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Americas Conference on Information Systems (AMCIS)

December 2006

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ABSTRACT
Drawing on flow theory, a process view of knowledge, and the technology acceptance model (TAM), this research investigates antecedents and effects of flow experience and examines factors important to behavioral intention in online gaming contexts. Research hypotheses are developed and tested with data from a survey study. Results find support for most of the hypotheses. An interesting exception occurs in the case of two TAM-based hypotheses.

Keywords
Flow, knowledge, online games, TAM

INTRODUCTION

It is estimated that the worldwide number of online game players reached 50 million in the year 2004 and is expected to be 114 million in the year 2006 (DFC Intelligence, 2004). To leverage this growth, participants in the industry need to have an improved understanding of player behaviors. For instance, e-commerce researchers have done little work in examining the factors important to the prediction of player behaviors. In this paper, we study two such factors: flow and knowledge.

As a subject of psychology and marketing research, flow experience has long been viewed as an emotional state of optimal experience achieved when performing some activity. Prior research suggests that flow experience is an important determinant of consumer behavior (Novak, Hoffman and Yung, 2000). In addition, flow experience can also affect the frequency and amount of time spent using online services or making online purchases through the development of customer loyalty (Jarvenpaa and Todd, 1997). Thus, knowing what conditions are conducive to online customers achieving flow experience is critical to the success of an online vendor, be it in the gaming sector or elsewhere.

As a subject of management research, knowledge has been recognized as a factor resulting in increased ability for activity (Akbar, 2003). Because flow experience is an intense state of activity, an interesting and important question is whether knowledge is useful in predicting flow experience. If it is, then knowledge may function as an effective lever for success of online game vendors. While one may intuitively believe that knowledge can affect flow, this important relationship has not been empirically tested.

To better understand player behavior in online games, this research investigates factors fundamental to behavioral intention and examines the impact of knowledge on flow in the context of online games. The theoretical underpinnings of this study rest on a process view of knowledge created to identify the lifecycle of knowledge (Davenport and Prusak, 1998), flow theory founded to examine state of mind (Csikszentmihalyi, 1975, 1990), and the technology acceptance model (TAM) developed to measure user acceptance of computer systems (Davis, 1989).

CONCEPTUAL DEVELOPMENT AND RESEARCH HYPOTHESES

Knowledge Concepts

As a fluid mix of framed experience, values, contextual information, and expert insight, knowledge provides users with a framework to evaluate and incorporate new experiences and information (Davenport and Prusak, 1998). Knowledge is a product of reflection and experience, which is conveyed in representations (e.g., linguistic, symbolic, digital, mental, behavioral, material patterns) that are usable to some processor (e.g. human mind) and can be categorized as being descriptive (characterizations of the state of some system – who, what, when, etc.), procedural (characterizations of how to do something), or reasoning (characterizations of logic or causality) (Holsapple, 1995, 2003, 2005).
A process view of knowledge suggests that knowledge is both used and embedded in various processes (i.e., in the behaviors of some processor, such as a person or organization). For example, Davenport and Prusak (1998) present a four-fold classification of knowledge processes: knowledge generation, knowledge codification, knowledge sharing, and knowledge utilization. In this classification, knowledge generation includes processes of knowledge creation and acquisition. Knowledge

creation refers to the activities of deriving and discovering new knowledge (Holsapple and Joshi, 2004). Knowledge acquisition refers to the intake or acceptance of knowledge from external sources (Davenport and Prusak, 1998). Knowledge codification refers to the translation of knowledge into representations such as documents, rules, and manuals for storage in a repository. Knowledge sharing refers to transfer of knowledge between processors. Finally, knowledge utilization is the use of knowledge to solve practical problems.

Flow Theory

As the founder of flow theory, Csikszentmihalyi (1990) defines it as the state in which an individual is so involved in an activity that nothing else seems to matter. He also argues that flow experience can occur in almost any activity including making music, rock climbing, dancing, reading, sailing, and playing chess. When in a flow state, a person's awareness is highly focused, time may seem to stand still, self-consciousness disappears, and there is a feeling of being in control of the environment (Hsu and Lu, 2004).

To better understand flow in the context of e-commerce and IT usage, researchers have tried to find answers to the most frequently asked questions: what are the antecedents of flow experience, what are the effects of flow experience, and what are the measures of flow experience. For instance, in a conceptual model of flow, Hoffman and Novak (1996) suggest that there are two primary antecedents of flow: skills/challenges and focused attention, and two secondary antecedents of flow: interactivity and telepresence (i.e., the mediated perception of an environment). They also indicate that the effects of flow are: consumer learning, perceived behavioral control, exploratory behavior, and positive subjective experience. Finally, they suggest a comprehensive measure of flow experience, although a measurement scale is not available in their study.

