

An Extended Model of Adoption of Technology in Households: A Model Test on People Using A Mobile Phone

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ABSTRACT

Individual adoption of technology has been studied extensively in the workplace (Brown & Venkatesh, 2005). Far less attention has been paid to adoption of technology in the household (Brown & Venkatesh, 2005). Obviously, mobile phone is now integrated into our daily life. Indeed, according to the more recent forecast of Gartner Research, 986 millions of mobile phones have been sold throughout the world in 2006 (Ouellet, 2006). And, as the tendency is showing up, mobile phone use will be continuously increasing in the future. The purpose of this study is then to investigate who uses a mobile phone, and why? In other

words, we try to identify who really are the users of a mobile phone and what are the determining factors who make such that they are using a mobile phone? On the basis of the theoretical foundations developed by Brown and Venkatesh (2005) to verify the determining factors in intention to adopt a computer in household by American people, this study examines the determining factors in the use of mobile phone in household by Canadian people. Data were gathered from 327 Atlantic Canadian people who own a mobile phone. Data analysis was performed using the structural equation modeling software Partial Least Squares (PLS). The results revealed that about half of the variables examined in the study showed to be determining factors in the use of mobile phone by people in household.

Keywords: Adoption of Technology, Model Test, Mobile Phone

INTRODUCTION

Since numerous years, mobile phone is used for different professional purposes, particularly by senior managers in the workplace. And this technology is more and more used in the workplace since mobile applications have been integrated to actual enterprise business strategies. Individual adoption of technology has been studied extensively in the workplace (Brown & Venkatesh, 2005). Far less attention has been paid to adoption of technology in the household (Brown & Venkatesh, 2005). Obviously, mobile phone is now integrated into our daily life. According to the more recent forecast of Gartner Research, 986 millions of mobile phones have been sold throughout the world in 2006 (Ouellet, 2006). And, as the tendency is showing up, mobile phone use will be continuously increasing in the future. The purpose of this study is then to investigate who uses a mobile phone, and why? In other words, we try to identify who really are the users of a mobile phone and what are the determining factors who make such that they are using a mobile phone?

Few studies have been conducted until now which investigate the intention to adopt a mobile phone by people in household (in the case of those who do not yet own a mobile phone) or the use of mobile phone in the daily life of people in household (in the case of those who own a mobile phone). Yet we can easily see that mobile phone is actually completely transforming the ways of communication of people around the world. It is therefore crucial to more deeply examine the determining factors in the use of mobile phone by people in household. This is the aim of the present study. The related literature on the actual research area of mobile phone is summarized in Table 1. In addition to the summary of literature on the actual research area of mobile phone presented in Table 1, other researchers have identified some factors which might increase the use of mobile phone by people in household. For example, in a large study carried out in 43 countries of the world, Kauffman and Techatassanasoontorn (2005) noted a faster increase in the use of mobile phone in countries having a more developed telecommunications infrastructure, being more competitive on the wireless market, and having lower wireless network access costs and less standards regarding the wireless technology. And a study involving 208 users by Wei (in press) showed that different motivations predict diverse uses of mobile phone. According to the Wei's findings, mobile phone establishes a bridge between interpersonal communication and mass communication. As we can see in the summary of literature related to mobile phone presented above, few studies until now examined the determining factors in the use of mobile phone by people in household. Thus, the present study brings an important contribution to fill this gap as it allows a better understanding of the impacts of mobile phone usage in people's daily life. It focuses on the following two research questions: (1) Who are the buyers of mobile phone for household use? and (2) What are the determining factors in the use of mobile phone by people in household?

Table 1. Related Literature Survey (adapted from Isiklar & Büyüközhan, 2007, p. 267)

<i>Research Area</i>	<i>References</i>
Mobile phone diffusion and its impacts on people's daily life.	LaRose (1989) Kwon & Chidambaram (2000) Botelho & Costa Pinto (2004) Funk (2005) Andonova (2006)
Mobile phone ownership and usage.	LaRose (1989) Kwon & Chidambaram (2000) Palen et al. (2000) Aoki & Downes (2003) Selwyn (2003) Davie et al. (2004)
Mobile phone ownership and usage from a behavioral and psychological perspective.	Karjaluoto et al. (2003) Wilska (2003) Davie et al. (2004)
Effects on human health and daily activities.	Repacholi (2001) Salvucci & Macuga (2002) Weinberger & Richter (2002) Sullman & Baas (2004) Treffner & Barrett (2004) Westerman & Hocking (2004) Balik et al. (2005) Balikci et al. (2005) Eby et al. (2006) Rosenbloom (2006) Törnros & Bolling (2006)
Evaluation and design of mobile phone features for user interface and user satisfaction.	Chuang et al. (2001) Chen et al. (2003) Han & Wong (2003) Chae & Kim (2004) Han et al. (2004) Lee et al. (2006)
Analytical evaluations of mobile phone-related observations.	Tam & Tummala (2001) Campbell & Russo (2003) Han & Wong (2003) Wang & Sung (2003) Lai et al. (2006)

The paper builds on a framework suggested by Fillion (2004) in the conduct of hypothetico-deductive scientific research in organizational sciences, and it is structured as follows: first, the theoretical approach which guides the study is developed; second, the methodology followed to conduct the study is described; finally, the results of the study are reported and discussed.

THEORETICAL APPROACH

This study is based on the theoretical foundations developed by Venkatesh and Brown (2001) to investigate the factors driving personal computer adoption in American homes as well as those developed by Brown and Venkatesh (2005) to verify the determining factors in intention to adopt a personal computer in household by American people. In fact, Brown and Venkatesh (2005) performed the first quantitative test of the recently developed model of adoption of technology in households (MATH) and they proposed and tested a theoretical extension of MATH integrating some demographic characteristics varying across different life cycle stages (see Danko & Schaninger, 1990) as moderating variables. With the exception of marital status (we included sex instead) and behavioral intention (we included user satisfaction instead (see Hobbs & Osburn, 1989)), all the variables proposed and tested by Brown and Venkatesh (2005) are used in this study, but none of them is tested as moderating variable. And we added two new variables in order to verify whether people are using mobile phone for security and mobility. The resulting theoretical research model is depicted in Figure 1.

