

The Influence of Privacy Calculus, User Interface Quality and Perceived Value on Mobile Shopping

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Abstract—This study examined the relationship among privacy calculus (including risk, benefit and value of information disclosure), prior privacy experience, user interface quality, perceived value and intention of mobile shopping. Through survey, this study collected 228 valid responses to test the hypotheses. The results showed that prior privacy experience positively impacted risk of information disclosure, benefit and risk of information disclosure positively and negatively impacted value of information disclosure respectively. User interface quality has a positive effect on perceived value and intention of mobile shopping; however, it influenced value of information disclosure negatively with an unexpected direction. Finally, value of information disclosure impacted positively perceived value of mobile shopping, which in turn affected intention of mobile shopping. The findings provided implications and suggestions for marketing practice.

Index Terms—Privacy calculus, information disclosure, user interface quality, perceived value.

I. INTRODUCTION

In response to business opportunities in mobile commerce, existing online vendors or new entrants who invested heavily in information technology strive to improve sales for online transactions. For example, Ikea developed mobile applications applying augmented reality to increase the experiential value of customers. Additionally, the luxury industries used to resist online business and were concerned that e-commerce may lower luxury brand image and lead to insulation between sellers and buyers. However, with the growing popularity of online shopping, some of the luxury corporations started online businesses and their sales accounted for the overall proportion of sale increases over time.

From the environmental psychology perspective, physical store atmosphere affects people's beliefs about a place. For an online store, the website interface substitutes the physical store atmosphere, and becomes a proxy of online environmental cues [1]. Therefore, website interface quality plays an important role in the success of e-commerce [2]. Studies show that website atmosphere impacts on both internet surfing and online transactions [3]. Moreover, scholars suggest that an effective website provides ample information, attractive appearance, and affluent manipulation [4]. As such, a well-designed website interface enhances perceived value and purchase intention of online transactions [4], [5]. Mobile shopping has grown rapidly in recent years, but studies of the impact of mobile user interface quality on

consumer attitudes and behaviors are still limited. There are differences between interfaces of mobile devices and desktops, because the screens of mobile devices are smaller than those of computers, the volume of text and efficient manipulation is more important on mobile interfaces than on computers. Thus, this study adapts Aladwani & Palvia's [6] dimensions of interface quality, including information, content, technology, and appearance, to examine the influence of user interface quality on perceived value and purchase intention.

The perspective of privacy calculus proposes that consumers compare potential risks and benefits of information disclosure and assess possible outcomes during transactions and, thus, decide whether to provide information to vendors. That is, consumers perform a risk-benefit analysis of disclosing personal information to evaluate the net gain and decide whether to disclose personal information to vendors [7]. Worry about potential risks of information disclosure is the main reason for individuals' lack of interest in establishing an online relationship with vendors [8]. Therefore, considering the effect of user interface quality on mobile shopping, this study also analyzes the impact on privacy benefits and risks on perceived value and purchase intentions for mobile shopping, helping extend the understanding of user interface quality and privacy calculus concepts on perception and mobile shopping intentions.

II. LITERATURE REVIEW

A. Privacy Calculus

Privacy concerns have received growing interest in recent decades. However, privacy issues are not specific to a particular field [9], although it is commonly recognized that information technology plays a key role in personal information privacy [10]. Privacy concerns are defined as an individual's general tendency to worry about information privacy, considering that online consumers are facing serious threats to the privacy of their information [7]. Many consumers do not register on websites primarily because of these concerns. Vendors provide personalized services for collecting personal information in two ways. First, vendors require consumers to submit identifiable personal information to register on websites or acquire warranty letters of products. Second, vendors collect personal information from shopping records or by tracking internet surfing without consent [11].

Scholars apply different perspectives for explaining privacy concerns. The privacy calculus theory is a common approach for analyzing individuals' information disclosure behavior [7], suggesting that individuals' intention to

disclose information is based on the comparison of expected benefits and risks. That is, consumers perform a risk-benefit analysis to assess the consequences of providing personal information to vendors. Literature considers that the consequences of calculus are the cumulative effects of risks and benefits, and defined perceived value of information disclosure, as the individuals' overall assessment of information disclosure is based on perceptions of privacy risks incurred and benefits received [7].

