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Convenient or Useful? Consumer Adoption of Smartphones for Mobile Commerce

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Completed Research Paper

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Abstract

Merchants have developed apps for the smartphone that assist consumers through the buying process, from when they gather information to when they decide to purchase. Sharing information, such as location, shopping preferences and financial data, can enhance consumers' experience. However, they may be reluctant to disclose these details unless they perceive that the benefits gained are more than the risk of privacy loss. This privacy calculus is added to the unified theory of acceptance and use of technology (UTAUT2) in order to explain consumers' willingness to exchange the disclosure of personal information for additional value. Sharing information makes mobile commerce more convenient by saving time and effort. Companies are able to send offers that are tailored to a specific customer. Payments are processed faster because the merchant already has the financial data on hand. UTAUT2 is further extended with the Theory of Convenience. Results from a survey of over 300 consumers show that perceived value and perceived convenience are influencing variables and that perceived value mediates the influence of perceived convenience on intention to use.

Keywords: UTAUT2, smartphones, mobile commerce, privacy calculus, convenience.

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Introduction

In North America, Internet retailing continues to grow and has now become one of the most popular ways for consumers to shop (Statista 2015). For 2015, growth in the U.S. is forecast to be 13% with estimated sales of $271 billion dollars (Euromonitor 2016). With the increased ownership of smartphones and their use for mobile commerce, this growth will continue with sales estimated to reach $523 billion over the next five years, up 56% from 2015 (Inc 2016). Faster wireless networks, larger screens and friendly apps are some of the reasons why more shoppers are browsing and buying on their smartphones (Linder 2016). In a recent study by pwc (2016), 54% of those surveyed reported that they buy products online at least monthly and 34% anticipated that their smartphone will soon become their main tool for mobile commerce.

'Commerce' refers to activities that are focused on the transfer of ownership of a physical product or the transfer of rights to use a service (Centre for Retail Research 2015). Such activities include gathering information about products, comparing features and prices, and, once the decision to purchase is made, paying for the product. Consumers are able to use their mobile devices for these activities and, in addition, if they are willing to provide personal information, they can receive promotional offers. Apple Pay and Google Wallet will further increase the diffusion of mobile devices for mobile commerce (Euromonitor 2016; Liébana-Cabanillas et al. 2014).

The use of mobile devices, such as smartphones, for mobile commerce allows consumers the convenience of shopping anywhere at anytime (Kim et al. 2010; Okazaki and Mendez 2013). Another unique feature of smartphones is their function of broadcasting their location, thereby enabling merchants to offer location-based services (Junglas et al. 2008). About 82% of smartphone users turn to their devices to help them make a product decision (Ipsos 2015). By utilizing mobile Internet as an alternative shopping channel, consumers gain the advantage of mobility, ubiquity, personalization and most importantly, convenience (Cao et al. 2014). When asked to choose between price and convenience, global shoppers ranked price as second with convenience as number one (pwc 2016).

However, there has been little research on the effect of convenience on consumer intention to use a mobile device for any of the activities associated with mobile commerce. Past studies on technology adoption have empirically shown that perceived usefulness is a key influencing factor on the intention to use an IT artifact (Schepers and Wetzels 2007; Zhang et al. 2012). Venkatesh et al. (2003) synthesized eight technology models into the Unified Theory of Adoption and Use of Technology, UTAUT, and further extended this model into UTAUT2 in order to explain consumer acceptance (Venkatesh et al. 2012). Constructs were added to the model, but Convenience was not included. Collier and Kimes (2013) evaluated convenience in the context of self service technologies, using resource-matching theory. Liu et al. (2015) replaced perceived usefulness by perceived value, which in turn was influenced by a number of variables, one of which was convenience. Teo et al. (2015) focused on mobile payment, where performance expectancy was influenced by perceived transaction convenience and perceived transaction speed. For example, gathering product data on a mobile device would be useful, but the consumer will be inclined to abandon this activity if it is not convenient. In this study, the UTAUT2 model is extended with the construct of perceived convenience.

Convenience is enhanced when consumers believe that there is a value in sharing information. They use a 'privacy calculus' to balance the benefits of disclosing personal information with the risk of loss of privacy (Culnan and Armstrong 1999). Dinev and Hart (2006) found that Internet trust as well as personal Internet interest influenced the willingness of consumers to provide personal information. Kehr et al. (2015) conducted an empirical study, which showed that individuals' decisions to share private information are situation specific and depend on pre-existing attitudes, such as trust of the institution. In this study, we replace the price value construct in UTAUT2 with perceived value that results from the privacy calculus. UTUAT2 has been selected due to its focus on consumers, who are voluntary users of

their mobile devices. Following the suggestion of Venkatesh et al. (2012), we are creating new theory by adding constructs to the foundational theory of UTAUT2.

The context of this study is to investigate the factors that influence consumers' intention to use their mobile devices for mobile commerce. More specifically, we seek to answer the following questions: a) does perceived convenience influence consumers' intention to use mobile commerce? b) does the sharing of information inhibit intention to use mobile commerce? The contribution of our research is the creation of new theory by extending UTAUT2 with perceived convenience and the privacy calculus.