Figure 1 shows that Brown and Venkatesh (2005) integrated MATH and Household Life Cycle in the following way. MATH presents five attitudinal beliefs grouped into three sets of outcomes: *utilitarian*,

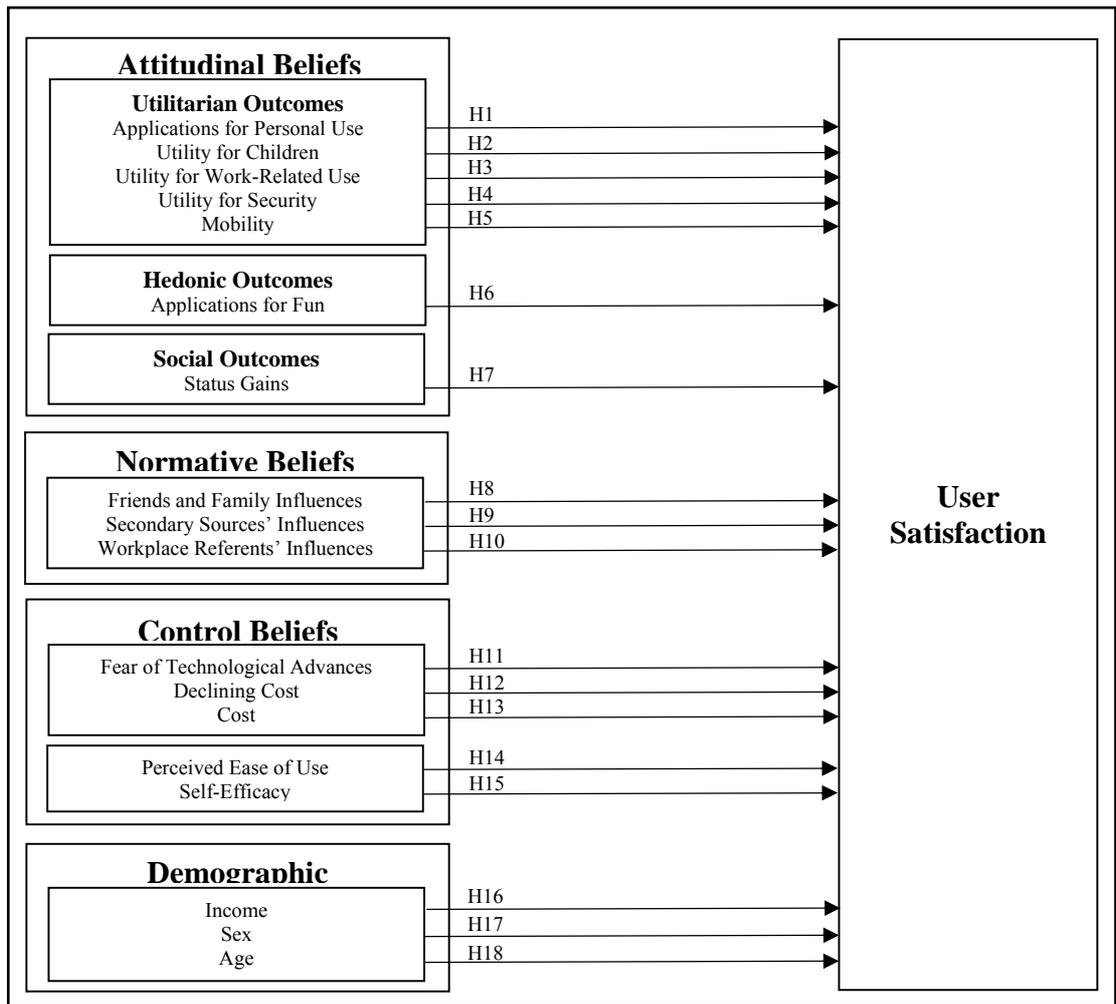


Figure 1. Theoretical Research Model

Table 2. Variables and Definitions

<i>Beliefs and Characteristics</i>	<i>Variables</i>	<i>Definitions</i>
<i>Attitudinal Beliefs</i>	Applications for Personal Use	The extent to which using a mobile phone enhances the effectiveness of household activities (adapted from Venkatesh & Brown, 2001).
	Utility for Children	The extent to which using a mobile phone enhances the children's effectiveness in their activities (adapted from Venkatesh & Brown, 2001).
	Utility for Work-Related Use	The extent to which using a mobile phone enhances the effectiveness of performing work-related activities (adapted from Venkatesh & Brown, 2001).
	Utility for Security	The extent to which using a mobile phone increases the security of its user and his/her family.
	Mobility	The extent to which a mobile phone allows to use only this telephone to perform all personal and professional activities.
	Applications for Fun	The pleasure derived from mobile phone use (adapted from Venkatesh & Brown, 2001). These are specific to mobile phone usage, rather than general traits (adapted from Brown & Venkatesh, 2005; see Webster & Martocchio, 1992, 1993).
	Status Gains	The increase in prestige that coincides with the purchase of a mobile phone for home use (adapted from Venkatesh & Brown, 2001).
<i>Normative Beliefs</i>	Friends and Family Influences	"The extent to which the members of a social network influence one another's behavior" (Venkatesh & Brown, 2001, p. 82). In this case, the members are friends and family (Brown & Venkatesh, 2005).
	Secondary Sources' Influences	The extent to which information from TV, newspaper, and other secondary sources influences behavior (Venkatesh & Brown, 2001).
	Workplace Referents' Influences	The extent to which coworkers influence behavior (Brown & Venkatesh, 2005; see Taylor & Todd, 1995).
<i>Control Beliefs</i>	Fear of Technological Advances	The extent to which rapidly changing technology is associated with fear of obsolescence or apprehension regarding a mobile phone purchase (adapted from Venkatesh & Brown, 2001).
	Declining Cost	The extent to which the cost of a mobile phone is decreasing in such a way that it inhibits adoption (adapted from Venkatesh & Brown, 2001).
	Cost	The extent to which the current cost of a mobile phone is too high (adapted from Venkatesh & Brown, 2001).
	Perceived Ease of Use	The degree to which using the mobile phone is free from effort (Davis, 1989; also adapted from Venkatesh & Brown, 2001).
	Self-Efficacy (or Requisite owledge)	The individual's belief that he/she has the knowledge necessary to use a mobile phone. This is closely tied to computer self-efficacy (Compeau & Higgins, 1995a, 1995b; see also Venkatesh & Brown, 2001).
<i>Demographic Characteristics</i>	Income	The individual's year gross income (see Wagner & Hanna, 1983).
	Sex	The individual's sex (male or female) (see Danko & Schaninger, 1990).
	Age	The individual's age (see Danko & Schaninger, 1990). In this case, age is calculated from the individual's birth date.