Risk of information disclosure is the degree of potential loss, which an individual associates with the release of personal information to a firm [10]. Consequently, information disclosure could potentially expose consumers to various privacy risks. Pavlou [11] argues that the potential loss of information disclosure damages consumer privacy in two ways. The first is the inappropriate use of personal information due to lack of proper privacy controls, such as unsolicited e-mails, credit card fraud, or identity theft. The second is the unauthorized secondary use of personal information. Empirical research provides evidence that perceived risk of information disclosure has a negative impact on information disclosure [10]. For example, Li et al. [8] examine the relationship between perceived privacy risks and intention to use personal health records (PHR), the results shows a negative impact of perceived privacy risks on intention to use PHR.

Consumers with high privacy risk concerns perceive a greater loss potential and are cautious about disclosing their information. Therefore, in the context of mobile shopping, this study suggests that consumers perceive a potential risk associated with information disclosure; therefore, information disclosure risk is negatively correlated with perceived information disclosure value.

H1: Risk of information disclosure has a negative effect on information disclosure value.

According to privacy calculus, individuals anticipate to face potential risks as well as favorable outcomes from disclosing personal information [10]. Scholars have identified three major benefits of information disclosure, including financial rewards, personalization, and social adjustment benefits [10]. First, financial rewards, such as price discounts, coupons, or compensation, serve as an incentive to attract individuals to renounce a certain degree of privacy in return for anticipated benefits. Recent privacy research provides empirical evidence that financial rewards can foster information disclosure [13].

Second, online vendors collect personal online consumer behavior and preferences to provide personalized services better meeting the consumer demands. Li et al. [8] examine the relationship between privacy calculus and the intention to use PHR systems. Their results show that the perceived benefits is the major factor determining the intention to adopt PHR, as patients anticipate to obtain more reliable personal health records and improve communication with their healthcare providers. Xu et al. [13] show that the benefit of location-based services (LBS) is the value of personalization that enhanced user experiences and smoothness of interactions has for increasing individualized functionalities of mobile devices, and propose that the anticipated benefit has a positive influence on intention to disclose personal

information in LBS.

Third, the social adjustment benefit refers to individuals providing personal information to integrate into social groups and build a social identity. Christofides et al. [14] examine student behavior on Facebook and finds that students were concerned about their friends questioning them about providing fake personal information; therefore, they disclosed personal information on Facebook.

From the viewpoint of mobile shopping, this study shows that individuals disclose personal information to online vendors in return for potential benefits related to financial rewards and personalization, and anticipate them to have a positive influence on the information disclosure value.

H2: Benefits of information disclosure have a positive effect on information disclosure value.

Scholars argue that previous experience of information disclosure is related to privacy value [15]. From the social contract perspective, individuals consider that a social contract is established when they provide information to online vendors [16]. When privacy is invaded, individuals believe that the social contract is broken and have feelings of betrayal and perception of unfairness, thereby affecting the risk assessment of transactions with other sellers who might also violate the social contract. Pavlou & Gefen suggest [17] that negative experiences create a negative sense of the market value, including on others unrelated to the negative incidents. Therefore, individuals who have been the victims of privacy abuses have stronger concerns regarding information disclosure [18]. Indeed, research has shown that prior privacy invasions were negatively related to intention of providing personal information online [15].

This study argues that past negative privacy experiences result in higher perceived risk when providing personal information to online vendors; therefore, it proposes the following hypothesis:

H3: Prior privacy experience has a positive effect on information disclosure risk.

B. Perceived Value

Marketing literature defines perceived value as the perceived net gains associated with the products or services acquired [19]. From the utility theory, Thaler [20] proposes that the perceived value deriving from purchasing a product is the sum of the acquisition and transaction values. The acquisition value is perceived based on a comparison between the equivalent value of a product and its objective price, while the transaction value is based on the difference between the objective price and the reference price of the product being purchased. Therefore, the perceived acquisition and transaction values of the product are positively linked to the buyers' perceived value of the product. Similarly, Monroe & Krishnan [21] postulates that buyers' perceptions of value are formed on a mental trade-off between perceived quality (or benefits) and perceived sacrifice (selling price). That is, buyers gain the net perceived value of a deal by comparing the perceived quality to perceived sacrifice. Buyers attribute positive value to a product if the perceived quality is more than the perceived sacrifice, and heighten their intention to purchase.

This study proposes that the information disclosure value

exerts a positive effect on the perceived value of mobile shopping. A higher information disclosure value implies a lower risk or more trust in online transactions. If consumers trust an online vendor, they expend less effort and time searching for information about the online vendor and executing the online transaction, and then they perceive a higher value of the transaction [22]. Therefore, higher value of information disclosure to online vendors (i.e., lower risk of information disclosure) implies that vendors or transactions are trustworthy, decreasing the non-monetary cost of transactions, and, in turn, increasing the perceived value of mobile shopping. Hence:

H4: Information disclosure value has a positive effect on perceived value of mobile shopping.