This paper is organized as follows. The next section is the review of the literature, which includes the development of the hypotheses and concludes with the research model. The third section describes the methodology followed by the results of the empirical study. The results are discussed in the fifth section, with an outline of the limitations and some suggestions for future research. The final section is the conclusion, which includes implications for practitioners.

Literature Review and Research Model

Smartphones enable consumers to research products and make purchases from the comfort of their homes or while commuting on the bus. In stores, customers can compare products and prices without leaving the store and, having decided to make the purchase, they can simply wave their smartphone, with its digital wallet, over the payment terminal. This convenience comes at a price of disclosing personal information, from product preferences to financial data. In order to understand consumers' willingness to engage in mobile commerce, we extend UTAUT2 (Venkatesh et al. 2003) with the Privacy Calculus (Culnan and Armstrong 1999) and the Theory of Convenience (Connaway et al. 2011).

UTAUT2 as the Theoretical Foundation

The Technology Acceptance Model (TAM) (Davis 1989b) has two key influencing variables: perceived usefulness (PU) and perceived ease of use (PEOU). It is the most widely cited theory of technology adoption and has been used in a variety of settings (Khechine et al. 2016; King and He 2006). Venkatesh et al. (2003) synthesized the results of TAM with seven other popular theories of adoption and unified them into UTAUT, which has four key influencing variables: performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating conditions (FC). The UTAUT constructs of PE and EE are similar to PU and PEOU in TAM (Morosan and DeFranco 2016).

TAM and UTAUT were typically applied to the context of system adoption in the workplace, where workers are mandated to use a particular system. UTAUT was extended into UTAUT2 to explain consumer adoption, where use is voluntary (Venkatesh et al. 2012). The additional factors are habit, price value and hedonic motivation (HM). UTAUT2 has received wide acceptance (Baptista and Oliveira 2015).

UTAUT2 is selected as our theoretical foundation. Other studies have added and subtracted constructs, maintaining the core relationships of PE and EE. The model is easily extended, scales are readily available from extant literature and its core constructs have been validated across many disciplines, explaining up to 70% of the variance in behavioral intention to use (Im et al. 2011) and 50% in the actual use of technology (Holden and Karsh 2010). Compared to UTAUT, the extensions proposed in UTAUT2 produced a substantial improvement in the variance explained: for behavioral intention, the variance explained increased from 56 percent to 74 percent, and for actual use the variance explained increased from 40 percent to 52 percent (Venkatesh et al. 2012). In the following paragraphs, we describe the constructs in our model and propose hypotheses.

Performance expectancy

Defined as 'The degree to which an individual believes that using the system will help him or her to attain gains in job performance' (Venkatesh et al. 2003, p. 447), PE maps to Perceived Usefulness in TAM. Many empirical studies have shown this construct to have the largest effect on intention to use (ITU) (Baptista and Oliveira 2015). The meta analysis by King and He (2006, p. 751) concluded that the influence of usefulness was 'profound'. An example of the usefulness of mobile commerce is when shopping in a store, consumers search for information about a specific product, such as the detailed ingredients of a food item or the detailed specifications of a technical device. They can access this

information via their smartphone by linking directly to the manufacturer's website. Clicking on the appropriate app helps the consumer to be more productive than the alternative of seeking out a sales person, who may not have the same depth of information. Accordingly:

Hypothesis 1: Performance expectancy positively influences the intention to use smartphone apps for mobile commerce.

Effort expectancy

Effort Expectancy (EE) corresponds to Perceived Ease of Use in TAM (Davis 1989b). It is defined as the 'degree of ease associated with the use of the system' (Venkatesh et al. 2003, p. 450). The relationship between EE and intention to use (ITU) has been less conclusive than that between PE and ITU, but in many studies there is a significant, but small, effect (Dwivedi et al. 2011; Hess et al. 2014). Smartphone apps do not come with instruction manuals. Their design is intuitive, with the use of color schemes, buttons and a touch screen. Over the past two years, the growth of digital media usage has been from smartphone apps (Comscore 2015). With so many choices of apps, users are willing to try new functionality, but it must be easy to use. Therefore:

Hypothesis 2: Effort expectancy positively influences the intention to use smartphone apps for mobile commerce.

Habit

Habit is conceptualized as the extent to which people tend to perform behaviors automatically because of learning (Venkatesh et al. 2012). Although the sphere of mobile commerce is growing, it is still a fairly new phenomenon specifically in the use of mobile applications to aid the shopping experience. The proportion of consumers using mobile application to make purchases is relatively low with few people accustomed to shopping via mobile applications. Thus, in this paper, the construct habit is dropped.

Social Influence

UTAUT adopted Social Influence (SI) from the Theory of Reasoned Action (Fishbein and Ajzen 1976). The theory postulates that users are influenced by 'referent' others who are important to them. In an organizational context, this is significant (Dwivedi et al. 2011), where co-workers and supervisors are in a position to observe daily activities. For consumer activities, referent others may be friends and family who introduce a new app by word of mouth. An individual may learn of a new app, such as Apple Pay, and will then wish to use this app in order to impress the 'others'. We propose:

Hypothesis 3: Social influence positively influences the intention to use smartphone apps for mobile commerce.