hedonic, and *social*. Utilitarian beliefs are most consistent with those found in the workplace and can be divided into beliefs related to *personal use*, *children*, and *work* (we added beliefs related to *security* and *mobility*). The extension of MATH suggested and tested by Brown and Venkatesh (2005) presents three normative beliefs: *influence of friends and family*, *secondary sources*, and *workplace referents*. As for control beliefs, they are represented in MATH by five factors: *fear of technological advances*, *declining cost*, *cost*, *perceived ease of use*, and *self-efficacy* (or *requisite knowledge*). And, according to Brown and Venkatesh (2005), integrating MATH with a life cycle view (*marital status* (we included *sex* instead of *marital status*), *age*, and *presence/age of children*) that includes *income* (see Wagner & Hanna, 1983) allows to provide a richer explanation of household personal computer adoption (household mobile phone usage in this study) than those provided by MATH alone. Finally, as shown in Figure 1, the dependant variable of the theoretical research model developed is related to *user satisfaction* (satisfaction in the use of mobile phone by people in household). All of the variables integrated in the theoretical research model depicted in Figure 1 are defined in Table 2.

We can see in Table 2 that the definitions of MATH variables integrated in the theoretical research model proposed in Figure 1 are, in the whole, adapted from the theoretical foundations developed by Venkatesh and Brown (2001) to investigate the factors driving personal computer adoption in American homes. As for the definitions of the variables related to the household life cycle view and income, they were taken from Danko and Schaninger (1990) as well as Wagner and Hanna (1983), respectively. And the definitions of the two new independent variables that we added to the model are from our own. In fact, we defined these variables in accordance with which we wanted to measure regarding security and mobility before to develop and validate items measuring them on the basis of the definitions formulated.

In the remainder of the section, we develop eighteen research hypotheses (H1-H18) for the model suggested in Figure 1, which integrates MATH beliefs with some household life cycle variables (income, sex, and age) and our two new variables related to security and mobility.

H1: *Applications for personal use increase satisfaction in the use of mobile phone by people in household.*

H2: *Utility for children increases satisfaction in the use of mobile phone by people in household.*

H3: *Utility for work increases satisfaction in the use of mobile phone by people in household.*

H4: *Utility for security increases satisfaction in the use of mobile phone by people in household.*

H5: *Mobility increases satisfaction in the use of mobile phone by people in household.*

H6: *Applications for fun increase satisfaction in the use of mobile phone by people in household.*

H7: *Status gains increase satisfaction in the use of mobile phone by people in household.*

H8: *Friends and family influences increase satisfaction in the use of mobile phone by people in household.*

H9: *Secondary sources' influences increase satisfaction in the use of mobile phone by people in household.*

H10: *Workplace referents' influences increase satisfaction in the use of mobile phone by people in household.*

H11: *Fear of technological advances decreases satisfaction in the use of mobile phone by people in household.*

H12: *Declining cost increases satisfaction in the use of mobile phone by people in household.*

H13: *Cost decreases satisfaction in the use of mobile phone by people in household.*

H14: *Perceived ease of use increases satisfaction in the use of mobile phone by people in household.*

H15: *Self-efficacy increases satisfaction in the use of mobile phone by people in household.*

H16: *Income decreases satisfaction in the use of mobile phone by people in household.*

H17: *Sex (male vs. female) increases satisfaction in the use of mobile phone by people in household.*

H18: *Age decreases satisfaction in the use of mobile phone by people in household.*

In the next section of the paper, we describe the methodology followed to conduct the study.

METHODOLOGY

The study was designed to gather information concerning mobile phone use decisions in Atlantic Canadian households. The focus of the study is on individuals who own a mobile phone. We conducted a telephone survey research among individuals of a large area in Atlantic Canada. In this section, we describe the instrument development and validation, the sample and data collection, as well as the data analysis process.

Instrument Development and Validation

To conduct the study, we used the survey instrument developed and validated by Brown and Venkatesh (2005) to which we added three new scales, the first two measuring other dimensions in satisfaction in the use of mobile phone by people in household, that is, utility for security and mobility, and the last one measuring user satisfaction as such. The survey instrument was then translated in French (a large part of the population in Atlantic Canada is speaking French) and both the French and English versions were evaluated by peers. This review assessed face and content validity (see Straub, 1989). As a result, changes were made to reword items and, in some cases, to drop items that were possibly ambiguous, consistent with Moore and Benbasat's (1991) as well as DeVellis's (2003) recommendations for scale development. Subsequent to this, we distributed the survey instrument to a group of 25 MBA students for evaluation. Once again, minor wording changes were made. Finally, we performed some adjustments to the format and appearance of the instrument, as suggested by both peers and MBA students, though these minor changes had not a great importance here given the survey was administered using the telephone. As the instrument was already validated by Brown and Venkatesh (2005) and showed to be of a great reliability, that we used the scale developed by Hobbs and Osburn (1989) and validated in their study as well as in several other studies to measure user satisfaction, and that we added only few items to measure the new variables utility for security and mobility, then we have not performed a pilot-test with a small sample. The evaluations by both peers and MBA students were giving us some confidence that we could proceed with a large-scale data collection. The specific measures are presented in Appendix A.

