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# Exploring convenience in mobile commerce: Moderating effects of gender

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**ABSTRACT**

To date, little research has examined gender difference in how convenience is perceived in mobile com- merce (m-commerce). The current work presents and tests a theoretical model partially based on Tech- nology Acceptance Model (TAM), and posits a sequential relationship among four primary dimensions:
(1) intrinsic attributes of mobile device—portability and interface design; (2) ease of use; (3) extrinsic attributes of mobile device—simultaneity, speed, and searchability; and (4) perceived convenience of m-commerce. We posit that physical attributes of mobile device (portability and interface design) are antecedents of ease of use, which in turn determines three extrinsic attributes (simultaneity, speed, and searchability). The final dependent variable is perceived convenience. Based on prior research on TAM and gender theories, the study proposes 16 hypotheses, of which our data support 12. Our results indicate that the link between interface design and ease of use holds a key to motivate females' use of m-commerce. In closing, implications are discussed while important limitations are recognized along with future research suggestions.

## 1. Introduction

With the accelerated sophistication of the smartphone, the world is becoming increasingly more ubiquitous. After Apple intro- duced the multi-functional touch screen with the iPhone in 2007, a tiny keyboard pad became a thing of the past. Smartphone users can now access the Internet and search information more easily with built-in keyboards, which allow for rapid data entry. For example, a recent survey indicates that travel search with mobile device increased by 1200%, and in particular, hotel searches on Google Maps grew 3000% in 2011 (Torres, 2011). Furthermore, a wide variety of auxiliary applications—location-based services, Quick Response (QR) code, near field communication (NFC), and radio frequency identification (RFID)—have become more and more popular for firms to use in integrating mobile device into multi-channel or cross-media campaigns (Okazaki, Li, & Hirose, 2012). As a result, TNS Global's recent Mobile Life Survey, with 48,000 users in 58 countries, suggests that interest in mobile com- merce (m-commerce hereafter) is on the rise globally (TNS, 2012).

Consumers' choice of m-commerce—and the applications they use it for—has always been associated with the convenience it of- fers (Chae & Kim, 2003; Kim, Mirusmonov, & Lee, 2010; Luarn & Lin, 2005). The notion of this convenience is closely related to time-place flexibility. The literature on service marketing indicates that convenience depends on several factors, including time and effort. In an early essay on the importance of convenience in con- sumer purchasing, Kelley (1958) cites Charles G. Mortimer's (then-president of the General Foods Corporation) ''ten conve- nience forms'' appearing in the marketing system, which include time and place convenience. Evening hours, and fresh fruits and vegetables out of season typify time convenience. Examples of place convenience include ''life insurance in airline terminals, drive-it-yourself automobile rental services, and the planned shop- ping center.'' As time passed, the concept of convenience became increasingly important to consumers, especially in a context of information and communication technology (ICT) adoption. Still, little research has been undertaken to define exactly how it could be defined or examined in m-commerce.

Given this background, this research attempts to address differ- ences between men and women in terms of how they perceive causes and effects of convenience in m-commerce. The objective of the study is twofold. First, we try to identify key determinants of perceived convenience when consumers are engaged in m-com- merce. Second, we examine the moderating effects of gender on the relationships among these determinants. A baseline model is built around two of the most widely documented variables in new technology adoption—ease of use and perceived usefulness— which derive additional variables associated with m-commerce. To validate the model, a laboratory study is conducted with general consumers who are asked to perform a task, and respond to a series of questions that test our study thesis.

There are three reasons why we believe this study makes un- ique and important contributions to the literature. First, given

the extensive role of technology in businesses and the increasing presence of women in professional domains, understanding gender differences in individual technology adoption and usage decisions is an important issue for organizational psychologists as they at- tempt to manage the organizational change process. On the other hand, industry analysts repeatedly report that there is an impor- tant gender gap in the use of mobile device. Perhaps surprisingly, however, gender's role in the use of m-commerce has been inves- tigated only recently. So far, however, research has studied only gender-based perceptual differences and not gender-based differ- ences in decision-making processes about technology. Second, gen- der is an increasingly important segmentation variable in many industries (Wolin, 2003). Gender is often used as a part of the social and cultural meanings associated with developing a marketing strategy, because the male–female dichotomy is the most funda- mental dichotomy in society (Prakash & Flores, 1985). In particular, the literature suggests that, in electronic commerce, gender signif- icantly interacts with attitudinal and behavioral variables (Okazaki & Hirose, 2009). Third, a recent industry report indicates that the preferred size of smartphone screens may not be the same be- tween men and women—females are more likely than males to fa- vor slightly smaller devices. This makes us contemplate that the perceived usability or convenience of the same device may differ according to gender. Therefore, the gender preference can be a cru- cial issue in terms of the design and functionality of future smartphones.

This article is structured in the following manner: First, the sig- nificance of the study has been explicated in this section, to clarify the importance and motivation of the research. Second, a theoret- ical framework of gender is described. Then, our baseline research model is explained, along with a series of hypotheses. This is fol- lowed by a methodology, based on which an empirical survey is executed and the results are described. Finally, implications are discussed, while important limitations are recognized along with future research directions.