Facilitating Conditions

In addition to the users' own confidence that they have the skills to use an IT artifact, they need to be assured that facilitating conditions (FC) are in place (Taylor and Todd 1995; Triandis 1979). When using smartphones for mobile commerce, consumers expect the system to function flawlessly. When connecting via the Internet, they expect to receive the information requested. When making a payment with their mobile device, they expect secure financial transactions resulting in the correct exchange of funds. On those occasions that they require support, either for initial assistance or for help if something is not working correctly, they expect assistance to be available and any issue to be resolved speedily. Our next hypothesis is:

Hypothesis 4: Facilitating conditions positively influence the intention to use smartphone apps for mobile commerce.

Hedonic motivation

When Davis et al. (1992) asked whether computers at work were used because of their functionality or because they were enjoyable to use, they found that people at work were more productive when they were intrinsically motivated. Perceived enjoyment is 'the extent to which the activity of using the computer system is perceived to be personally enjoyable in its own right' (Davis et al. 1992, p. 1113).

In the case of consumers, where they are able to select an IT artifact of choice, this intrinsic motivation, or hedonic motivation (HM), is an influencing factor. There are over 1 million apps available for downloading (Zhu et al. 2014), which can be used for such activities as communicating with others, monitoring health or conducting mobile commerce (Rosales and Fernández-Ardèvol 2016). With such an array of choice for utilitarian apps that perform similar tasks, app developers need to provide additional incentives for their app to be selected. Venkatesh et al. (2012) recognized this and added hedonic motivation in UTAUT2 to further explain consumers' adoption of an IT artifact. App developers make use of the multiplicity of colors, the touch screen, buttons and the use of photos to add an element of entertainment. The consumer is guided through the screens as they make navigational choices. In addition to the utilitarian value of gathering information or making a purchase, the app has an added layer to make the experience enjoyable. We propose:

Hypothesis 5: Hedonic motivation positively influences the intention to use smartphone apps for mobile commerce.

Privacy Calculus

When consumers share data over the Internet, they wish to be notified how their data will be used. They want to be in control if other parties wish to access this information and they want to be confident that their data is secure (Li et al. 2010). Sharing data has many benefits: financial institutions authorize online transactions allowing payment to be made over the Internet; and merchants can send marketing information that is customized to individual preferences (Culnan and Bies 2003; Joinson and Paine 2007). However sharing personal data electronically with other parties raises concerns about security, unauthorized secondary use and illegal access (Li et al. 2010). In spite of these concerns, consumers are still willing to share data due to the benefits of more personalized service. Consumers trade off the value of these benefits with the risks of their personal data being compromised (Malhotra et al. 2004).

When individuals make a non-monetary exchange with an organization by providing them with their personal data, they understand that their information will be used for marketing purposes and their expectation is that the exchange will be fair (Culnan and Bies 2003). When asked for information, consumers perform a cost-benefit analysis, weighing the risks of their privacy being compromised against the benefits promised by the recipient of the information (Li et al. 2010). When engaged in mobile commerce, the privacy concerns are situational, dependent upon the trust in the merchant or financial institution and the nature of the information being requested. Sometimes they may simply ask themselves 'What is there to lose?' (Keith et al. 2013, p. 1172), as they already have shared other details about themselves.

Consumers perform a privacy calculus where they assess the perceived value by weighing the perceived privacy risks against the perceived benefits (Lanier Jr and Saini 2008; Smith et al. 2011). The following paragraphs describe the hypotheses that relate to the privacy calculus.

Perceived value

The concept of value has different meanings. It could mean an item with a low price that has the desired features or it could mean a product that has the right balance of price versus quality (Zeithaml 1988). In a monetary exchange, a higher priced item is typically considered more valuable than a lower priced item of a similar nature because the consumer perceives that the quality is superior (Dodds et al. 1991). Price value was added as a construct in UTAUT2 (Venkatesh et al. 2012) to represent the trade off between the benefits of a product compared to its cost.

Consumers may perceive value in a product because of its emotional appeal, its social value or its convenience value (Zhou 2011). Value can be defined as the trade-off between benefits and sacrifices

(Pura 2005). In the Privacy Calculus, the trade-off is represented by the willingness to share information. In the context of mobile commerce, consumers will be willing to share if they believe that there is value and we therefore replace willingness to share by perceived value. If consumers fear the risk of privacy loss more than the benefits to be gained, they will not be willing to share due to the lack of perceived value. In UTAUT2, Venkatesh et al. (2012, p. 161) define price value 'as the consumers' cognitive tradeoff between the perceived benefits and the monetary costs for using them'. In the context of the privacy calculus, this is equivalent to perceived value. In our model, we substitute the price value construct of UTAUT2 by the perceived value (PV) from the Privacy Calculus, which represents the consumers' cognitive tradeoff between benefits of disclosing personal information, including financial data, with the perceived risk of loss of privacy (Li et al. 2010; Unni and Harmon 2007). We propose:

Hypothesis 6: Perceived value positively influences the intention to use smartphone apps for mobile commerce.