Sample and Data Collection

First, in this study, we chose to survey people in household over 18 years taken from a large area in Atlantic Canada who own a mobile

phone. To do that, undergraduate and graduate students studying at our faculty were hired to collect data using the telephone. A telephone was then installed in an office of the faculty, and students, one at a time over a 3 to 4-hour period, were asking people over the telephone to answer our survey. And in order to get a diversified sample (e.g., students, retired people, people not working, people working at home, and people working in enterprises), data were collected from 9 a.m. to 9 p.m. Monday through Friday over a 5-week period. Using the telephone directory of the large area in Atlantic Canada chosen for the study, students were randomly selecting people and asking them over the telephone to answer our survey. The sample in the present study is therefore a randomized sample, which is largely valued in the scientific world given the high level of generalization of the results got from such a sample. Once an individual had the necessary characteristics to answer the survey and was accepting to answer it, the student was there to guide him/her to rate each item of the survey on a seven points Likert-type scale (1: strongly disagree ... 7: strongly agree). In addition, the respondent was asked to answer some demographic questions. Finally, to further increase the response rate of the study, each respondent completing the survey had the possibility to win one of the 30 Tim Hortons \$10 gift certificates which were drawn at the end of the data collection. To that end, the phone number of each respondent was put in a box for the drawing. Following this process, 327 people in household answered our survey over a 5-week period.

Data Analysis Process

The data analysis of the study was performed using a structural equation modeling software, that is, Partial Least Squares (PLS-Graph 3.0). Using PLS, data have no need to follow a normal distribution and it can easily deal with small samples. In addition, PLS is appropriate when the objective is a causal predictive test instead of the test of a whole theory (Barclay et al., 1995; Chin, 1998) as it is the case in this

study. To ensure the stability of the model developed to test the research hypotheses, we used the PLS bootstrap resampling procedure (the interested reader is referred to a more detailed exposition of bootstrapping (see Chin, 1998; Efron & Tibshirani, 1993)) with an iteration of 100 sub-sample extracted from the initial sample (327 Atlantic Canadian people). Some analyses were also performed using the Statistical Package for the Social Sciences software (SPSS 13.5). The results follow.

RESULTS

In this section of the paper, the results of the study are reported. We begin to present some characteristics of the participants. Then we validate the PLS model developed to test the research hypotheses. Finally, we describe the results got from PLS analysis to test the research hypotheses.

Participants

The participants in this study were either relatively aged or relatively young, with a mean of 39.8 years and a large standard deviation of 14.5 years. These statistics on the age of the participants are, in fact, consistent with the growing old population phenomenon. Near from two third of the participants were female (62%). Near from 80% of the participants were married (50.9%) or single (28.4%). The gross yearly income of the respondents in the study was in the range of \$0 to \$50,000. Indeed, 72.4% of the respondents were winning between \$0 and \$50,000, and, from this percentage, 35.5% were winning between \$30,000 and \$50,000. And 5.5% of the respondents were winning \$100,000 or over. Concerning the level of education, 25.5% of the participants in the study got a high-school diploma, 26.4% got a college degree, and 39.6% completed a baccalaureate. Only 2.1% of the participants got a doctorate, which is relatively consistent with the whole population in general. Finally, the respondents in our study were

mainly full-time employees (52.5%), retired people (12%), students (11.7%), self employed (9%), part-time employees (7.4%), and unemployed (4.6%). These last statistics on the respondents' occupation help to explain the large standard deviation on their age reported above. Indeed, 11.7% of the respondents were young students, while 12% were retired people. So the difference in age between the two groups is very large.

Validation of the PLS Model to Test Hypotheses

First, to ensure the reliability of a construct or a variable using PLS, one must verify the three following properties: individual item reliability, internal consistency, and discriminant validity (Yoo & Alavi, 2001; see the paper for more details). To verify individual item reliability, a confirmatory factor analysis (CFA) was performed on independent and dependent variables of the theoretical research model. A single iteration of the CFA was necessary given all loadings of the variables were superior to 0.50 and then none item was withdrawn nor transferred in another variable in which the loading would have been higher. Indeed, in the whole, items had high loadings, which suppose a high level of internal consistency of their corresponding variables. In addition, loadings of each variable were superior to cross-loadings with other variables of the model. Hence the first criterion of discriminant validity was satisfied. And to get composite reliability indexes and average variance extracted (AVE) in order to satisfy the second criterion of discriminant validity and to verify internal consistency of the variables, we used PLS bootstrap resampling procedure with an iteration of 100 sub-sample extracted from the initial sample (327 Atlantic Canadian people). The results are presented in Table 3.