## 2. Gender theories

Gender has been an important divide in consumer behavior in a wide range of social science disciplines, including m-commerce (Okazaki & Hirose, 2009). Gender is often used as a part of the so- cial and cultural meanings associated with developing a marketing strategy, because the male–female dichotomy is the most funda- mental dichotomy in society (Prakash & Flores, 1985). Moreover, we are expected to have learned gender roles since childhood. According to gender socialization theory, boys and girls are ex- pected to acquire not only sex-specific skills, but also sex-specific self-concepts and personality attributes, which enable them to feel masculine or feminine, as defined by a given culture (Barry, Bacon, & Child, 1957). As a result, men and women develop different sets of values which lead them to differ in their ethical and value pref- erences (Mason & Mudrack, 1998).

Gender schema theory posits that consumer behavior is a result of gender-based schematic processing (Bem, 1981). A schema is a cognitive structure that organizes and guides one's perception. A schema-based explanation of consumer response suggests that information about the gender and the event are accessed from memory. After comparison with the schema, the new information is encoded and assimilated into gender-linked associations that itemize appropriate gender-based behaviors. These behaviors be- come a gender schema against which individuals evaluate their own behaviors, in order to regulate their attitudes and behaviors (Bem, 1981). According to this theory, male schemas are associated with success and achievement to a higher degree than female sche- mas (Fırat & Dholakia, 1998).

Self-construal theory explains that gender-based information processing differences result from one's self-system, or self-con- strual. In this theory, women view themselves as interdependent with others (interdependent self-construal), and thus tend to focus on establishing and maintaining relationships with people and so- cial contexts. In contrast, men view themselves as independent of others (independent self-construal), and tend to have more indi- vidualistic goals. In addition, men are less concerned with belong- ingness or affiliation; thus, concerns about society, family, and other people are secondary for men.

Other streams of research indicate biological differences in the brain scheme. Specifically, the selectivity model (Meyers-Levy, 1989) posits that males and females differ in terms of their infor- mation processing strategy. This model argues that females are likely to rely on left-hemisphere processing, which concerns the specificities and intricacies represented by stimulus information, thus they will eventually seek emotional benefits. In contrast, males are likely to rely on right-hemisphere processing, which is related to global rules and other categorical concepts in processing information. Whereas females show a more detailed and elabora- tive processing style, males tend to focus on more holistic and undifferentiated processing. In other words, males often do not en- gage in comprehensive processing of all available information, but rather are selective. Thus, males will consider and rely on subsets of highly available cues. However, females tend to use a compre- hensive processing strategy in order to assimilate all available as- pects (Sánchez-Franco, Villarejo-Ramos, & Martín-Velicia, 2009).

## 3. The baseline model

The Technology Acceptance Model (TAM) (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989) is the most widely applied model of user acceptance and usage. TAM was adapted from the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). TAM suggests that two specific beliefs—perceived ease of use and perceived useful- ness—determine one's behavioral intention to use a technology, which has been linked to subsequent behavior (Sheppard, Hartwick, & Warshaw, 1988). TAM is one of the most widely used behavioral models in the information system (IS) field, and has served as a theoretical basis for its countless derivatives. For exam- ple, Venkatesh and Davis (2000) extended TAM to propose TAM2 by identifying further determinants of perceived usefulness, while Venkatesh, Morris, Davis, and Davis (2003) synthesized TAM and other seven prominent models of information technology accep- tance into the Unified Theory of Acceptance and Use of Technology (UTAUT).

Based on TAM, this study proposes a research model that de- scribes the factors influencing mobile users' perceived ease of use and

usefulness as they access, browse, and search the Internet for specific information. Fig. 1 summarizes our proposed model. First, we contemplate that there are two intrinsic attributes of mobile device that strongly affect perceived ease of use of m-com- merce—portability and interface design. Second, ease of use affects perceived usefulness, which is comprised of three extrinsic attri- butes of mobile device—simultaneity, speed, and searchability. The final consequence is perceived convenience, which would lead to the ultimate result of m-commerce use. Below, we explicate each dimension, explore relationships among them, and formulate hypotheses.