Zeithaml [19] considers that perceived value is a key determinant of purchasing intentions. Previous research on consumer decisions, such as the prospect and mental accounting theories, assume that consumers search for value maximization. Consumers prefer to conduct transactions with sellers whose products offer maximal value, thus, perceived value having a positive effect on mobile shopping purchase intentions. Empirical evidence supports that a higher perceived value increases the purchase intention. For example, Kim *et al.* [22] choose an online bookstore to examine how the perceived value influences the online purchase intention for both potential and repeat customers and the results show that the perceived value exerts a positive effect on the purchase intention for both categories of customers. This study uses the context of mobile shopping to examine the relationship between perceived value and purchase intention.

H5: Perceived value of mobile shopping has a positive effect on purchase intentions for mobile shopping.

C. User Interface Quality

User interfaces for mobile shopping include interfaces of websites and branded applications for mobile devices. Generally, user interface refers to a place where interactions between humans and machines occur. A good user interface allows users to interact with the software or hardware in a natural and intuitive way. Aladwani & Palvia [23] define perceived web quality as users' evaluation of website features that meet users' needs and reflect overall excellence of the web site. User interface quality is multi-dimensional in nature. For example, Aladwani [24] developed four dimensions of a 25-item instrument measures to capture the characteristics of website quality: technical, specific content, general content, and appearance dimension. First, the technical dimension refers to website characteristics, such as security, ease of navigation, search facilities, site availability, valid links, personalization, interactivity, and ease of access. Second, the specific content dimension considers characteristics such as contact information, general company information, product/service details, consumer policies, and customer support. Third, the general content dimension includes characteristics such as content usefulness, completeness, clarity, currency, conciseness, and accuracy. Finally, the appearance dimension comprises characteristics such as attractiveness, organization, proper use of fonts, colors, and appropriate use of multimedia.

According to the inference theory, people make judgments of the unknown based on information they obtain from available cues [25]. If consumers perceive that a website interface is of high quality, they are likely to use interface quality as a proxy of security, consider online vendors trustworthy and have a favorable perception of security of that site, and, in turn, increase perceived value of information disclosure. *The signaling theory suggests that providers can give cues that convey information about quality to customers if these signals are interpretable and credible. Subsequently, these can inform users of quality characteristics and lead to provider trust.*

Empirical results also provide evidence that website investments can be a signal of website quality and influence consumers' perception of website privacy security [1], [26]-[27]. For example, Chang & Chen [1] invite respondents who had at least one year of online shopping experience to examine the influence of interface quality on perceived security. The results demonstrate that customer interface quality positively affects perceived security. Therefore, this study proposes the following hypothesis:

H6: User interface quality has a significant positive influence on privacy value.

Mobile shopping not only provides acquisition value to consumers who buy the products they need, but also brings consumers transaction value. Compared to offline purchases, mobile shopping provides the following relative advantages of transaction value for consumers: on one hand, mobile shopping allows consumers to easily acquire product information, reducing the non-monetary transaction cost; on the other hand, consumers could effectively search for relatively cheaper products/services after price comparisons, which result in monetary cost reduction, thereby increasing the transaction value [28].

Bonsón Ponte *et al.* [26] suggests that favorable perceived information quality leads to users' trust in security and privacy protection of the website, which, in turn, increases the perceived value of the online transaction. Kilburn *et al.* [29] proposes that interface quality, composed of privacy and system availability, has a positive impact on the perceived value of online education courses. System availability provides users with assurance that their resources will be available and functioning properly at any time. Privacy provides users with feelings of security and assures them that their personal information will be secured within the confines of the program. The results show that system availability is a significant determinant of perceived value, while privacy has a non-significant impact on perceived value of online education courses. Therefore, this study proposes the following hypothesis:

H7: User interface quality has a significant positive influence on mobile shopping perceived value.

As per the unified theory of acceptance and use of technology, Al-Qeisi [30] consider website design quality as a facilitating condition for online usage intentions, in terms of resource perception and support available to perform a behavior. Kim *et al.* [31] introduce website quality of mobile payment systems (MPS) as antecedents of perceived usefulness and ease of use, both of which being important components of the technology acceptance model, and, in turn,

leading to MPS usage intention. Dennis et al. [32] regard web atmosphere as a primary driver of online behavior.

