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The Effect of Affordance on Ubiquitous Commerce Consumption

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Recommended Citation

Wang, Shu Ching; Xu, Xiaoyu; Lin, Kuan-Chung; and Wu, Jen Her, "The Effect of Affordance on Ubiquitous Commerce Consumption" (2017). *PACIS 2017 Proceedings*. 58.

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The Effect of Affordance on Ubiquitous Commerce Consumption

Completed Research Paper

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Abstract

The rapid development of ubiquitous technologies and mobile devices has made ubiquitous commerce (U-commerce) the next business wave. U-commerce enabled merchants with new opportunities to provide personalized services and novel shopping experiences to customers. Applying affordance theory, this study builds a research model that explains the consumer cognitive assimilation process in U-commerce and explores hedonic and impulsive consumption. This study played the U-commerce video for participants before they answered the questionnaires. The empirical results show that context-aware facilitation and social facilitation contribute equally in explaining cognitive assimilation. Meanwhile, cognitive assimilation significantly influences both hedonic consumption and impulsive consumption. This study sheds light on the two important facilitations derived from the U-commerce environment and also reveals the determinants for two types of interesting purchase behaviors in the U-commerce context.

Keywords: ubiquitous commerce, affordance theory, cognitive assimilation, hedonic consumption, impulsive consumption

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Introduction

With the rapid development of the Internet and information technologies, the traditional business model has largely changed. The Internet has also generated significant influence on consumer behavior and the commerce paradigm (Sheng et al. 2008). In recent decades electronic devices and new technologies (e.g. the ubiquitous computing) have become more portable, powerful and intelligent, providing more personalized, diverse and ubiquitous services (Franco et al. 2011). Using the portable equipment such as smart phones and tablets, location based devices and technologies like sensors, Radio Frequency Identification (RFID) tag and GPS via a variety of wireless communication technologies like Bluetooth, 4G/5G and Wi-Fi (Zhang et al. 2009), people can access the latest information, communicate with other stakeholders in the shopping mall and ask for personalized services. These services have a profound impact on people's daily lives (Sheng et al. 2008). The commerce business model is rapidly evolving to the next generation -- ubiquitous commerce (U-commerce) (Wang and Wu 2014; Franco et al. 2011).

Using intelligent ubiquitous computing technologies, location-based devices and context-aware networks, U-commerce has several advantages compared with m-commerce. While m-commerce is centered on wireless networks, enabling stakeholders to conduct electronic transactions using a mobile terminal and a wireless network (Sheng et al. 2008), U-commerce is grounded in four features, namely ubiquity, universality, unison and uniqueness (Junglas and Watson 2006). Ubiquity means sensors and RFID containing all product information are located in products and shopping malls connected to the Internet providing access to each stakeholder, including consumers. The device incompatibility problem is eliminated due to the universality feature. Unison covers the idea of integrated data across multiple applications. For instance, the identity, schedule, preference, the change in physical surroundings and the current context of a customer will be collected and computed irrespective of the devices used (Kumar et al. 2015). Uniqueness means that the information provided to the users is easily customized to their current context and particular preference at a specific time and place (Weiser, 1999).

Accordingly, U-commerce provides context-aware information to customers and facilitates real-time social interaction, which demonstrates all possibilities with strong clues to customers in conducting shopping environment transactions. U-commerce acts like a personalized shopping assistant for customers bringing convenience as well as a pleasant shopping experience. Customers can enjoy a highly efficient purchasing experience, easily conducting purchase actions for multiple purposes, such as seeking fun, novelty and enjoyment in the U-commerce environment.

Previous m-commerce research results cannot be applied to explain U-commerce consumption behavior because of the distinct U-commerce features. The determinants of U-commerce consumption behaviors may be different from those in m-commerce. The U-commerce environment offers much richer and customized information and action possibilities to customers via a variety of channels, which may change the customer's perceptions as well as the cognitive process. It is important to explore how the individual's cognition towards the products or services are aroused and comply with the recommendations provided in the U-commerce environment. U-commerce successfully arouses the customer's potential to conduct hedonic and unplanned consumptions during the shopping process.