## 3.1. Intrinsic attributes of mobile device ? perceived ease of use

The literature on mobile commerce offers insight into key features that users especially appreciate, namely the portability and interface design of the handheld device. In prior m-commerce
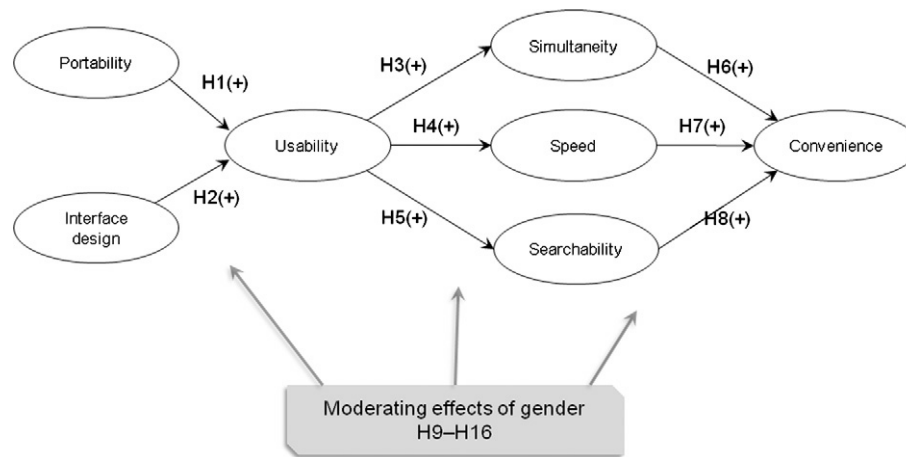


Fig. 1. Research model and hypotheses.

research, the extent of portability has been pointed out as one of the intrinsic factors that influence handheld device use and satis- faction (Kuziemsky, Laul, & Leung, 2005). Portability means the quality of being light enough to be carried, which relates to the very physical characteristic of the device (Bruner & Kumar, 2005; Kim et al., 2010). According to Junglas and Watson (2006), porta- bility reflects ''the physical aspects of mobile devices that enable them to be readily carried for long periods of time'' (p. 573). Gao, Rau, and Salvendy (2009) point out that ubiquity means being por- table, which enables an extensive reach beyond our special and temporal constraints. The portability of a technology has been associated with the use and effectiveness of an ICT, and reflects high levels of mobility in our social lives (Garfield, 2005). Such por- tability is essential for an IS to support all forms of mobility, and by being smaller in size, it becomes more ''stylistic.'' Thus:

H1: Portability will directly and positively affect perceived ease of use.

With regard to interface design, Cyr, Head, and Ivanov (2006) argue that design aesthetics of mobile Web sites could be an important antecedent of overall enjoyable user experience with mobile devices. They found that perceived visual aesthetics of the mobile interface would impact user perceptions of usefulness and perceived ease of use of the device. More narrowly defined, Li and Yeh (2010) view design aesthetics in m-commerce as ''the balance, emotional appeal, or aesthetic of a website and it may be expressed through the elements of colors, shapes, language, music or animation'' (p. 674). Their study indicates that design aes- thetics is a significant intrinsic determinant of ease of use. From an industry perspective, interface design drastically improved after the introduction of the multi-functional touch screen, which was first introduced by the iPhone in 2007. This technological break- through removed one of the most tedious impediments—a tiny input keyboard and screen—and drastically increased the level of perceived ease of use. Therefore, it seems reasonable to assume:

H2: Interface design will directly and positively affect perceived ease of use.

## 3.2. Perceived ease of use ? extrinsic attributes of mobile device

We posit that perceived usefulness consists of three extrinsic benefits in m-commerce—simultaneity, speed, and searchability. The

concept of simultaneity can be better understood in a frame- work of temporal mode of work versus temporal mode of the actor. The ''temporal mode of work'' refers to the temporal nature of tasks and events (Lee & Liebenau, 2000). While some events occur irregularly or sporadically, others take place regularly, following a predetermined, or at least predictable, sequence (monochronic). The ''temporal mode of the actor'' relates to how workers organize their time to deal with tasks and events. A polychronic worker would address tasks and events spontaneously as they arise irreg- ularly, whereas a monochronic worker would only deal with tasks and events at specified times and conduct one thing at a time, des- ignating some slots of time for specific tasks. That is, while the temporal mode of work is concerned with the structure of work, the temporal mode of the actor is concerned with the process of working. When mobile device is incorporated into our work pro- cesses, it could help us to disrupt monochronic temporal order by shifting the ways in which we structure our work patterns to be more polychronic (Lee & Liebenau, 2000). Using mobile device, whether to e-mail, search, or download, enables us to involve our- selves in several tasks—which could have forced us to relocate our- selves—simultaneously.

H3: Perceived ease of use will directly and positively affect simultaneity of the tasks.

Speed is similar to immediacy or one's perceived amount of time between an action and its consequences (Crano, 1995). Speed is also related to timeliness that has been conceptualized as a com- ponent of system quality, which significantly affects user satisfac- tion (Wixom & Todd, 2005). Prior m-commerce research has termed speed of mobile device as instant connectivity (Ko, Kim, & Lee, 2009) or ubiquitous availability (Gao et al., 2009). In this re- gard, we view speed as a response to time pressure in situations involving the use of services when consumers evaluate available alternatives that best fit their needs (Kim et al., 2010). Nonetheless, unless the device is easy to use, speed might not be perceived as a utility. Thus:

H4: Perceived ease of use will directly and positively affect speed of mobile device.