There is considerable research examining the relationship between website elements and their influence on usage intentions. For example, Al-Qeisi *et al.* [31] examine the relationship between website design quality and usage behavior by incorporating website design quality into the unified theory of acceptance and use of technology model, and their findings indicate that the technical, general content, and appearance dimensions of a website are most important for usage of internet banking. These dimensions are significantly related to usage behavior both directly and indirectly.

Barnes & Vidgen [33] develop a model for intranet quality and acceptance and precedes a web survey from the sales and marketing division of a multinational manufacturing company. The results demonstrate that intranet quality (composed of usability, design and information quality) is a significant factor in determining intention to use, thereby enhancing actual use. Therefore, this study proposes that user interface quality has a positive influence on mobile shopping intentions.

H8: User interface quality has a significant positive influence on intention of mobile shopping.

The research model of this study is depicted in Fig. 1.

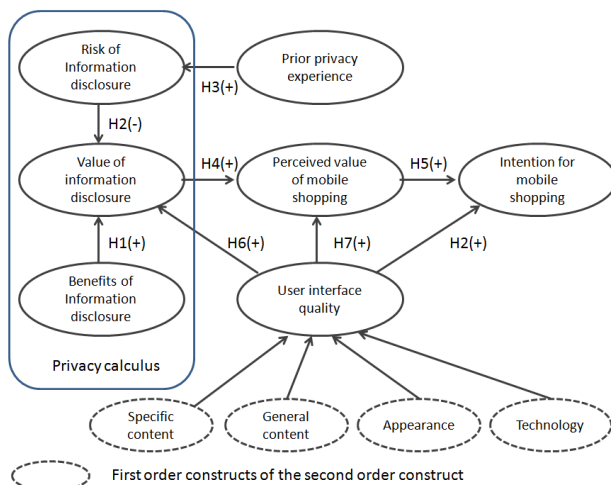


Fig. 1. Research model.

III. RESEACH METHODOLOGY

Self-administered questionnaires are distributed via online. The respondents are limited to those who had experiences of mobile shopping. A total of 262 responses are collected and 228 responses are usable after removing incomplete responses.

The questionnaire contains four following sections. The first is about the measurement of privacy calculus (including benefit, risk, and value of information disclosure), prior privacy experience, user interface quality, perceived value and intention of mobile shopping. User interface quality is a second-order formative construct including general content, specific content, technology and appearance dimensions. The constructs are measured on a seven-point *Likert* scale ranging from 1=strongly disagree to 7=strongly agree. The second is about consumer behavior in mobile shopping, and the last is

demographic characteristics, such as gender, education, and disposable incomes per month, and occupations.

IV. ANALYSIS

A. Analysis of Measurement Model

This research used PLS to test the reliability and validity of the constructs [34]-[35]. As seen in Table I, the results showed that composite reliability for each of the latent variables exceeded 0.7, suggesting good reliability [36]. The AVE (average variance extracted), a measure of convergent validity, for each construct was greater than the recommended threshold 0.5 [37]. Additionally, all the indicators had loadings greater than the recommended 0.7 [35], and that indicators loaded well on their respective constructs. These test results demonstrate good convergent validity. The construct correlations were lower than the square root of AVE of their respective constructs [37] and all the indicators loaded well on their own construct and poorly on other constructs, suggesting good discriminant validity.

TABLE I: CR, AVES, AND CORRELATIONS

Constructs	CR	AVE	1	2	3	4	5	6	7	8	9	10
1.BID	0.91	0.77	0.88									
2.RID	0.94	0.79	0.40	0.89								
3.PPE	0.91	0.77	0.26	0.34	0.8							
4.VID	0.91	0.88	0.03	-0.04	0.25	0.91						
5.GC	0.96	0.79	0.52	0.46	0.14	-0.01	0.89					
6.SC	0.94	0.76	0.61	0.39	0.20	-0.05	0.70	0.8				
7.APP	0.92	0.69	0.44	0.40	0.15	0.03	0.71	0.6	0.8			
8.TECH	0.95	0.72	0.68	0.41	0.15	0.03	0.76	0.6	0.6	0.8		
9.PV	0.94	0.83	0.47	0.17	0.17	0.32	0.74	0.4	0.4	0.5	0.9	
10.INT	0.96	0.88	0.39	0.24	0.18	0.29	0.48	0.4	0.3	0.4	0.7	0.9

BID: benefits of information disclosure; RID: risk of information disclosure; PE: prior privacy experience; VID: value of information disclosure; GC: general content; SC: specific content; APP: appearance; TECH: technology; PVMS: perceived value of mobile shopping; INT: intention of mobile shopping

Diagonal elements are the square root of AVEs and off-diagonal elements are correlations.