This study proposes the following questions to address the above issues: (1) what are the determinants

of hedonic consumption and impulsive consumption in U-commerce? (2) What are the critical factors influencing customer cognitions in U-commerce? Applying the law of affordance theory, this study first sheds light on the affordances (context-aware facilitation and social facilitation) in assimilating and facilitating the consumer's cognition towards the products or services in the U-commerce environment. This study then expands the present understanding towards the potential consumption behaviors (hedonic consumption and impulsive consumption) influenced by cognitive assimilation in U-commerce.

Literature Review

Affordance Theory in U-commerce

U-commerce utilizes both context awareness, real-time social interaction and intelligent applications embedded within mobile communication devices; thereby able to detect a customer's unique identity, store and gather abundant information and sense changes in the customer's physical surroundings, including the people, objects and events within and conditions of that environment (Wang and Wu 2014). Customers are always connected seamlessly in these context-aware networks, allowing personalized services to be delivered based on the customers' identities, preferences and geographical locations.

Affordance theory is developed from the ecology, and is outlined based on the argument that affordance reflects an action possibility formed by the relationship between an actor (a person or animal) and the world. Affordances provide critical clues to the operation of things (Norman 1999). A doorknob, affords opening and closing a door. Thus, the differentiation between a chair and a table in a room is based on the possibilities they afford for actions with them, rather than simply their shapes (Goel et al. 2013). In IS literatures, affordance is described as the relationship between an actor and an artifact so it is relevant to the possible actions on the IT artifacts (Volkoff and Strong 2013). IT artifacts may comprise various technical objects, component parts, the interface through which the actor interacts with it, and the outputs of the IS. Similarly, U-commerce as an IT artifact utilizes advanced technologies, such as sensors, ubiquitous computations, integrated data, mobile devices and the Internet to provide highly relevant and strong clues to customers regarding all of the action possibilities, such as the possible consumption behaviors in the U-commerce environment. In other words, U-commerce offers the meaning or value of a product or a conversation between stakeholders consists of what it affords to a customer.

Owing to the reason that affordance sheds lights on the perceived possibilities for actions and the interactions within it, prior literatures have shown special interests in two kinds of interactions, namely context facilitation and social facilitation (Goel et al. 2013). Context facilitation is defined as the comprehension an individual has about what he is to do in an environment by virtue of the elements in that environment. Social facilitation is defined as the comprehension an individual has about other people in the same space based on an understanding of them in a social sense. Such an understanding involves more than just a perception of others' presence but also an understanding of their behaviors or actions. We define context-aware facilitation as the support that a U-commerce environment provides in the form of various cues (assistances and services) in the environment related to the business activities (Goel et al. 2013). In U-commerce environments an individual's information is well recorded and computed, such as the locations, preferences and the current context. Hence,

U-commerce is able to predict the consumer's preferences and automatically reveal all of the action possibilities in such a shopping environment, such as personalized shopping routes, recommended products and shopping list, entities and resources nearby such as coffee shop for a shopping break. In other words, U-commerce acts like a personal assistant to provide context-aware facilitations for people to effectively understand the meanings and functions of products and services and obtain comprehension about the actions they can perform in such a context (Schilit and Theimer 1994).

According to the social facilitation definition, the understandings towards others, such as their opinions and meanings of their behaviors, are usually developed through social interaction, communication and experience. In the U-commerce environment, merchants are able to identify a customer's needs, routines and preferences, and provide real-time personalized services. A consumer can freely interact with merchants to facilitate their understandings towards the products and service as well as their action possibilities, such as the customized delivery service or special offers via the real-time interaction within the U-commerce context. Consumers are able to enjoy personalized services, and have a convenient and pleasant shopping experience during the process. Thus, social facilitation is defined for this study as how well a U-commerce medium enables real-time social interactions (Goel et al. 2013).