Perceived privacy risk

Consumer privacy concerns depend upon a number of factors, such as the type of information requested, the trust in the organization with whom it is being shared and the security infrastructure in place to prevent unauthorized access or loss (Zhou 2011). The perceived privacy risk (PPR) associated with these concerns is conceptualized as a single dimensional variable (Dinev and Hart 2006; Xu et al. 2009). It is a measure of the potential loss that would be incurred in a given context, taking into account the various concerns. For example, consumers would consider the perceived privacy risk to be large when financial information is shared on an unknown website, but would consider the risk to be small if the website belonged to a large trustworthy bank (Xu et al. 2009). Demographic information such as postal code, age or education has low risk, but as the data becomes more personal, such risks as identify theft increase and the individual's perception of privacy risk increases (Lanier Jr and Saini 2008). Smartphone apps often request personal private information, resulting in higher evaluation of the risks associated with mobile commerce (Yang and Forney 2013). Perceived privacy risk has a negative effect on perceived value (Liu et al. 2015). Therefore we add:

Hypothesis 7: Perceived privacy risks negatively influence perceived value of using smartphone apps for mobile commerce.

Perceived benefits

Providing personal information can provide the consumer with perceived benefits (PB) related to their mobile shopping experience. These benefits may have a monetary value, a temporal value or a spatial value. Customers save money via loyalty programs that many retailers offer. Frequent customers are rewarded with points that have a value towards future purchases. Special discount offers can be targeted to the consumer based on past purchase history and a record of preferences (Yang and Forney 2013).

By sharing personal information, the consumer does not have to re-enter the shipping address on each purchase. When making a purchase, the form of payment can be stored with the retailer. For example, Amazon one-click enables purchases to be completed with one click of the mouse, by accessing the pre-registered payment method and shipping details (Singh et al. 2005).

Spatial benefits are realized when the location of the consumer is shared with merchants. Location based services can deliver messages customized to the consumer based on where they are located (Unni and Harmon 2007). Consumers can scan QR (Quick Response) bar codes printed on or near a product in order to receive more detailed information (Meydanoglu 2013). Hence, we propose:

Hypothesis 8: Perceived benefits have a positive influence on perceived value of using smartphone apps for mobile commerce.

Theory of Convenience

Convenience stores are situated on many street corners in residential areas. They sell commodity products and provide consumers with time-savings compared with travelling to a supermarket for items such as milk and sugar. The American Marketing Association defines a convenience product as an item that is bought with little time and effort in the buying process (American Marketing Association 2016). Copeland (1923) differentiated convenience goods from shopping goods and specialty goods as items that are easily accessible. Holton (1958) stressed the importance of time savings.

Convenience has been conceptualized as a multidimensional construct (Brown and McEnally 1991). An item is considered convenient if it performs its task quickly, is readily at hand, saves effort and is portable (Yale and Venkatesh 1986). There is typically a compromise: on price, such as paying more for sugar when purchased in a convenience store; or quality, such as cooking a frozen pre-packaged dinner. In addition to time and effort, convenience has a spatial component too (Brown and McEnally 1991; Yoon and Kim 2007). Buying sugar when the consumer is already shopping in the supermarket is more convenient than making an extra journey to the corner store.

Mobile commerce has the potential: to save time – there is no need to travel to different stores to review different products; to save money – prices for the same product can be compared in one app; and to remove spatial constraints – so long as there is access, the consumer can go Internet shopping wherever they are.

Convenience and usefulness are different constructs. Using a smartphone to pay in a physical store may be useful because the digital wallet is able to store multiple payment cards and permit choice of payments. However it may not be convenient dependent upon the design of the app: the phone has to be available, the security code has to be entered to open the phone, the digital wallet app has to be selected and the phone waved over the payment terminal, assuming that the terminal is enabled for non-touch payments. The alternative is to take a payment card out of a physical wallet and wave the plastic card, with the knowledge that if the terminal is not wave enabled, the card can be inserted. The digital wallet, in this example, when compared to the physical card, is useful, but not convenient.

Convenience is a construct in its own right, but it has been confounded with both usefulness and ease of use. A common indicator to measure usefulness, from extant literature, is '…makes me more productive'. When productivity is associated with the saving of time and effort, convenience is being measured (Poon 2008). For example, using an app to seek information about a product while in a store is convenient because the app saves the effort of having to find a sales person and saves time because detailed information is readily available over the Internet delivered to the smartphone. The app is also useful because it delivers information about the product, which helps the consumer make a purchasing decision.

Convenience is different than effort expectancy (EE) from UTAUT, which is a measure of the concept of how easy the system is to use. A smartphone app is easy to use when the design is intuitive, no tutorial is required and the user knows how to access the key functions through minimal trial and error. Although the design of an app may be easy to use, it may not be convenient. Many websites provide the capability of paying via a credit card. The navigation is easy and the consumer immediately knows where to enter payment card details. However, the app is not as convenient as the one-click offered by sites such as Amazon, where once the payment data is stored, it is accessed immediately by clicking on the one-click button, resulting in time saved because less data has to be entered.

The perceived convenience (PC) of an IT artifact is the consumers' belief that the use of the IT artifact will enable them to complete the task in a speedy manner, at a time and place of their choosing (Kim et al. 2010). From the extant research of TAM, consumers will use their smartphones for mobile commerce if the app is useful and easy to use. We argue that a further necessary condition is that the app be convenient to use. We argue that convenience is distinct from EE and PE. Table 1 summarizes the definitions of Convenience, Ease of Use and Usefulness.