Table 3. Means, Standard Deviations, Composite Reliability Indexes, Correlations, and Average Variance Extracted of Variables

Variable	M	SD	Reliability Index	Correlations and Average Variance Extracted ^c																		
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Applications for Personal Use	3.84	2.16	0.82	0.77																		
2. Utility for Children	2.07	2.52	0.96	.27	0.94																	
3. Utility for Work-Related Use	3.17	2.46	0.91	.39	.10	0.88																
4. Utility for Security	5.62	1.68	0.89	.21	.16	-.04	0.85															
5. Mobility	3.55	2.12	0.88	.30	.05	.23	.09	0.84														
6. Applications for Fun	2.88	2.23	0.89	.35	.05	.23	.13	.25	0.82													
7. Status Gains	2.45	1.72	0.93	.18	.15	.19	.13	.31	.37	0.90												
8. Friends and Family Influences	3.66	2.27	0.93	.26	.05	.16	.13	.19	.43	.40	0.88											
9. Secondary Sources' Influences	3.24	2.25	0.90	.17	.09	.08	.10	.09	.25	.23	.36	0.87										
10. Workplace Referents' Influences	3.12	2.41	0.98	.26	-.03	.37	.04	.19	.31	.29	.53	.33	0.98									
11. Fear of Technological Advances	3.21	1.97	0.83	-.06	.10	.04	.10	-.09	.04	.15	.13	.15	.16	0.79								
12. Declining Cost	4.14	1.94	0.89	.17	.13	.08	.12	.12	.06	.05	.04	.13	.08	-.04	0.85							
13. Cost	4.38	1.83	0.96	.07	.01	.04	.16	.13	.04	.22	.16	.07	.10	.24	-.09	0.96						
14. Perceived Ease of Use	5.69	1.45	0.88	.19	-.05	.09	.15	.27	.24	.18	.17	-.02	.20	-.11	.15	.00	0.80					
15. Self-Efficacy	6.39	1.02	0.93	.18	-.14	.04	.12	.18	.12	.03	.11	-.08	.12	-.12	.15	-.00	.66	0.91				
16. Income ^a	NA	NA	NA	.04	.11	.09	-.12	-.11	-.32	-.23	-.24	-.05	-.04	-.07	.02	-.11	-.05	-.00	NA			
17. Sex ^a	NA	NA	NA	-.04	-.03	-.22	.27	-.02	.09	-.06	.06	.00	-.04	.04	-.11	.03	-.03	-.02	-.22	NA		
18. Age ^b	39.80	14.49	NA	.12	-.24	.20	.04	.21	.46	.22	.31	.16	.37	-.05	-.03	.10	.31	.18	-.41	.16		
19. User Satisfaction	5.46	1.48	0.86	.18	.04	-.09	.31	.20	.21	.11	.16	.06	.03	-.10	.21	-.06	.40	.27	-.13	.10		
																				.06	0.71	

^aThis variable was coded as a nominal variable. It was measured in terms of non quantified distinct categories.

^bThis variable was coded as a continuous variable. It was measured using the respondents' birth date.

^cBoldfaced elements on the diagonal of the correlation matrix represent the square root of the average variance extracted (AVE). For an adequate discriminant validity, the elements in each row and column should be smaller than the boldfaced element in that row or column.

As shown in Table 3, PLS analysis indicates that all square roots of AVE (boldfaced elements on the diagonal of the correlation matrix) are higher than the correlations with other variables of the model. In other words, each variable shares more variance with its measures than it shares with other variables of the model. Consequently, discriminant validity is verified. Finally, as supposed previously, we can see in Table 3 that PLS analysis showed high composite reliability indexes for all variables of the theoretical research model. The variables have therefore a high internal consistency, with composite reliability indexes ranging from 0.82 to 0.98.

Hypothesis Testing

To test the research hypotheses, we developed a PLS model similar to those of Fillion (2005), Limayem and DeSanctis (2000), Limayem et al. (2002), and Yoo and Alavi (2001). The PLS model is depicted in Figure 2. As we can see in Figure 2, the t-value (2.26) and beta coefficient (0.15) got in the PLS structural equation model indicate that the path from utility for work-related use to user satisfaction is significant ($p < 0.01$). In short, as we anticipated, in this study, utility for work increased satisfaction in the use of mobile phone by people in household. Consequently, hypothesis 3 is supported. Figure 2 shows that the path from utility for security to user satisfaction is very significant ($t = 3.69$, $\beta = 0.22$, $p < 0.001$). In other words, as we expected, the new variable utility for security that we added in this study to the model suggested by Brown and Venkatesh (2005) increased satisfaction in the use of mobile phone by people in household. As a result, hypothesis 4 is supported. The t-value (1.7) and beta coefficient (0.09) got in the PLS structural equation model presented in Figure 2 indicate that the path from mobility to user satisfaction is significant ($p < 0.05$). Therefore, as we anticipated, the new variable mobility that we added in this study to the model proposed by Brown and Venkatesh (2005) increased satisfaction in the

use of mobile phone by people in household. Hypothesis 5 is then supported. As shown in Figure 2, the t-value (1.76) and beta coefficient (0.11) got in the PLS structural equation model indicate that the path from applications for fun to user satisfaction is significant ($p < 0.05$). In short, as we expected, in the present study, applications for fun increased satisfaction in the use of mobile phone by people in household. And hypothesis 6 is supported.