Hypotheses and research model development

This study draws on affordance theory to explore and explain the impacts of both context-aware facilitation and social facilitation on consumption behaviors through an individual's cognitive development within U-commerce. Norman's (1999) viewpoint on affordance theory suggests that the affordance of objects and the settings in the environment can arouse an individual's feedback and cognitive reflections towards the affordance of the objects. This feedback can generate cumulative effects on the individual interpretation and cognition towards the actions. The cognition effects can eventually lead the individual to conduct the related actions and missions suggested in the context.

In the U-commerce environment ubiquitous technology and interactive applications are integrated so consumers can experience personalized services. Thus, consumers may give feedback about the convenience and advantages of the U-commerce context. All of these cognitions and feedback can exert cumulative effects on the individual's understanding of U-commerce. The entities and services in the U-commerce environment are thereby able to strongly influence the consumer's cognitions towards products, services and actions. The consumer's existing understanding might be suppressed or enhanced. In other words, context-aware facilitation and social facilitation are able to change the consumer's previous cognition towards the products, services and possible actions in the U-commerce environment. In this study, cognitive assimilation refers to the extent to which individuals adjust their existing cognitions through the absorption of external influences (e.g. new information and experiences) derived from a U-commerce context (D'Rozario and Douglas 1999; Klein 2012).

Context-aware facilitations are able to exert influence on consumers' cognitions towards the environmental properties. In a technological-mediated environment, context-aware facilitations can provide customers with a wide range of cues and instructions in the environment related to the business tasks, such as recommended products and possible shopping routes. Consumers are

able to comprehend and adjust their understanding of the information accordingly, and assign positive meanings to the objects and behaviors in the environment, such as believe the recommended products are useful and qualified (Goel et al. 2013). Accordingly, the cognitive assimilation process is realized in the U-commerce context. Therefore, according to the affordance theory, it is reasonable to propose this hypothesis:

H1. Context-aware facilitation is positively associated with cognitive assimilation.

In general, consumers can conduct synchronous social interactions within the U-commerce environment so that personalized services and shopping assistance can be provided accordingly. The friendly mediated interaction between the customers and merchants produces a shopping support environment, further creating a positive feeling of empathy and belonging for the customers (Cheng 2014). It is more comfortable and pleasant for the customer to develop a congruent understanding with the merchants towards the meaning of their interactions, promotions, as well as the purchase recommendations, which suggests the customer's cognitive assimilation process. Hence, we would like to propose the hypothesis:

H2. Social facilitation is positively associated with cognitive assimilation

Hedonic consumption refers to the pleasant and enjoyable purchasing experience people have in a U-commerce context (Hirschman and Holbrooks 1982). In the "Design-in affordance", Norman indicated that the users of an artifact can obtain the feeling of satisfaction and pleasure (Norman, 1999). Similarly, U-commerce shopping experience may provide the hedonic gratifications to consumers. Consumers conduct consumption searching for happiness, fantasy, awakening, sensuality and enjoyment (To et al. 2007). In other words, the customers love to shop because they enjoy the U-commerce shopping process. Shopping behavior is no longer just a boring task or a mission to complete (Bloch and Bruce 1984; Sherry 1990). In U-commerce, the hedonic gratification may derive from cognitive assimilation. U-commerce provides customers the most relevant recommendations, personalized shopping services and real time social interactions with merchants to reveal novel and interesting action possibilities. Cognitive assimilation is a process full of novelty and pleasure. People recognize, absorb and understand the interesting information and the enjoyable outcome of consumption during the process. Hence, it is likely that cognitive assimilation generates hedonic gratification and elicits the customer's hedonic consumption. Hence, the following hypothesis is proposed:

H3: Cognitive assimilation is positively associated with hedonic consumption.