Construct	*Definition*
Perceived Convenience	An item is considered convenient if it performs its task quickly, is readily at hand, saves effort and is portable. (Yale and Venkatesh 1986)
Perceived Ease of use/ Effort expectancy	The 'degree of ease associated with the use of the system'. (Davis 1989a; Venkatesh et al. 2003, p. 450)
Perceived Usefulness / Performance Expectancy	The 'degree to which a person believes that using a particular system would enhance his or her job performance'. (Davis 1989a, p. 320; Venkatesh et al. 2003)

Table 1: Definitions of Convenience, Ease of Use and Usefulness

Because well-designed smartphone apps allow consumers to engage in mobile commerce at any time and any place, convenience will positively influence the intention to use. We therefore propose that:

Hypothesis 9: Perceived convenience positively influences the intention to use smartphone apps for mobile commerce.

Mediating influence of Perceived Value

Perceived convenience is hypothesized to positively influence intention to use (see Hypothesis 9). Consumers like the convenience of smartphone apps: they can engage in mobile commerce anytime and anyplace. However, their engagement depends upon perceived value. Some consumers may deem that the risk of disclosing private information is not worth the benefits of receiving coupons delivered to their smartphone. Using their privacy calculus, perceived value is low. Even if the app were designed to be convenient, they would be reluctant to use it. According to Baron and Kenney (1986), when a variable intervenes between two other variables, it has a mediating effect. In our model, perceived value mediates the influence of convenience on intention to use. Therefore our final hypothesis is:

Hypothesis 10: Perceived value mediates the influence of perceived convenience on intention to use.

Research Model

The research model is shown in Figure 1.

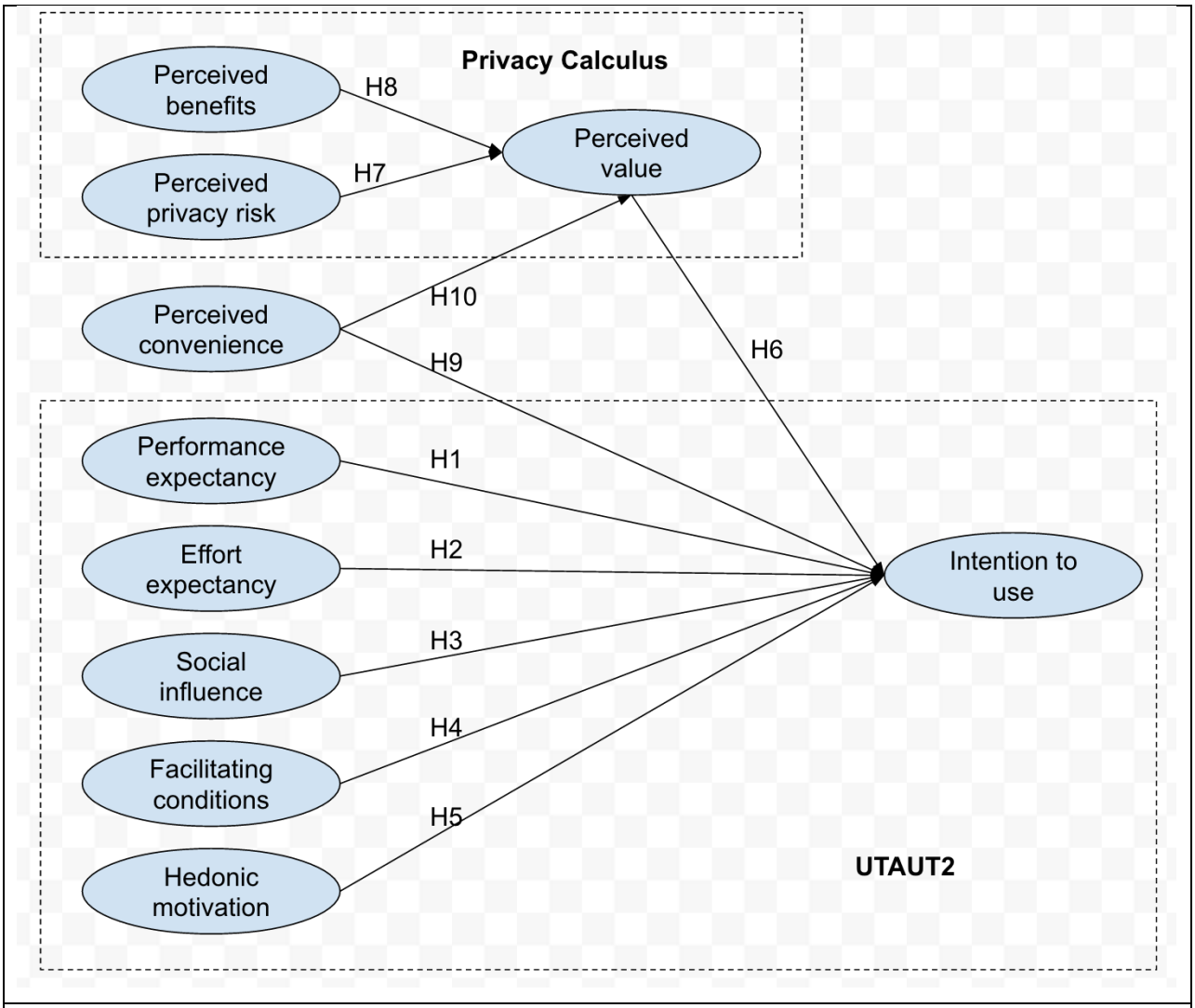

Figure 1. Research model

Methodology

The instrument to gather data was an online survey. Initial consultations were conducted with user experience (UX) experts who provided input to specific questions about convenience, usefulness and ease of use. The indicators for each construct were adapted from extant literature. The resulting survey was sent to a limited number of participants who were solicited for feedback. After making recommended changes, the survey was sent to 1,101 participants, utilizing the services of an organization that recruits individuals who are willing to respond to questionnaires. In the Consent portion of the survey, participants were told that the survey is about mobile commerce, defined as 'when you use your smartphone, or other mobile device, to order and pay for products and services.'