Searchability refers to the extrinsic capability of mobile device in making a thorough examination. This dimension has been widely discussed in context awareness computing (Pascoe, Ryan, & Morse, 2000). Searchability is somewhat similar to localization proposed by Junglas and Watson (2006), which is defined as the capability to pinpoint the position of a user or entity. Nonetheless, searchability does not limit to geographically specific services location- based services, because it covers information or data search in a computer-mediated environment.

H5: Perceived ease of use will directly and positively affect searchability of mobile device.

3.3. Perceived usefulness ? perceived convenience

Perceived convenience has been pointed out as one of the obvi- ous benefits of mobile computing, driven from portability and immediate accessibility (Sharma & Gutiérrez, 2010). Perceived convenience can be defined as agility, accessibility, and availability of a service, which is flexible in time and location. For handheld mobile gaming, what is relevant is neither reliability nor owner- ship, but the ''it fits my life'' dimension, which addresses why the games must be played in this context. The mobile device is essentially a ubiquitous device and enables the consumer to be entertained at any time, in any place. At the same time, this dimen- sion crystallizes the core utilitarian values of mobile games: sim- plicity in design, functionality in technology, and practicality in use. In our study context, perceived usefulness—consisting of simultaneity, speed, and searchability—determines the levels of perceived convenience.

H6: Simultaneity will directly and positively affect perceived convenience.
H7: Speed will directly and positively affect perceived convenience.
H8: Searchability will directly and positively affect perceived convenience.

4. Moderation effect of gender

Our primary question in this article is whether men and women recognize perceived convenience equally when they are engaged in m- commerce. If we envisage the smartphone as a handheld com- puting device, it would fall in a ''male domain.'' This masculiniza- tion of the computing device has been widely documented in the literature (Todman & Day, 2006). In this regard, TAM has been used in research that explores gender-based perceptual differences and their effects on new technology adoption. Yang and Lester (2005) finds that males identify stronger perceived ease of use, compared with their female counterparts. Nonetheless, Venkatesh and Morris (2000) reported the contrary in the adoption of a new IS—women are more likely to be influenced by perceived ease of use than men, while men placed a greater emphasis on perceived useful- ness. Portability represents one of the most important physical attributes of mobile device and it serves as a clear divide from bulkier computing devices (Serif & Ghinea, 2008). Portability, which is analogous to mobility, provides the ability to access ser- vices on the move—users can carry the device to conduct transac- tions from anywhere within a mobile network area, which eventually determines ease of use of the mobile device (Kim et al., 2010). Thus:

H9: Portability will influence perceived ease of use more strongly for women than for men.

Interface design is related to aesthetic perspective, and thus somewhat dissimilar to portability. According to gender-based schematic processing theory, such a stylistic aspect of mobile phone can be related to female schema (Katz & Sugiyama, 2005). Furthermore, something small and cute has been pointed out as an essential attribute favored by females (Cyr, Head, & Ivanov, 2010). Such gender-based biological stimulus processing should be applicable to multimedia device, leading to female preference

of portable, rather than fixed (e.g., desktop), device. Thus, we posit the following hypothesis:

H10: Interface design will influence perceived ease of use more strongly for women than for men.

The selectivity model suggests that there are important gender differences in information processing. Of particular interest to us, this theory posits that females tend to possess a detailed and elab- orative processing style, whereas males tend to focus on holistic and undifferentiated processing. This makes us believe that males are more likely to organize their tasks in a polychronic manner, compared with females. Prior research suggests that men appear highly motivated by productivity-related factors such as useful- ness (Ong & Lai, 2006). In TAM, perceived ease of use is conceptu- alized as a determinant of perceived usefulness, positing that the easier it is to use an IS, the more useful it is perceived. This implies that an IS that is easier to use will generate the best cost/benefit ratio for achievement- oriented individuals (Venkatesh & Morris, 2000). This can be interpreted in our study context to say that men may be more likely to appreciate ubiquitous attributes— namely simultaneity, speed, and searchability—compared with women, because these attributes are directly related to task pro- ductivity and efficiency, hence achievement in our daily lives. Thus:

H11: Perceived ease of use will influence simultaneity more strongly for men than for women.
H12: Perceived ease of use will influence speed more strongly
for men than for women.
H13: Perceived ease of use will influence searchability more strongly for men than for women.

Finally, because of our previous arguments, it seems reasonable to assume that men, more so than women, may weigh the benefits of m-commerce in satisfying their needs. Prior research indicates that males appreciate mobile device for efficiency and functional- ity, while women look for communication and networking. In gen- eral, this seems consistent with male proclivity to highlight competitiveness, as opposed to cooperation (Coates, 1986). In addition, male conversation often has a hidden agenda of achieving and maintaining social standing. Therefore:

H14: Simultaneity will influence perceived convenience more strongly for men than for women.
H15: Speed will influence perceived convenience more strongly for men than for women.
H16: Searchability will influence perceived convenience more strongly for men than for women.

In the following section, the methodology used to test these hypotheses is explained in detail.