Impulsive buying is a common human behavior (Rook and Fisher 1995; Kacen and Lee 2002; Badgaiyan and Verma 2015). In this study, impulsive consumption refers to the spontaneous or unplanned purchasing behavior conducted in a U-commerce context (Beatty 1998). Consumers are inclined to conduct unplanned behavior when they are emotionally attracted to the products and shopping atmosphere (Kacen and Lee 2002). In U-commerce cognitive assimilation is a pleasant process for customers due to the personalized service, effective shopping assistant, novel elements and innovation and the enjoyable shopping experience. Therefore, cognitive assimilation is more likely to arouse the customers' positive emotions and attraction towards the products and services recommended, which can further induce unplanned consumption. Hence,

the following hypothesis is proposed:

H4: Cognitive assimilation is positively associated with impulsive consumption.

The research model is presented as follows:

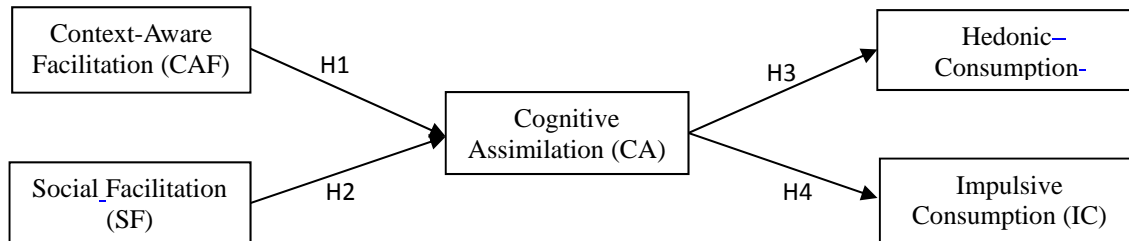


Figure 1. Research Model

Research Design

Research Instrument Development

A survey questionnaire was developed to collect empirical data. The research model constructs were measured using multiple-item perceptual scales. All items were measured using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The majority of the items are adapted from the extant research, and slightly modified to fit the U-commerce research context. Based on the definitions in the literature and the context of this study, some new items were developed for this study and further examined. The measures for context-aware facilitation and social facilitations were adapted from Goel et al. (2013). The concept and items for cognitive assimilation were derived from D’Rozario and Douglas (1999) and Klein (2012). While Hedonic consumption was taken from Saleem et al. (2012) and Arnold and Reynolds (2012), the items for impulsive consumption were tailored from Beatty and Ferrell (1998) and Saleem et al. (2012).

In order to ensure the instrument content validity, small scale pretests and personal interviews were conducted. Eighteen panelists (including six professors of information system departments, seven practitioners and five researchers who have participated in U-commerce) were interviewed. A questionnaire pilot test was conducted. This step was aimed to ensure the content validity, which suggests the completeness and appropriateness of the research instrument. In other words, all aspects of a construct were measured appropriately in the research domain to ensure the validity and reliability of the measurement.

According to the expert feedback results, the instrument was refined through wording, rephrasing sentences, and eliminating ambiguous questions. The final questionnaire contains 20 questions and consists of three parts. The first part, a motivation letter, states the purpose of this study and the relevant definitions. In the second part, respondents are asked to answer questions, providing demographic information. Finally, the third part contains the items measuring the research model constructs.

Data Collection

The proposed research model was tested with data collected from both a web-based survey and paper questionnaire. The empirical data was collected from April to May, 2013. Considering the U-commerce environment is still at the early stage, participants may have no comprehensive picture about U-commerce. A specific hyperlink of the shopping scenario video was, therefore, given to all participants before obtaining their answers. By the time this survey was concluded, 334 questionnaires were collected, among which 270 respondents were identified as valid respondents.

The potential non-response bias was assessed by comparing the early versus late respondents that were weighed on several demographic characteristics. The t-test and χ^2 analysis were used to examine the distributions between these two data sets. The results indicated that there are no statistically significant differences, and demonstrated that non-response bias was not a serious concern in this study. Furthermore, the valid data provided by 126 males and 144 females show that 88% of the respondents' ages ranged from 19 to 28 and 78.1% of the respondent's educational attainment were college or university. Furthermore, Harmon's single-factor test was used to assess common method bias. As expected, no single factor emerged, and five factors were extracted and collectively accounted for 64.5% of the variance in the data, with the first factor accounting for 16.3% of the total variance. These findings suggest that common method bias is not a major concern.