Throughout the questionnaire, participants were reminded that mobile commerce refers to the use of their smartphone to order and pay for products or services. For the constructs of UTATU2, scales were adopted from past studies. For the new constructs related to the Privacy Calculus and the Convenience, indicators that were adopted are shown in Table 2.

Perceived Benefits (Kehr et al. 2015)
When providing personal information via my smartphone…
• I will enjoy benefits that are tailored for me
• I will receive the products and services that are suitable for me
• I will receive a more customized service
Perceived Privacy Risk (Yang et al. 2015)
When using my smartphone, I am often asked to provide personal information, such as my name, address, gender and age. I am worried that…
• my privacy information could be misused
• my personal information could be inappropriately shared with others
• my personal information could be hacked
• my personal privacy could be threatened
Perceived value (Yang et al. 2015)
In spite of the risks involved in sharing my personal information and payment data, I believe that using my smartphone for mobile commerce..
• is valuable
• is worthwhile
• overall delivers good value
• is beneficial to me
Perceived convenience (Jiang et al. 2013)
• Mobile commerce is fast
• Mobile commerce is convenient
• Mobile commerce saves me time
• I can shop anywhere regardless of my location
• I can shop at any time
Note: Participants were asked to rate their agreement/disagreement using a Likert scale.

Table 2: Indicators for new constructs

Because we are developing new theory, PLS was selected as the statistical tool. It is well suited for prediction and theory building (Gefen et al. 2000). The selected software was SmartPLS version 3.2.4, which analyzes the data and provides various reports that test both the measurement model and the structural model. Internal consistency was tested by analyzing the outer loadings of the relationship of each indicator to its construct. Discriminant validity was tested via the Fornell-Larcker criterion (Fornell and Larcker 1981).

In the second stage, the structural model was tested via the PLS algorithm, which calculated the path coefficients and R^2 for the endogenous variables. The t values were calculated using bootstrapping set to 5000 samples.

In order to determine the effect of Perceived Value as a mediating variable, the Variance Accounted For (VAF) was calculated by multiplying the indirect effects (Preacher and Hayes 2004).

Results

Descriptive Statistics

The survey was sent to 1,101 participants. Panel data was used to access the population of Canada. The selection criteria were that the participant must be 18 years or older and must own a smartphone. Ages ranged from 18 to 81. The responses were analyzed to eliminate questionnaires that were incomplete or did not pass the attention filters. There were 352 completed responses (32%). 54% were male and 46% were female. The majority owned smartphones for four years or more. See Table 3.

Length of ownership	*%*	*Number*
Less than 1 yr.	4%	15
1 and 2	8%	29
2 and 3	10%	34
3 and 4	18%	63
4 and 5	16%	56
Over 5 years	44%	155

Table 3. Length of smartphone ownership

Three percent of all participants were not aware of the 'tap' feature for a credit card, where the payment terminal authorized a payment, typically $100 or less, without the need for a Personal Identification Number (PIN). 11% were not aware that their smartphone could also be used to 'tap'. 30% had never 'tapped' their plastic credit card and 70% had never tapped their smartphone. For debit cards, 45% had never 'tapped' and 75% had never tapped their smartphone. See Table 4.

	Use of tap for Credit		*Use of tap for Debit*	
Function	*With Plastic Credit Card*	*With use of Smartphone*	*With Plastic Debit Card*	*With use of Smartphone*
Did not know it was possible	3%	11%	4%	12%
Only available in a few stores	5%	11%	3%	8%
Never tapped	30%	70%	45%	75%
Tapped sometimes	22%	6%	21%	4%
Tapped often	40%	2%	27%	1%

Table 4. 'Tapping' to pay

Owners of smartphones have a variety of choices when paying for an item in a store: they can pay with cash, with a plastic card or their smartphone. They were asked to rank these three payment methods in terms of convenience, speed and reliability. Plastic credit cards were the most convenient and the fastest, but cash was ranked the most reliable. Smartphones were the least convenient. The ranks and scores are shown in Table 5. The minimum score is 352 (if all participants were to rank the item as one) and the maximum score is 1,056 (if all participants were to rank the item as three).

Convenience			*Speed*			*Reliability*		
Rank	*Score*	*Method*	*Rank*	*Score*	*Method*	*Rank*	*Score*	*Method*
1	432	Plastic	1	504	Plastic	1	402	Cash
2	619	Cash	2	629	Cash	2	571	Plastic
3	816	Smartphone	3	734	Smartphone	3	894	Smartphone

Table 5. Convenience ranking for methods of payment

The Measurement Model

The SmartPLS algorithm calculates the outer loadings for each construct. All indicators were convergent, as their correlation coefficients were greater than 0.708 (Henseler et al. 2009).