User interface quality is a formative second-order construct in the model, the assessments of measurement quality of second-order construct is conducted in two stages, at the first-order construct level and at the second-order construct level. The measurement assessment of first-order reflective constructs is executed in the previous section. At the second-order construct level, using the weights of the first-order constructs on the second-order constructs to assess the contribution of each first-order constructs to the second-order construct [38], [39]. As seen in Table II, All the first-order constructs weights are higher than 0.1 and significant, demonstrating empirical support for the first-order constructs relevance for the construction of the formative second-order construct and a appropriate level of validity [40]. Moreover, the examination of multicollinearity

between the first-order constructs is desirable, excessive multicollinearity can destabilize the second-order construct [41]. The variance inflation factor (VIF) was used to check the potential problems of multicollinearity. With values among 2.20 to 3.19, far below the cut-off of 5 [42], suggesting that multicollinearity is not a problem.

TABLE II: WEIGHTS, T-VALUES AND VIF OF THE FIRST-ORDER CONSTRUCTS ON THE SECOND-ORDER CONSTRUCT

Second-order construct	first-order construct	weights	t-value	VIF
User interface quality	General content	0.31	24.29	3.19
	Specific content	0.23	22.31	2.20
	Technology	0.21	20.10	2.28
	Appearance	0.39	28.21	2.85

B. Hypotheses Testing Results

Table III provides the results of the structural model. Regarding the relationships of antecedents of value of information disclosure, benefits ($\beta=0.49$, $P<0.01$) and risk ($\beta=-0.22$, $P<0.01$) of information disclosure influenced value of information disclosure positively and negatively respectively, supporting H1 and H2. Prior privacy experience positively influenced risk of information disclosure ($\beta=0.34$, $P<0.01$), supporting H3.

As predicted, H4 and H5 were supported: value of information disclosure increases perceived value of mobile shopping ($\beta=0.32$, $P<0.01$), which in turn enhances intention of mobile shopping ($\beta=0.70$, $P<0.01$).

As to the factors influenced by user interface quality, user interface quality influenced perceived value ($\beta=0.54$, $P<0.01$) and intention ($\beta=0.14$, $P<0.01$) of mobile shopping, supporting H7 and H8, respectively. However, user interface quality influenced valued of information disclosure significantly but unanticipated sign ($\beta=-0.15$, $P<0.01$), not supporting H6.

TABLE III: THE RESULTS OF PLS

Hypothesized relationship	Estimates	t-value
H1: Benefits of information disclosure → Value of information disclosure	0.49	6.93
H2: Risk of information disclosure → Value of information disclosure	-0.22	3.08
H3: Prior privacy experience → Risk of information disclosure	0.34	6.86
H4: Value of information disclosure → Perceived value of mobile shopping	0.32	6.07
H5: Perceived value of mobile shopping → Intention of mobile shopping	0.70	11.83
H6: User interface quality → Value of information disclosure	-0.15	2.46
H7: User interface quality → Perceived value of mobile shopping	0.54	10.18
H8: User interface quality → Intention of mobile shopping	0.14	2.20

t-value is significant at $p<0.05$ when it exceeds 1.96.

V. CONCLUSION

All of the hypothesized relationships are significant but the result that user interface quality negatively impacted on value of information disclosure is unexpected. The possible explanation might be that current online consumers have

affluent experience and knowledge of internet usage to understand the leakage of privacy information is not necessarily caused by user interface quality and thus are not viewed user interface quality as a cue of privacy security. This research has some implications for improving the understanding related to the relationship among privacy calculus, user interface quality, perceived value and intention of mobile shopping. User interface quality and privacy calculus help online vendors to increase perceived value and intention of mobile shopping. The more vendors improve value of information disclosure and user interface quality, the more customers attempt to proceed mobile shopping.

VI. LIMITATIONS AND FUTURE RESEARCH

Future research can take this study further by addressing several limitations of this study. First, the data for this study were drawn from a convenience sample and generalizations of the results must be made with caution. The replication of this study with a more balanced proportion of internet users regarding the country of residence would be desirable. Second, this study exclusively focused on privacy issues and user interface quality to explain the underlying patterns of perceived value of mobile shopping. However, other independent constructs may be considered to improve the explaining power. Third, given the importance of perceived value in explaining intention to mobile shopping, including the mediating and moderating relationships between perceived value and intention could advance our understanding in explaining the formation of intention to mobile shopping.

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