Data analysis methods

Structural equation modeling (SEM) has been suggested as a rigorous method to examine the reliability and validity of instruments and the significance of relationships between constructs, providing a set of indices for evaluating the model fit. SEM is best suited to data analysis in confirmatory research. Hence, in order to examine the theory-based research models and hypotheses, SEM was employed as the data analysis method in the current study.

The research model (including both measurement and structural models) is evaluated using partial least squares (PLS). PLS is utilized to accommodate the presence of a complex model and the exploratory nature of this research. Moreover, PLS uses bootstrapping to estimate standard errors for parameter estimate, which somewhat helps avoid the restrictive distributional assumptions. A two-step approach was followed for proceeding with the data analysis. Confirmatory factor analysis (CFA) was used to estimate the measurement model. The reliability and validity of the measurements were examined using this technique. The path coefficients and statistical significance were then examined by testing the structural model applying the bootstrapping procedure.

Data Analysis and Research Results

Measurement Validity and Reliability

CFA was utilized to test the measurement adequacy. The assessment of reliability, convergent validity, and discriminant validity was conducted using PLS 2.0. The reliability of the instruments was assessed by examining the composite reliability. The convergent validity was assessed using the factor load and Average Variance Explained (AVE). The discriminant validity was evaluated using the AVE square root criteria and the item loads on their associated factors were compared with the item loads on the other factors. The results of which demonstrate a satisfactory fit.

The factor load values were all over the 0.7 threshold presented in table 1, showing that more than half of the variance in an observed item is explained by its construct. The Cronbach's alpha value, which

assumes that scores for all items have the same range and meaning; composite reliability and AVE of the constructs were all over the 0.7, 0.7 and 0.5 thresholds, respectively, as shown in Table 1. The squared roots of AVE were higher than their correlations with other constructs. The results show that all items fit their respective factors quite well and these measures have unidimensionality, convergent and discriminant validity.

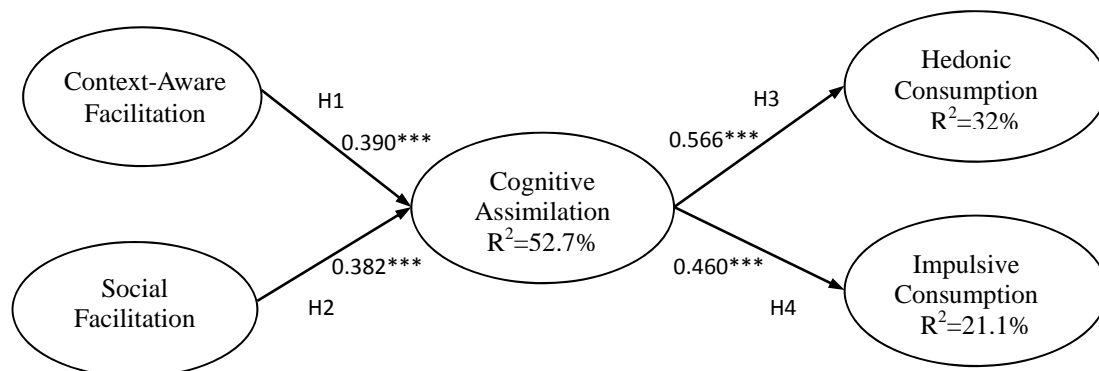
Table 1. Inter-construct Correlations

Construct	Minimum factor-loading	Cronbach's Alpha	Composite Reliability	AVE ^a	CA	CAF	HC	IC	SF
CA	0.77	0.80	0.87	0.62	0.79^b				
CAF	0.75	0.80	0.87	0.62	0.68	0.79			
HC	0.78	0.83	0.89	0.66	0.57	0.62	0.81		
IC	0.71	0.74	0.84	0.57	0.46	0.37	0.46	0.75	
SF	0.73	0.77	0.85	0.59	0.68	0.77	0.55	0.38	0.77

^a Average variance extracted.
^b Diagonal elements are the square roots of AVE. Off-diagonal elements are correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Evaluation of the Structural Model

Figure 2 shows the PLS analysis results and the path coefficient of the constructs. The results indicate that the cognitive assimilation variance in U-commerce explained by context-aware facilitation and social facilitation is 52.7%. Meanwhile, the hedonic consumption variance is 32% and the impulsive consumption variance is 21.1% which are both explained by cognitive assimilation.