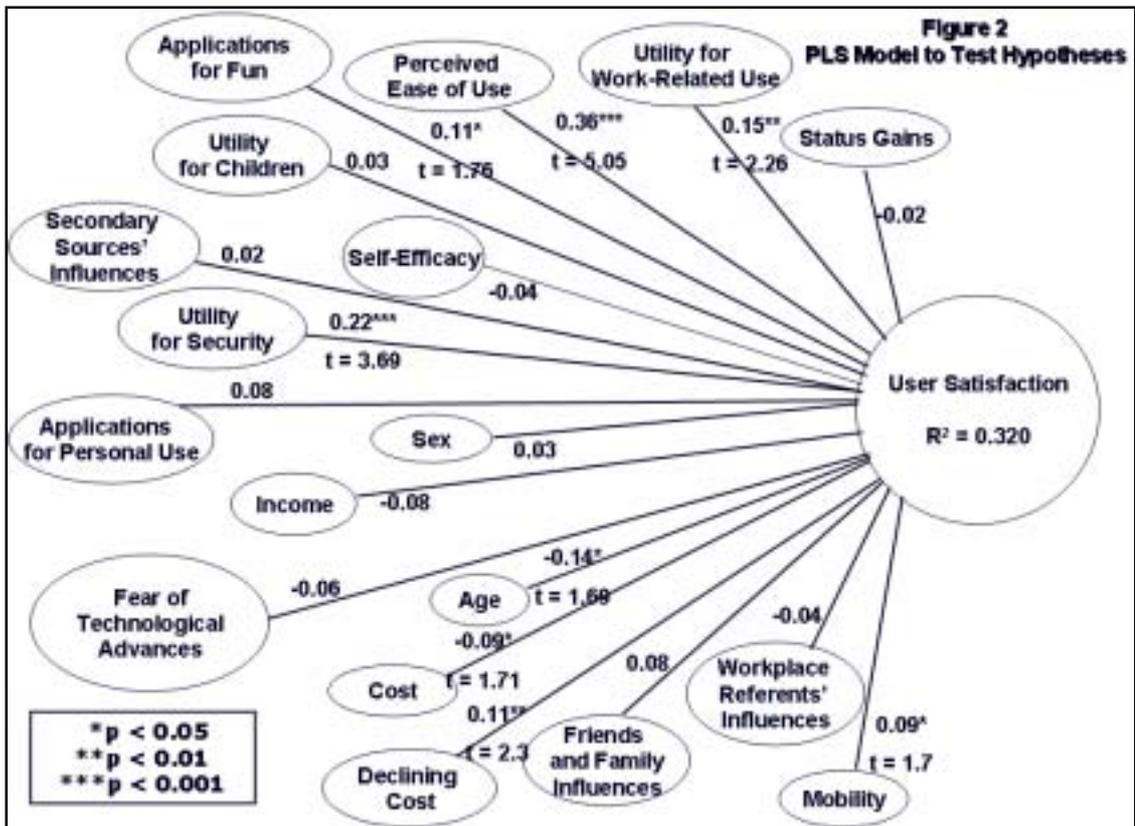


Figure 2. PLS Model to Test Hypotheses

We can see in Figure 2 that the path from declining cost to user satisfaction is significant ($t = 2.3$, $\beta = 0.11$, $p < 0.01$). Thus, as we expected, in this study, declining cost increased satisfaction in the use of mobile phone by people in household. Consequently, hypothesis 12 is supported. As shown in Figure 2, the t -value (1.71) and beta coefficient (-0.09) got in the PLS structural equation model indicate that the path from cost to user satisfaction is significant ($p < 0.05$). Therefore, as we anticipated, in this study, cost decreased satisfaction in the use of mobile phone by people in household. Hence hypothesis 13 is supported. The high t -value (5.05) and beta coefficient (0.36) got in the PLS structural equation model indicate that the path from perceived ease of use to user satisfaction is very significant ($p < 0.001$). In this study, we expected that this largely used variable, originating from Davis's (1989) technology acceptance model (TAM), would increase satisfaction in the use of mobile phone in household. So our expectations revealed to be exact. Consequently, hypothesis 14 is supported. Figure 2 shows that the path from age to user satisfaction is significant ($t = 1.69$, $\beta = -0.14$, $p < 0.05$). Thus, as we anticipated, in this study, age decreased satisfaction in the use of mobile phone by people in household. As a result, hypothesis 18 is supported. Finally, Figure 2 shows that the t -values and beta coefficients related to all the other variables in the model are too low to be significant. Thus, hypotheses 1, 2, 7, 8, 9, 10, 11, 15, 16, and 17 are not supported.

DISCUSSION AND CONCLUSIONS

The last section of the paper is devoted to a discussion about the results of the study and some conclusions. And to support our discussion and conclusions, we provide the reader with a more detailed view of the PLS structural equation model developed to test the research hypotheses, including the percentages of variance explained of variables (see Table 4).

Table 4. Beta Path Coefficients, T-Values, and Percentages of Variance Explained of Variables

<i>Variable</i>	<i>Beta</i>	<i>t</i>	<i>R²</i>
Applications for Personal Use	0.08	1.15	0.039
Utility for Children	0.03	0.54	0.000
Utility for Work-Related Use	0.15**	2.26	0.029
Utility for Security	0.22***	3.69	0.055
Mobility	0.09*	1.7	0.006
Applications for Fun	0.11*	1.76	0.038
Status Gains	-0.02	0.34	0.000
Friends and Family Influences	0.08	1.17	0.002
Secondary Sources' Influences	0.02	0.34	0.001
Workplace Referents' Influences	-0.04	0.64	0.001
Fear of Technological Advances	-0.06	0.53	0.014
Declining Cost	0.11**	2.3	0.027
Cost	-0.09*	1.71	0.009
Perceived Ease of Use	0.36***	5.05	0.086
Self-Efficacy	-0.04	0.58	0.001
Income	-0.08	1.07	0.001
Sex	0.03	0.49	0.000
Age	-0.14*	1.69	0.011

*p < 0.05; **p < 0.01; ***p < 0.001.

As shown in Table 4 (and Figure 2), the eighteen independent variables examined in the study explained 32 percent ($R^2 = 0.320$) of the variance in satisfaction in the use of mobile phone by people in household. And we can also see in Table 4 that the eight variables who showed to be significant (see also the significant beta path coefficients in Figure 2), that is, utility for work-related use, utility for security, mobility, applications for fun, declining cost, cost, perceived ease of use and age, explained alone 26.1 percent of the variance in satisfaction in the use of mobile phone by people in household. Thus, these eight variables are assuredly very important factors to take into account in future studies on the mobile phone and on the part of mobile phone providers, and more particularly perceived ease of use and utility for security which explained alone 14.1 percent of this variance (see Table

4). It is very interesting to see here that the two new variables that we added to the Brown and Venkatesh's (2005) theoretical research model, that is utility for security and mobility, showed to be very significant ($p < 0.001$ and $p < 0.05$, respectively; see Table 4) in satisfaction in the use of mobile phone by people in household. Indeed, the present study showed that people are, to some extent, using a mobile phone for a matter of security (the mobile phone is useful for their own security and those of their families) and mobility (the mobile phone provides them with the possibility to use only this telephone to perform all their personal and professional activities). So here are two new variables which we might add to the integrated research model of MATH and household life cycle characteristics suggested by Brown and Venkatesh (2005) to test in future studies. In addition, these two new variables might be included in the sales marketing plan of mobile phone providers.