## 5. Methodology

### 5.1. Laboratory study

To address the above hypotheses, a task-based laboratory study was conducted. There were 150 respondents chosen from a profes- sional research firm's online panel. A quota sampling was applied according to the distribution of age, sex, and occupation, which approximates to the population. The study took place in two cit- ies—the first and second most populated cities. The participants were prescreened according to their mobile phone usage and Inter- net connection. Only those who have used or regularly use mobile

CFA results.

| Hypothesized paths | | | b | a | CR | AVE |
|---|---|---|---|---|---|---|
| Portability[a] | '? | These services are practical, because I can use them without difficulty wherever I am | 0.64 | 0.77 | 0.78 | 0.55 |
| Portability | '? | Using these services outside my home or my workplace creates no problems for me | 0.78 | | | |
| Portability | '? | I find it convenient to use these services because they do not make me dependent on any fixed installation | 0.79 | | | |
| Interface design[b] | '? | The information displayed in my mobile handset is aesthetically appealing | 0.78 | 0.89 | 0.90 | 0.76 |
| Interface design | '? | Regardless of the type of information it offers, my mobile device usually uses beautiful colors, graphics, and layout | 0.88 | | | |
| Interface design | '? | I usually find the design of my mobile device visually attractive | 0.94 | | | |
| Perceived ease of use[c] | '? | It is easy for me to become skillful at looking for information with mobile Internet | 0.87 | 0.93 | 0.93 | 0.81 |
| Perceived ease of use | '? | It is easy to browse a search engine with mobile Internet. | 0.92 | | | |
| Perceived ease of use | '? | Learning how to find information with mobile device is easy for me | 0.91 | | | |
| Speed[a] | '? | The time taken to locate somebody or his or her information using these services is much shorter than by any other method | 0.73 | 0.74 | 0.77 | 0.53 |
| Speed | '? | Compared to other similar media, these services provide quicker ways of updating | 0.82 | | | |
| Speed | '? | The speed of these services makes using them an efficient way to manage my time | 0.61 | | | |
| Simultaneity[a] | '? | Using these services enables me to resolve problems that need attention now | 0.70 | 0.71 | 0.72 | 0.46 |
| Simultaneity | '? | I can use these services while I am doing something else | 0.71 | | | |
| Simultaneity | '? | While using these services, I can also handle other tasks | 0.62 | | | |
| Searchability[a] | '? | These services enable me to search for information, regardless of its source | 0.69 | 0.78 | 0.79 | 0.56 |
| Searchability | '? | These services enable me to discover new things, wherever I am | 0.71 | | | |
| Searchability | '? | These services give me the freedom to find the information that I need | 0.83 | | | |
| PC[b] | '? | Using mobile device to search information makes my life easier | 0.77 | 0.86 | 0.86 | 0.67 |
| Perceived convenience[c] | '? | The mechanism associated with mobile device is truly functional | 0.86 | | | |
| Perceived convenience[c] | '? | I find mobile device very practical | 0.83 | | | |

Note: b = Standardized coefficient, a = cronbach's alpha, CR = composite reliability, AVE = average variance extracted.

[a] Okazaki and Mendez (forthcoming).
[b] Mathwick et al. (2001).
[c] Dabholkar and Bagozzi (2002).

Table 1

Internet were chosen for the survey. Each participant was paid €30 as an incentive. The subjects were invited to the firm's research laboratory with a prior appointment. Each subject was then asked to use his or her mobile handset and seek information related to the Louvre Museum in Paris. Specifically, they were asked to con-nect to the Internet with their mobile device and find (1) the gen-eral description of the museum, and (2) its exact location on a map. This task took approximately 10 min to complete. Immediately after performing the task, the participants were asked to respond to a computer-assisted structured questionnaire and indicate the extent of their perceptions according to the items on a seven-point scale (''completely disagree'' to ''completely agree'').

## 5.2. Measures

The measures used in this study are adapted from prior re-search. Specifically, the items for perceived ease of use and per-ceived convenience are from Dabholkar and Bagozzi (2002). Interface design is adapted from Mathwick, Malhotra, and Rigdon (2001). The remaining constructs, namely portability, simultaneity, speed, and searchability were measured by scales developed by Okazaki and Mendez (in press). All measures are listed in Table 1.

## 6. Results

### 6.1. Measurement assessment

All measures were analyzed for reliability and validity following guidelines offered by Anderson and Gerbing (1988), and Hair, Black, Babin, Anderson, and Tatham (2006). The scale calibration process began by establishing unidimensionality across the con- structs. We assessed unidimensionality by examining the pattern of standardized residuals and the modification indexes generated from a confirmatory factor analysis (CFA). A maximum likelihood method was used with AMOS18. A CFA consisting of 10 latent vari-ables was run. The CFA produced the following fit index: v2168 ¼ 300:14 (p < 0.001), CFI = 0.93, NFI = 0.93, TLI = 0.91, and RMSEA = 0.073. In a model with good fit, the v2 statistic should not be significant at the 5% level. However, the literature suggests that this index is based on the central v2 distribution, which often becomes unrealistic in much empirical research (Byrne, 2001). The values of the CFI and TLI indexes should be close to 1, although val-ues between 0.90 and 0.95 are considered adequate (Bagozzi & Yi, 1988). The RMSEA index should be close to zero (Byrne, 2001). Thus, all the indexes, except the v2 statistic, are in an acceptable range. In addition, all items exhibited high standardized loadings on their intended factors. Thus, the measurement model was deemed to be acceptable.