Note: * t > 1.96, ** t > 2.576, *** t > 3.291

Figure 2. Structural Model

Hypothesis 1 is strongly supported, according to the significant path coefficient from context-aware facilitation to cognitive assimilation. This result implies that context-aware facilitation is positively related to cognitive assimilation. Similarly, the direct effect drawn from social facilitations to cognitive assimilation is confirmed by the significant path coefficient. Accordingly, ~~the~~ hypothesis 2 is supported by the empirical data. This indicates that social facilitation exerts a similar effect on cognitive assimilation. Finally, the results indicate that cognitive assimilation significantly and positively predicts hedonic consumption and impulsive consumption. Cognitive assimilation exerts a

stronger effect on hedonic consumption compared to its effect on impulsive consumption. Therefore, H3 and H4 are strongly supported in this study. Figure 2 presents the hypotheses evaluation statistical results. The predictive validity was evaluated by examining the R square and path coefficient.

Discussion and Conclusion

Applying the affordance theory, this study seeks to provide a theoretical framework to investigate the determinants of consumer behaviors in U-commerce by embracing two ideas: (1) Context-aware facilitation and social facilitation in the U-commerce environment can exert influences on assimilating consumers' positive cognitions towards the products and services recommendations. (2) This study suggests that positive consumer behaviors, including hedonic consumption and impulsive consumption, are due to the cognitive assimilation in the pleasant and superior U-commerce environment. In other words, the empirical results show that both context-aware facilitation (H1) and social facilitation (H2) positively influence cognitive assimilation. In addition, cognitive assimilation significantly facilitates hedonic consumption (H3) and hedonic consumption (H4).

Context-aware facilitation (H1) and social facilitation (H2) contribute equally to influence cognitive assimilation. The results suggest that, providing a wide range of cues regarding the environment, products and services, context-aware facilitation and social facilitation positively influence the customer's comprehended cognition towards the related business activities in a U-commerce context. These two types of affordance can intensively enhance or suppress the individual's initial cognitions. In other words, according to the affordance theory, an individual is highly likely to comply with the recommendations provided due to the context-aware facilitation and social facilitation. Accordingly, the cognitive assimilation process is realized in the U-commerce context.

The results of this study suggest a very significant cognitive assimilation effect on hedonic consumption (H3). Prior studies indicated that people seek hedonic experiences for enjoyable and experiential qualities (Wakefield and Baker 1998). During hedonic shopping, people engage in the emotional involvement and enjoyment experience (Lacher and Mizerski 1994). In a U-commerce environment, people assign positive meanings to personalized services and comply with the recommendations due to the cognitive assimilation process, and further enjoy the convenience and superior services providing the pleasure and joy. The customers love to conduct hedonic consumption because they develop pleasant and exciting experiences during the cognitive assimilation process in the U-commerce context. Hence, hedonic-oriented consumption is formulated in U-commerce.