In the large-scale study in which Brown and Venkatesh (2005) integrated MATH and some household life cycle characteristics (as moderating variables), the integrated model explained 74 percent of the variance in intention to adopt a personal computer for home use, a substantial increase of 24 percent over baseline MATH that explained 50 percent of the variance. In the present study, we used the integrated model proposed by Brown and Venkatesh (2005), with the exception of the household life cycle variable marital status (we added sex instead). We also added two new independent variables to the model, namely, utility for security and mobility. But we used the other household life cycle variables as independent variables in our research model instead of moderating variables as did Brown and Venkatesh (2005). Finally, given that we investigated the perceptions of people already using a mobile phone instead of those having the intention to adopt a mobile phone, as did Brown and Venkatesh (2005) for the personal computer, we used the dependent variable user satisfaction

instead of behavioral intention. And the model explained 32 percent of the variance in satisfaction in the use of mobile phone by people in household (see Table 4 and Figure 2). Thus, in this study, our research model explained a smaller percentage of variance than those explained by MATH alone (without the household life cycle characteristics and using behavioral intention as dependent variable).

Further, in a previous study in which we investigated the intention to buy a mobile phone by people in household (see Fillion & Berthelot; this paper has been also submitted in Management Review: An International Journal), we also used the theoretical research model suggested by Brown and Venkatesh (2005) to which we added the same two independent variables utility for security and mobility than we included in the present study in which we investigated satisfaction in the use of mobile phone by people in household. And our model explained 50 percent of the variance in intention to buy a mobile phone, while in the present study our model explained 32 percent of the variance in satisfaction in the use of mobile phone. Of course, the dependent variable was different in the two studies. Indeed, we used behavioral intention in the previous study and user satisfaction in the present study. Hence we can see that the variable behavioral intention is probably more appropriate as dependent variable in the research model proposed by Brown and Venkatesh (2005) than is user satisfaction, even when the model is augmented of some new independent variables. However, it is to be noted that, in the model we used in this study, more independent variables showed to be good predictors in satisfaction in the use of mobile phone by people in household than did independent variables in the model we used in the previous study in intention to adopt a mobile phone for household use. So though the result of our test seems, at first, not to be very conclusive, in this study, we found several interesting things to

advance knowledge in this new and exciting field of adoption and use of technology in households.

First, we found eight very important variables that seem to be good predictors in satisfaction in the use of mobile phone by people in household, and more particularly ease of use, declining cost as well as the two new variables that we added to the Brown and Venkatesh's (2005) model, utility for security and mobility (see Table 4). These eight variables are also very important to take into account by mobile phone providers to design new mobile phones still better adapted to people's needs and to do their sales marketing. Second, we found that people are, to some extent, using a mobile phone for a matter of security and mobility, given our two new variables utility for security and mobility showed to be very significant (see Table 4). Third, we found that it is probably more appropriate to use the dependent variable behavioral intention instead of user satisfaction in the model proposed by Brown and Venkatesh (2005), even augmented of our two new independent variables utility for security and mobility, given the percentage of variance explained in intention to adopt a mobile phone for household use in our previous study is relatively higher. But, according to us, it is also appropriate to include user satisfaction as dependent variable in the model given we found more good predictors in satisfaction in the use of mobile phone in the present study than in the previous one in which we used behavioral intention as dependent variable. The dependent variable *use behavior* proposed by Thompson et al. (1991) might also be tested in future studies. Also, we suggest the test of new independent variables which might explain a greater percentage of variance in satisfaction in the use of mobile phone by people in household in future studies. To that end, we recommend three new independent variables in the next paragraph. Finally, the results of this study provided the evidence that it is probably better to use the household life cycle variables as moderating variables in the

model, as did Brown and Venkatesh (2005), given the percentage of variance explained in intention to adopt a new technology in household by the model tested by these authors was significantly higher. We can then anticipate here that if we would have been using the household life cycle variables as moderating variables in our theoretical research model instead of independent variables, the percentage of variance explained by the model in satisfaction in the use of mobile phone by people in household would have been probably higher.

It would be interesting in future studies to add some other new variables to the actual theoretical research model (those suggested by Brown and Venkatesh (2005) augmented with the two new variables that we tested in the present study, depending, of course, on the technology examined) in order to try to explain yet more variance in satisfaction in the use of a new technology in household. For example, the variable *attention* might be added in social outcomes (a lot of people, particularly young and old people, are feeling to be alone in the actual stressing world, in which both men and women are working and get very busy, so the mobile phone might be a good way to communicate with other people everytime and everywhere to get the feeling to be less alone), the variable *social norm* might also be added in social outcomes (who knows, people might be using a mobile phone just to do as everybody!), and the variable *control* might be added in utilitarian outcomes (some people might be using a mobile phone to control other people in their family or others; maybe another kind of Big Brother!). It would be also interesting to test the actual model in other situations and with other populations. For example, in a subsequent study, we tested the actual model with Atlantic Canadian people who are using high speed Internet at home. As in this study, we used the dependent variable user satisfaction given the respondents were already using high speed Internet. The results of the study will follow in a subsequent paper. It will be interesting to see whether the

results remain the same as those got from people who are using a mobile phone at home.