The internal consistency of the model was confirmed by SmartPLS where Cronbach's alpha was greater than 0.8 (Cronbach and Meehl 1955), Average Variance Extracted (AVE) was greater than 0.5 and Composite Reliability was greater than 0.6 (Henseler et al. 2009).

SmartPLS was used to prepare Fornell Larcker scores (Fornell and Larcker 1981) and the resulting table showed that the square root of AVE was greater than the correlation coefficients.

The Structural Model

The coefficient of determination, R^2, is the proportion of the variance of the dependent variable that is explained by the independent variables. For intention to use, $R^2 = 0.645$ and for value, $R^2 = 0.561$, both of which are considered moderate (Hair et al. 2011).

For each path in the model, the t-values were calculated by bootstrapping with 5000 samples. A number of independent variables did not have a significant influence on intention to use: these were facilitating conditions, performance expectancy and social influence. All other hypotheses were supported with $p<0.01$.

The effect size of each variable is measured by f squared. Each construct is removed from the model and the change in R^2 is calculated. The value of f^2 is:

$$f^2 = (R^2 \text{ included} - R^2 \text{ excluded}) / R^2 \text{ included}$$

where R^2 included is for all constructs and R^2 excluded is when the selected construct is removed from the model.

The effect size is considered small if it is between 0.02 and 0.14, medium if it is between 0.15 and 0.34 and large if it is 0.35 and over (Hair et al. 2014). Table 6 shows the effect size.

Construct	*Dependent variable*	f^2	*Effect size*
Perceived value	Intention to use	0.203	medium
Hedonic motivation	Intention to use	0.043	small
Perceived convenience	Intention to use	0.025	small
Effort Expectancy	Intention to use	0.022	small
Perceived convenience	Perceived value	0.321	medium
Perceived benefits	Perceived value	0.235	medium
Perceived privacy risk	Perceived value	0.029	small

Table 6. Effect size

Mobile Commerce Features

The survey provided a list of features that could be useful for mobile commerce. The most popular feature was seeking information about products and the least popular feature was paying in a store with the smartphone. See Table 7.

Feature	*Score*
Searching information about products	77
Comparing prices of products	73
Receiving loyalty points	68
Buying products over the Internet	65
Receiving e-coupons	63
Paying with loyalty points	62
Receiving digital receipts	59
Paying in store with smartphone	48

Table 7. Mobile commerce features ranked

Mediating influence of Perceived Value

The independent variable, perceived convenience (PC) has a direct effect on intention to use (ITU). It also has an indirect effect through the mediating variable, perceived value (PV). The indirect effect is calculated as the product of the two indirect paths: PC to PV and PV to ITU (Preacher and Hayes 2004).

The model was run with Perceived Value to determine the path coefficients of the indirect paths of PC to ITU. Then the model was run without PV to determine the path coefficient of the direct path. The significance of the paths was tested with bootstrapping. All paths were significant at $p<0.001$. The Variance Accounted For is the ratio of the indirect effect to the total effect.

The indirect effect is (PC to PV) * (PV to ITU) = 0.434 * 0.466 = 0.202

The direct effect is (PC to ITU) = 0.145

The total effect = indirect effect + direct effect = 0.347

Variance Accounted For (VAF) = indirect effect / total effect = 58%.

Our results show that perceived value partially mediates the influence of convenience on intention to use (Hair et al. 2014).

Summary of Results

Seven of the ten hypotheses were supported. **Table 8** shows the results.

No.	*Hypothesis*	*Path coeff.*	*t statistic*	*P value*	*Supported*
1.	PE → ITU	-0.052	0.969		
2.	EE → ITU	0.125	2.710	0.007	✓
3.	SI → ITU	0.06	1.306		
4.	FC → ITU	-0.012	0.301		
5.	HM → ITU	0.193	3.313	0.001	✓
6.	PV → ITU	0.466	7.529	0	✓
7.	PPR → PV	0.119	3.060	0.002	✓
8.	PB → PV	0.377	7.529	0	✓
9.	PC → ITU	0.145	3.101	0.002	✓
10.	PC → ITU mediated by PV		VAF = 58%		✓

Table 8: Summary of Results

Discussion

The privacy calculus was supported: perceived benefits and perceived privacy explained 56.1% of the variance for perceived value. An explanation could be that consumers want to receive value, but they are wary of disclosing too much information. They seek the right balance between the benefits that are promised if they share specific information. They may be willing to provide personal data to allow the retailer to tailor products and services to their preferences and send them e-coupons and loyalty discounts. There is perceived value when the benefits of these offerings are considered to be greater than the risk of any privacy loss. This perceived value was a significant factor influencing intention to use. Consumers are influenced by the positive outcomes that they expect from the transaction.

Perceived convenience was a significant factor influencing intention to use. Mobile commerce allows transactions to be conducted anywhere at any time. This convenience is enhanced by the savings of time and effort. Consumers can compare products offered by multiple retailers without having to visit stores. They save time by clicking on the smartphone and browsing search results. They save the effort of travelling to stores, seeking out a salesperson and making notes to compare products.