Similarly, impulsive consumption is very likely to occur due to cognitive assimilation in the U-commerce environment (H4). The empirical results fit our expectation. As discussed earlier, the consumers are very likely to assimilate their cognitions and eventually accept the recommendations provided during the U-commerce shopping process. In other words, people sometimes conduct unplanned or spontaneous purchases (Rook and Fisher 1995) or a purchase with no intention to buy before entering the store integrating the U-commerce technologies (Engel et al. 1982). ~~On the other hand, according to chaos theory a minor change in the chaos system may generate unpredicted consequences. In U-commerce an individual's cognition towards certain products can be changed due to the U-commerce recommendations. Such changes are highly likely to generate unexpected impulsive buying when the consumer engages in the U-commerce shopping experience.~~

Theoretical Implication

This study utilizes the affordance theory to investigate the consumers' cognitions and following behaviors in the next wave of conducting business -- U-commerce. This study has not only theoretically constructed a model to interpret the critical affordances in facilitating the consumers' cognition assimilation, but also reveals that two types of consumption behaviors are determined through cognitive assimilation. This study provides empirical support for context-aware facilitation and social facilitation effects on cognitive assimilation. According to affordance theory (Norman, 1999), individuals' cognition towards products and services can be influenced and assimilated due to their absorption and cognitive feedback regarding the affordances (context-aware facilitation and social facilitation) within the U-commerce environment. According to our knowledge, few studies have investigated the individual's cognitive compliance process in U-commerce. Therefore, the affordance theory application in this study sheds light on the critical role of context-aware facilitation and social facilitation in the U-commerce environment providing understanding of these two types of critical affordances in explaining cognitive assimilation.

Moreover, the second contribution derives from the investigation of two kinds of interesting consumption behaviors (hedonic consumption and impulsive consumption) in U-commerce. These two consumption behaviors also stem from the U-commerce context. Based on affordance theory, this study proposes a strong and comprehensive theoretical model to investigate hedonic consumption. The empirical evidences suggest that the cognitive assimilation process in the U-commerce environment can generate a pleasant and enjoyable shopping experience. Individual consumers would like to engage in hedonic consumption eventually due to this shopping process. In addition, cognitive assimilation process is pleasant, and enables customers to absorb the novel and interesting information which can further facilitates their purchase decision. Therefore, customers are emotionally attracted to the products and shopping atmosphere. Hence, impulsive consumption is very likely to happen in U-commerce.

Practical Implication

The development of U-commerce is still at its early stage. This study aims to provide guidelines and suggestions to U-commerce service providers and help them in identifying appropriate services for customers. Context-aware facilitation and social-facilitation have been shown useful in assimilating consumers' cognitions which can further elicit consumption. Intelligent context-aware affordance should therefore be provided. The information recommended to customers should be effective, efficient and personalized for providing convenient and pleasant shopping experience and eliciting potential purchases. The more benefit that a customer perceives from the context-related information in U-commerce, the more likely a customer will depend upon the recommendations for making their shopping decisions. U-commerce acts like the personalized shopping assistant for better and more appropriate choices in the shopping environment.

In order to help consumers accept the recommendations, personalized needs and desires, and an enjoyable shopping experience should be addressed and taken care of during the real-time interaction. The merchants should provide synchronous feedback and communication regarding the promotions and marketing activities during the interaction with consumers. To attract customers, U-commerce service providers need to offer personalized services with benefits that provides social-enhancing technologies.

Limitation and Future Study

Several limitations should be acknowledged in this study. Because U-commerce is still at its infant stage in Taiwan, the survey design and investigation regarding the research samples are all based on the situational video. It is difficult to simulate the comprehensive details in the real U-commerce context to examine the real U-commerce users' cognition and actual behavior. This study was conducted in Taiwan. Care must be taken when one is trying to generalize the results of this study to other social, economic and cultural environments. Hence, with the rapid development of U-commerce, future research can provide a more realistic experience to subjects and conduct the research in other areas and different cultures, in order to produce more reliable and meaningful results.

Moreover, the respondents in this study ranged mainly in age from 19 to 28 so the majority of the participants are students. It has been suggested that a student sample is appropriate for investigating new technologies since they are usually the first adopters and typical users. Further studies might need to expand the boundaries of this analysis to other populations.

Acknowledgments

This research was supported by the Ministry of Science and Technology, Taiwan under operating grants MOST 105-2420-H-110-002-MY3 and MOST 105-2420-H-022-003 and was partially supported by the Aim for the Top University Plan of National Sun Yat-Sen University and Ministry of Education, Taiwan.

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