In subsequent empirical research, Novak et al. (2000) hypothesize that flow experience is determined by high levels of skill/control, high levels of challenge and arousal, and focused attention. The consequents of flow experience included in their model are consumer behavior variables including online shopping and Web use applications (e.g. search for production information and participation in chat rooms). The most important construct of the model, flow experience, is measured with a three-item scale following a narrative description of flow.

Koufaris (2002) finds that product involvement, value-added search mechanisms, Web skills, and challenges are four important antecedents of flow experience. He also finds that the effects of flow experience are online consumer intention to return and their likelihood of making unplanned purchases. The flow experience in the study is measured by three constructs: shopping enjoyment, perceived control, and concentration, representing three dimensions of flow experience. Because shopping enjoyment is the only measure of flow predicting consumer intention to return, Koufaris (2002) argues that given online consumers are not simply website users, a multi-construct measure of flow might be inadequate to explain their behavior. Thus, he suggests using a simple construct such as shopping enjoyment to measure flow experience in online consumer behavior research.

In accord with this suggestion, the research reported here measures flow experience in terms of one important and common dimension: enjoyment. In other words, we treat the enjoyment dimension of flow as its central construct in the current study. As the emotional response of pleasure from an activity, enjoyment can occur not only in the course of physical activities, but also in the pursuit of mental activities such as playing chess and cyber-games. Prior research suggests that enjoyment is critical to e-commerce because it can significantly impact consumer attitude and belief toward using an online service or making an online purchase (Jarvenpaa and Todd, 1997).

The Technology Acceptance Model (TAM)

Having already received substantial research attention, TAM helps researchers and practitioners better understand technology and information system use. TAM suggests that technology use intentions are predicted by two behavioral beliefs: perceived usefulness and perceived ease of use (Davis, 1989). Prior research shows great support for TAM, although these studies do not involving a gaming context. In this study, we argue that TAM also applies to the context of online gaming. Figure 1 shows the research model.

The Impact of Knowledge on Flow

Because knowledge is the underlying basis of skill that allows people to act (Koskinen, 2003), and skill is an important antecedent to flow (Csikszentmihalyi, 1990), we are led to hypothesize that (similar to skill) knowledge may be another significant antecedent to flow. Through the process of knowledge generation or knowledge sharing, new knowledge is created, acquired, or obtained. Such new knowledge gives players the capability to solve puzzles, use controls, and understand game backgrounds. Thus, players are more likely to enjoy playing online games. In addition, the process of

knowledge utilization allows players to apply their knowledge to gaming activities, resulting in better decisions or actions that enable players to interact with an online game more efficiently and effectively. Such improved interaction gives players a strong sense of involvement and interest.

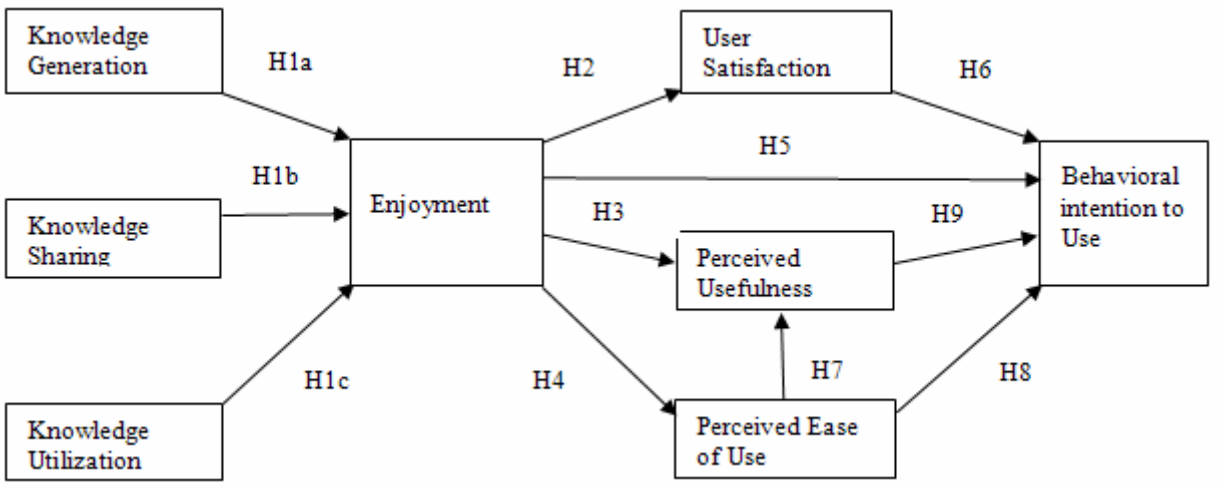

Figure 1. Research Model

Hypothesis 1a: In the context of online gaming, knowledge generation is positively related to enjoyment.

Hypothesis 1b: In the context of online gaming, knowledge sharing is positively related to enjoyment.