Next, the internal consistency of multiple measures was assessed using composite reliability (CR) and average variance extracted (AVE). Unlike Cronbach's alpha, which represents a lower bound estimate of internal consistency due to its assumption of equal weightings of items, the CR offers a better estimate of variance shared by the respective indicators, while AVE serves as an even stricter estimate (Hair et al., 2006). As a benchmark, researchers generally recommend 0.70 and 0.50 for CR and AVE, respectively, as an appropriate reliability for an exploratory study. As shown in Table 1, the CRs and AVEs for all the multiple reflective constructs meet this criterion, with one exception (simultaneity). Thus, in general, the construct reliability can be deemed as satisfactory.

Discriminant validity is the extent to which a construct truly differs from neighboring constructs (Hair et al., 2006). This was as- sessed from the latent constructs correlations matrix, where the square roots of the AVE along the diagonal are reported. The corre- lations between the constructs are reported in the lower left off- diagonal elements in the matrix. Hair et al. (2006) suggest that average variance shared between a construct and its measures

Table 2
Discriminant validity.

|  | M | SD | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Portability | 5.62 | 1.26 | 0.74 | | | | | | |
| 2. Interface design | 5.14 | 1.36 | 0.52 | 0.87 | | | | | |
| 3. Perceived ease of use | 5.46 | 1.31 | 0.55 | 0.63 | 0.90 | | | | |
| 4. Speed | 5.22 | 1.45 | 0.63 | 0.55 | 0.39 | 0.73 | | | |
| 5. Simultaneity | 5.17 | 1.56 | 0.55 | 0.42 | 0.45 | 0.76 | 0.68 | | |
| 6. Searchability | 5.74 | 1.17 | 0.89 | 0.55 | 0.51 | 0.69 | 0.67 | 0.75 | |
| 7. Perceived convenience | 5.88 | 1.11 | 0.67 | 0.43 | 0.55 | 0.62 | 0.67 | 0.74 | 0.82 |

Note: M = Mean, SD = standard deviation. Diagonal elements in bold are the square root of average variance extracted (AVE) between the constructs and their indicators. Off-diagonal elements are correlations between the constructs.

should be greater than the variance shared between the constructs and other constructs in the model. Thus, discriminant validity is satisfied when the diagonal elements (square root AVE) are greater than the off-diagonal elements in the same row and column. As Ta- ble 2 shows, this condition was met for all the combinations, ex- cept two constructs (portability and simultaneity). However, because of the size of the correlation matrix, some violations may occur simply through chance (Malhotra, Kim, & Agarwal, 2004). Therefore, it can be argued that in this study at least a rea- sonable extent of discriminant validity was established.

## 7. Hypotheses testing

## 7.1. H1–H8

On this basis of our measurement model assessment, a struc-tural model was examined. The fit indexes were deemed to be acceptable: v2178 ¼ 441:04 (p< 0.001), CFI = 0.90, NFI = 0.90, TLI = 0.90, and RMSEA = 0.076. The hypotheses were tested accord-ing to the statistical significance of coefficient beta for the hypoth-esized paths. The results are summarized in Fig. 2.

H1and H2 contemplate two paths from portability and interface design to ease of use, respectively. The structural model results indicate the standardized coefficients for both paths are statisti-cally significant (0.34 and 0.47, respectively). Thus, both H1 and H2 were supported.

In H3–H5, we posit that perceived ease of use has a direct and po-sitive impact on simultaneity, speed, and searchability of mobile de-vice, respectively. The standardized coefficients of these structural paths were statistically significant with solid effects (0.52, 0.50, and 0.62, respectively). Thus, our data provide support for H3

H6–H8 predict that simultaneity, speed, and searchability of mobile device will collectively produce perceived convenience. In fact, the structural model indicates that these paths were signifi-cant, but the effect size varied. The strongest effect was observed on the path from searchability to perceived convenience (standard-ized b = 0.56, p<0.001). The path from speed was more modest (0.19, p< 0.05), as was the path from simultaneity (0.28, p<0.01). Thus, H6–H8 were supported by our data.
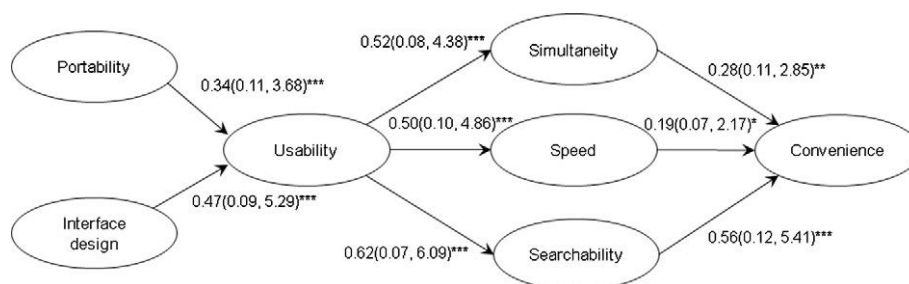


Fig. 2. Baseline model results. The numbers indicate standardized coefficients with standard errors and t-values, respectively, within the parenthesis. $^{*}$p < 0.05, $^{**}$p < 0.01, $^{***}$p < 0.001.