Regarding the limitations of this study, as pointed out by Brown and Venkatesh (2005), the primary limitation is the reliance on a single informant. It is possible that other members of the household would have provided different responses concerning the motivations to use a mobile phone at home. Future research in household use of technology should incorporate responses from multiple members of the household to truly assess the nature of household use. A second limitation of the study is that it was conducted in only one area in Atlantic Canada. If the study would have been carried out in the whole Atlantic Canada, its results would be of a higher level of generalization. But the fact that the sample of the study was a randomized sample allows a high level of generalization of its results. Another limitation of the study is the administration of the survey instrument over the telephone. Some respondents might have not very well understood some items of the survey instrument over the telephone and then provided more or less precise ratings on these items, introducing the possibility of some response bias. But the method we privileged in this study to administer the survey instrument is not an exception to the rule. Each method has its own limitations.

To conclude, much more research will be needed on the use of technology in households in order to better understand its impacts on people's daily life. The research will allow, among others, at least to minimize, if not to remove, some negative impacts of technology in people's daily life in the future and to develop new technologies still better adapted to people's needs. We will continue to inquire into this new and exciting field.

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APPENDIX A

List of Items

Following are the instructions that were provided to the participants to focus on the use of mobile phone at home.

Hello, my name is ... I am calling you concerning a study on the mobile phone conducted by two researchers at the Faculty of administration of the University... Do you have a mobile phone? If no, thank you and bye. If yes, could you answer our survey please? Your participation would be much appreciated, but it is free and you can refuse to answer some questions or stop to answer the survey at any time. The objective of the study is to better understand why people at home are using a mobile phone. The survey takes about 10 minutes of your time to complete. And some questions about your personal information will be asked to you at the end of the survey. You will have the chance to win one of the 30 \$10 Tim Horton gift certificates which will be drawn at the end of the data collection. For more details about the ethical aspects of the study, feel free to contact the *Faculté des Études Supérieures et de la Recherche* (FESR) at the University...

Please note that there is no right or wrong answer. For each question we would like to know on a scale from one to seven whether you strongly agree or strongly disagree, with one being strongly disagree and seven being strongly agree.

<i>Variables</i>	<i>Items (Seven-point Likert-type scales, with 1 = strongly disagree and 7 = strongly agree)</i>
Applications for Personal Use	I find that the mobile phone has tools for personal productivity.
	I find that the mobile phone has tools to support household activities.
	The mobile phone has software that helps with activities at home.
Utility for Children	The mobile phone provides applications that my kid(s) can use.
	The mobile phone has useful applications for my kid(s).
	I find the mobile phone to be a useful tool for my kid(s).
Utility for Work-Related Use	The mobile phone is useful for me to work-at-home.
	The mobile phone provides applications related to my work.
	I am able to work at home more effectively because of applications on my mobile phone.
Utility for Security	I find the mobile phone to be useful for my security.
	The mobile phone provides applications related to my security.
	I find the mobile phone to be useful for the security of my family.
Mobility	A mobile phone allows having only this telephone to perform all personal and professional activities.
	I use only my mobile phone to perform all my personal and professional activities.
	The applications provided by the mobile phone allow using only this telephone to perform all personal and professional activities.
Applications for Fun	The mobile phone provides many applications that are enjoyable.
	I enjoy playing games on the mobile phone.
	The mobile phone has applications that are fun.
	I am able to use the mobile phone to have fun.

<i>Variables</i>	<i>Items (Seven-point Likert-type scales, with 1 = strongly disagree and 7 = strongly agree)</i>
Status Gains	People who have a mobile phone at home have more prestige than those who do not.
	People who have a mobile phone at home have a high profile.
	Using a mobile phone is a status symbol.
Friends and Family Influences	My friends think I should use a mobile phone for personal use.
	Those in my social circle think I should use a mobile phone for personal use.
	My family members think I should use a mobile phone for personal use.
	My relatives think I should use a mobile phone for personal use.
Secondary Sources' Influences	Information from newspapers suggests that I should use a mobile phone for personal use.
	Information that I gather by watching TV encourages me to use a mobile phone for personal use.
	Based on what I have heard on the radio, I am encouraged to use a mobile phone for personal use.
Workplace Referents' Influences	My coworkers think I should use a mobile phone for personal use.
	My peers at work think I should use a mobile phone for personal use.
Fear of Technological Advances	The trends in technological advancement make me worried.
	I am afraid that today's best mobile phones will be outmoded fairly soon.
	I am worried about the rapid advances in mobile phone technology.
Declining Cost	The cost of mobile phones is constantly reducing.
	I believe the cost of mobile phones will continue to reduce in the future.
	I think we will see better mobile phones for a lower price in the near future.

<i>Variables</i>	<i>Items (Seven-point Likert-type scales, with 1 = strongly disagree and 7 = strongly agree)</i>
Cost	Mobile phones that are available today are too expensive.
	I think mobile phones are quite pricey.
	I consider a mobile phone to be an important purchase.
Perceived Ease of Use	The interaction with a mobile phone is clear and understandable.
	Interacting with a mobile phone does not require a lot of mental effort.
	I find a mobile phone is easy to use.
	I find it easy to get a mobile phone to do what I want it to do.
Self-Efficacy	I feel comfortable using a mobile phone on my own.
	If I wanted to, I could easily operate a mobile phone on my own.
	I can use a mobile phone even if nobody helps me.
User Satisfaction	I am satisfied with the technical quality of my mobile phone.
	I am satisfied with the access to technical support provided by the provider of my mobile phone.
	I am satisfied with the equipment (applications, games, tools, etc.) provided with my mobile phone.
	I am satisfied with the ease of operation of my mobile phone.
	I am satisfied with the technical reliability of my mobile phone.
	I am satisfied with my usage of my mobile phone.

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