The influence of perceived convenience on intention to use is mediated by perceived value. A new retailer may offer more convenient online shopping with faster payment processing if the consumer stores their credit card information on the retailer's website. However, the consumer may deem that there is too much risk and that the perceived value is low. Although the offering is convenient, the consumer will be reluctant to proceed because of the lack of value. An app may be very convenient to use, but if it lacks sufficient value, the consumer will hesitate to deploy it.

Hedonic motivation is also a significant factor. Although the key motivations for consumers to engage in mobile commerce are convenience and value, enjoyment is a necessary component that app designers need to provide by making full use of the touch screen, colors and navigation tools. Consumers are looking for apps that are convenient, deliver value and fun to use.

Effort expectancy had a small, but significant, effect on intention to use. The majority of smartphone apps are designed to be easy to use and, typically, can be learned very quickly. Most of the complex activities take place on the merchant's server and the user of the smartphone simply responds to prompts that guide product search or instruct which information to enter.

The most surprising result was the lack of significance of PE →ITU. Past studies, as summarized by meta-analyses, have shown that PE is a key influencing variable (Khechine et al. 2016). It may be that in our model PC and PV were masking the effect of PE. In order to determine if PE had an effect, we ran the model without PV and PC and the results confirmed that the influence of PE on ITU was significant. Our conclusion is that there is some confounding of PC and PV with PE. In this study, we used indicators from extant literature and performed confirmatory factor analysis for each construct. For each construct, the indicators were significantly convergent. However, this does not address the possible overlapping of indicators for these constructs. As suggested in the section on Future Research, principal component analysis could be employed in future studies.

Social influence was not significant. This may be explained by the fact that mobile commerce activity is a solo act. Referent others are not around to witness use or non-use. Once the individual has become aware of an app that enables mobile commerce, they make the decision on their own based on the perceived value and perceived convenience to be gained.

Facilitating conditions were not significant. In North America, the Internet is fast, stable and reliable. Service providers offer help lines 24/7. Merchants have help desks and financial institutions are ready to assist their customers with any hint of security concerns. Because of the underlying infrastructure, consumers anticipate that support will be available.

Limitations

We used the services of a professional research organization that recruits individuals who are interested in helping research and who receive a reward for responding to survey questionnaires. This is not necessarily representative of the general population. We only wanted answers from individuals who own smartphones and, although this is the majority of the population (Comscore 2015), it still excludes the opinions of non-smartphone owners. A further limitation is that the survey was sent to Canadian consumers and therefore reflects their experience with the Canadian Internet and payment infrastructure.

Future Research

This research lays the groundwork for future research into the construct of perceived convenience. There is some confounding of PC with PE and EE. Qualitative research with subject matter experts would assist in clarifying the difference between these three constructs. Then the indicators for PC, PE and EE could be subjected to a principal component analysis so that the resulting factors are uncorrelated from each other and are therefore measuring separate and distinct constructs. Future studies of perceived convenience could specify PC as a second order construct, with speed, reliability and effort as its first order variables. In our model, all constructs were specified as reflective. With further assistance from subject matter experts, the constructs could be specified as formative and results compared. In 2015, more than 25% of the world's population owned smartphones (Statista 2016) with access to mobile commerce through the Internet. With the addition of cultural constructs (Hofstede and McCrae 2004), future researchers will be able to make comparisons made across different countries.

Conclusion

Venkatesh et al. (2016) suggested that, instead of applying existing theory to new contexts, adoption research should be developing new theory. In this paper we have followed their suggestion. We have taken UTAUT2 as our foundation and extended it with the privacy calculus and the theory of convenience. We conducted an empirical study with over three hundred owners of smartphones, asking them about their intention to use mobile commerce. The results supported the majority of our hypotheses, with perceived value and perceived convenience having the largest effect on intention to use.

Our study offers a fresh road to adoption research, building on established theory. Perceived convenience should be added to performance expectancy and effort expectancy as an additional influencing factor. Future research should investigate the differences between these three independent variables (PC, PE and EE) and ensure that their measures do not confound. Will a consumer who finds an app useful in its functionality use the app if is not convenient? We have provided a direction for the academic community

to extend UTAUT2: given the amount of information that users share via the Internet, we suggest including the privacy calculus together with perceived convenience.

Convenience should not be underestimated. It is interesting to note that currently, North American shoppers do not have the most convenient mobile purchasing options available to them. For example, in China, WeChat is an ecosystem which offers Facebook type linking with friends, whatsapp type chatting with contacts and an Amazon type 'buy' button for products, all without having to leave WeChat (The Economist 2016). The app is also used to scan QR codes of other users to exchange contact information, a process used more often than exchange of business cards (pwc 2016). Currently, North American users of smartphones do not have the same convenience to move from one app to another depending upon the function they wish to perform. The implication of our study for practitioners is that good design must include convenience.

Implications for practitioners

Consumers enjoy using their smartphones. They like apps that are fun to use and at the same time deliver value. In order to overcome the risks of privacy loss, merchants need to find ways to assure consumers that their data is secure and fully protected from unauthorized access. The benefits of using mobile commerce need to be clearly described. Finally, the app must save them time and effort. Consumers will use their smartphones for mobile commerce if it delivers value while being convenient and enjoyable to use.

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