Table 3

## 7.2. H9–H16

To test Hypotheses 9–16, we first performed an individual esti- mation for males and females (Table 3), then multigroup analysis to determine the moderation of gender (Table 4). The latter test examined whether the strengths of the paths were different be- tween men and women.

Consider the first test presented in the table. To test H9, that the path from portability to perceived ease of use is stronger for fe-males than for males, we ran two multiple-sample models. In the first model, all paths were unconstrained between the two groups (''unconstrained model'') or the baseline model in the first row of Table 4. In the second model, the portability to perceived ease of use path was constrained to be equal for both subsamples (''con-strained model''). The difference in chi-square values between the two models ($v2 = \square 6.77$) with a single degree of freedom is sta-tistically significant at the p=0.01 level. Therefore, we may con-clude that the direct path between portability and perceived ease of use is greater for females, compared to their male counterparts. Other tests were conducted similarly.

H9 posits that the path from portability to perceived ease of use will be perceived more strongly by women than by men. Our mul-tigroup analysis indicates the t-value for this difference is statisti-cally significant. However, the direction was opposite to what we predicted—males perceived this path more strongly than women did. Thus, H9 was not supported.

H10 hypothesizes that interface design affects perceived ease of use more strongly for women than for men. The difference in this effect between males and females was significant with the pre-dicted direction. Thus, H10 was supported.

H11–H13 relate to the paths from perceived ease of use to simultaneity, speed, and searchability, respectively. We predict these effects to be perceived more strongly for men than for wo-men. Our statistical tests ring true for all hypotheses as the males' perceptions of these paths were stronger than their female coun-terparts. H11–H13 were all supported.

In H14–H16, the perceptions of the paths from simultaneity, speed, and searchability to perceived convenience were thought to be stronger for men than for women. Contrary to our prediction.

Table 3
Invidual estimation.

| Hypothesis | Paths | | | Standardized b for males | | Standardized b for females | |
|---|---|---|---|---|---|---|---|
| H9 | Portability | ? | Ease of use | 0.49 | *** | 0.45 | *** |
| H10 | Interface design | ? | Ease of use | 0.33 | *** | 0.42 | *** |
| H11 | Ease of use | ? | Simultaneity | 0.69 | *** | 0.37 | *** |
| H12 | Ease of use | ? | Speed | 0.51 | *** | 0.46 | *** |
| H13 | Ease of use | ? | Searchability | 0.59 | *** | 0.54 | *** |
| H14 | Simultaneity | ? | Perceived convenience | 0.54 | *** | 0.57 | *** |
| H15 | Speed | ? | Perceived convenience | 0.26 | ** | 0.28 | ** |
| H16 | Searchability | ? | Perceived convenience | 0.11 | * | 0.19 | * |

\* $p < 0.05$.
\*\* $p < 0.01$.
\*\*\* $p < 0.001$.

Table 4
Multigroup analysis.

| Paths[a] | | | Constrained model | | Unconstrained model | | D (df = 1) | |
|---|---|---|---|---|---|---|---|---|
| | | | $v^2$ | df | $v^2$ | df | | |
| Portability | ? | Ease of use | 734.77 | 368 | 728.00 | 367 | 6.77 | ** |
| Interface design | ? | Ease of use | 734.77 | 368 | 729.37 | 367 | 5.40 | * |
| Ease of use | ? | Simultaneity | 734.77 | 368 | 729.55 | 367 | 5.22 | ** |
| Ease of use | ? | Speed | 734.77 | 368 | 729.98 | 367 | 4.79 | * |
| Ease of use | ? | Searchability | 734.77 | 368 | 724.38 | 367 | 10.39 | ** |
| Simultaneity | ? | Perceived convenience | 734.77 | 368 | 734.64 | 367 | 0.13 | n.s. |
| Speed | ? | Perceived convenience | 734.77 | 368 | 733.28 | 367 | 1.49 | n.s. |
| Searchability | ? | Perceived convenience | 734.77 | 368 | 734.66 | 367 | 0.11 | n.s. |

n.s. = non-significant.
[a] Freely estimated in the unconstrained model.
\* $p < 0.05$.
\*\* $p < 0.01$.

