of the loop” or “detached” without the mobile device that they may be accustomed to carrying). Interestingly, users of mobile devices experienced a simultaneous sense of freedom from being bound to their desks with a tethered device, yet, at the same time, a sense of captivity owing to the compulsiveness of responding to communication initiated by others at any or every time.

INTERESTINGLY, USERS

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Changing relationships among individuals: Having a device readily available often allowed and encouraged individuals to communicate, whether using voice or text, with others with whom communication would not have otherwise occurred, thereby establishing or reestablishing functionally useful ties. The availability of a communication device also tends to lead to greater frequency and volume of communication with members of the immediate social network, rendering the relationships “closer” [2]. Interactions using mobile devices can transform the nature of interpersonal relationships in yet another interesting though unexpected way. One of the mobile groups we studied reported that their leader, who normally plays a facilitative role in face-to-face meetings, came to be perceived as being more autocratic, leading to dissatisfaction in the team. The one-to-one communication imperative of using the devices resulted in the leader becoming the central node in the communication, with all members sending their responses to him, and the leader unilaterally *making* the decisions and communicating *his decisions* to the group members.

Output—Adoption Outcome

A positive experience with the use process, reflected in favorable assessment in terms of the functional, psychosocial, and relational outcomes, influenced adoption decisions and behavior. This pattern is likely to hold true especially in a voluntary technology adoption scenario. Different levels of adoption were signaled by study participants based on the degree of commitment of time, effort, and financial resources to enable the routine use of different features of the technology over time.

Conclusion

The areas of m-communication and m-commerce are promising, yet confusion is abundant. Much of the existing literature dwells on the description of technological leaps and the economic implications,

largely ignoring the fact that without widespread acceptance of mobile devices among individual consumers, the promise of mobility cannot be realized. In our study, through social analysis, we have investigated how and why mobile handheld device adoption occurs. While we do not claim the findings presented here are exhaustive, we are hopeful the holistic framework presented will be valuable in advancing knowledge in the emerging area of m-communication and m-commerce. 

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