Table 5
Summary of hypotheses testing.

| Hypotheses | | Results |
|---|---|---|
| H1: | Portability will directly and positively affect perceived ease of use | Supported |
| H2: | Interface design will directly and positively affect perceived ease of use | Supported |
| H3: | Perceived ease of use will directly and positively affect simultaneity of the tasks | Supported |
| H4: | Perceived ease of use will directly and positively affect speed of mobile device | Supported |
| H5: | Perceived ease of use will directly and positively affect searchability of mobile device | Supported |
| H6: | Simultaneity will directly and positively affect perceived convenience | Supported |
| H7: | Speed will directly and positively affect perceived convenience | Supported |
| H8: | Searchability will directly and positively affect perceived convenience | Supported |
| H9: | Portability will influence perceived ease of use more strongly for women than for men | Rejected |
| H10: | Interface design will influence perceived ease of use more strongly for women than for men | Supported |
| H11: | Perceived ease of use will influence simultaneity more strongly for men than for women | Supported |
| H12: | Perceived ease of use will influence speed more strongly for men than for women | Supported |
| H13: | Perceived ease of use will influence searchability more strongly for men than for women | Supported |
| H14: | Simultaneity will influence perceived convenience more strongly for men than for women | Rejected |
| H15: | Speed will influence perceived convenience more strongly for men than for women | Rejected |
| H16: | Searchability will influence perceived convenience more strongly for men than for women | Rejected |

however, the difference in the strength between males and females was not statistically significant for any of these paths. Thus, our data rejected H14–H16.

The hypotheses testing results are summarized in Table 5. On this basis, we attempt to provide interpretations and implications of the findings in the following section.

## 8. Conclusions

This study explores gender differences in the use of m-com- merce. Our hypotheses testing supports the majority of our predic- tions. Below we attempt to draw some meaningful conclusions of the study.

Our research makes several theoretical contributions. First, the study contemplates intrinsic and extrinsic attributes of mobile device. Intrinsic attributes—portability and interface design correspond to physical properties, while extrinsic attributes—simul- taneity, speed, and searchability—represent perceptions of utility. While much prior research suggests that these attributes are unique benefits of mobile device, little effort has been made to paint a clear map as a theoretical model. The causal relationships among (1) intrinsic attributes, (2) ease of use, (3) extrinsic attributes, and (4) perceived convenience, can serve as an initial stepping stone to expand into a more complete behavioral model. We consider this to be the most important theoretical contribution of this study.

Second, our results indicate that the link between interface de- sign and ease of use has special relevance for females, compared with the link between portability and ease of use. This seems to indicate that size and mobility are not key in marketing goods and services via mobile device for women. Something cute, aes- thetic, or neat in size is a good motivator for females to use mobile device to access or search information.

Third, the extrinsic attributes of mobile device can be para- phrased as the essential components of ubiquity concept in m- commerce. We conceptualize that, when consumers are engaged in m-commerce, they feel or perceive it to be ubiquitous, because (1) they can perform other activities simultaneously with other communication or transactions, (2) it is quick and immediate, and (3) the device allows them to search wireless Web networks for necessary information beyond time and place constraints. Our findings indicate that males tend to perceive the link between ease of use and these attributes more strongly than their female coun- terparts. This seems analogous to the findings of prior research on gender in e-commerce, in that, in general, women may not per- ceive computer-mediated environments as being as trustworthy as men do (Rodgers & Harris, 2003). Even though women perceive mobile device as easy to use, they feel a certain reluctance and hes- itation if they need to engage in online transactions.

This interpretation also seems consistent with our general understanding of masculinity and femininity. That is, men are more attracted by power-centered, competitive technology, while women are more attracted by interpersonal, network-creating technology. Such masculinization of computing devices may sound simplistic, but seems to exist. It will probably thus serve as an important divide in marketing highly technological products.

On the other hand, there was no gender effect on the links be- tween extrinsic attributes and perceived convenience. This sug- gests that women do recognize mobile device as a handy tool for searching information, especially when they need a quick solution to the task in question.

## 9. Limitations and future research directions

There are a few limitations which may have impacted on re- sults. First and foremost, due to the nature of our laboratory study, the sample size was small. Future research should increase the number of respondents to improve the generalizability of the re- sults. Second, our research stimulus was limited to information search in a static (i.e. laboratory) setting. A logical extension of this study could be to ask the respondents to seek information in a more dynamic setting. For example, it would be interesting to examine how they perceive simultaneity, speed, and searchability, when they move from one location to another.

Future research could attempt to cross-validate our model in other countries, because the perception of time may differ accord- ing to culture. For example, prior research suggests that ideas asso- ciated with linear (monochronic) time has been dominated in Western culture (Lee & Liebenau, 2000). Thus, our future explora- tion should include non-Western culture, such as Japan or China. Finally, gender socialization theory often disagrees with occupa- tional socialization theory. For example, prior research finds that, while no significant gender differences emerged in unemployed individuals, significant differences existed between employed wo- men and men (Mason & Mudrack, 1998). In this light, future re- search should include another independent variable, occupation, to further our findings.

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