Hypothesis 1c: In the context of online gaming, knowledge utilization is positively related to enjoyment.

The Impact of Flow on Online Game User Satisfaction

To study the role of emotion in consumption, Oliver (1992) finds that enjoyment is highly correlated with satisfaction. Similarly, looking at a customer's commitment value and examining its relationships with the customer's satisfaction, Lee, Pi, Kwok and Huynh (2003) find that shopping enjoyment contributes significantly to the attainment of customer satisfaction.

Hypothesis 2: Enjoyment is positively related to online game user satisfaction.

The Impact of Flow on Perceived Usefulness, Perceived Ease of Use, and Behavioral Intention to Use

Agarwal and Karahanna (2000) provide empirical evidence that perceived usefulness, perceived ease of use, and behavioral intention are important consequences of flow experience in the context of using the World Wide Web. Koufaris (2002) finds that shopping enjoyment has a significant effect on consumer intention to return. At the same time, Venkatesh (2000) suggests that enjoyment significantly impacts perceived ease of use. Moreover, prior work also suggests that flow experience has a direct effect on online customer loyalty (Choi and Kim, 2004). Thus, we are led to posit that such relationships could carry over to the context of online gaming.

Hypothesis 3: Enjoyment is positively related to perceived usefulness of an online game website.

Hypothesis 4: Enjoyment is positively related to perceived ease of use of an online game website.

Hypothesis 5: In the context of online gaming, enjoyment is positively related to behavioral intention to use.

The Impact of User Satisfaction on Behavioral Intention to Use

Previous studies indicate that user satisfaction can significantly influence the behavioral intention to use information systems (DeLone and McLean, 1992). In an extended technology acceptance model, Shih (2004) examines the impact of user

satisfaction on acceptance of e-shopping and finds that user satisfaction has a significant influence on the behavioral intent toward not only purchasing products, but also using an online service.

Hypothesis 6: Online game user satisfaction is positively related to behavioral intention to use that game.

Relationships among TAM Constructs

This study adopts TAM and argues that the same relationships among the three constructs (i.e. perceived ease of use, perceived usefulness, and behavioral intention) are present in the context of using an online game website.

Hypothesis 7: Perceived ease of use is positively related to perceived usefulness of an online game website.

Hypothesis 8: Perceived ease of use is positively related to the behavioral intention to use an online game website.

Hypothesis 9: Perceived usefulness of an online game website is positively related to behavioral intention to use that site.

METHODOLOGY

Survey Instrument, Pilot Test, and Data Collection

To study the hypotheses, data were collected via a survey instrument administered to undergraduate students. Before the main data collection, a pilot test of the survey instrument was conducted to ensure accuracy and clarity. Overall, a total of 253 valid responses are used for final data analysis of this study. Of all these 253 respondents with online gaming experience, around 60% are male. The respondents' average age is 23 and their average weekly online gaming hours are 3. The average years of online game experience is 2.8 and home is the dominant location of playing online games.

Results

Partial Least Squares (PLS) Graph Version 3.0 is employed to measure the reliability and validity of data, and to test the research hypotheses. All items (shown in appendix A), except for two items in perceived usefulness (PUF2 and PUF3) and one item in perceived ease of use (PEU3), exhibited high loadings (>.707) on their respective constructs, and no items loaded more strongly on the constructs they were not intended to measure. The three items whose loadings are less than .707 but larger than .6 are still acceptable because there exist additional high-loading item(s) measuring the same latent construct (Chin 2001). All ICRs (Internal Consistency Reliability) are larger than 0.75, exceeding the minimum reliability criterion (.70). All square roots of AVEs (Average Variance Extracted) are larger than the minimum validity criterion (.707), and in all cases larger than the correlations between that construct and all other constructs. Over all, these results provide strong evidence of convergent and discriminant validity, as well as reliability of the measurement instruments.

In general, seven of the eleven hypotheses are supported. Knowledge generation has a significant effect on enjoyment, thus supporting hypothesis 1a. Inconsistent with hypothesis 1b, knowledge sharing has a negative but non-significant effect on enjoyment. Hypothesis 1c, which posits that knowledge utilization is positively related to enjoyment, is supported at a statistically significant level. Consistent with the predictions, enjoyment has a statistically significant association with user satisfaction, perceived usefulness, perceived ease of use, and behavioral intention to use, thus supporting hypotheses 2, 3, 4, and 5. User satisfaction has no statistically significant relationship with behavioral intention to use. Thus, hypothesis 6 is not supported. Supporting hypothesis 7, perceived ease of use has a statistically significant association with perceived usefulness. Finally, neither perceived ease of use nor perceived usefulness has statistically significant relation with behavioral intention to use; thus, hypotheses 8 and 9 are not supported.

DISCUSSION

This study has some implications for future research. First, future research can include other knowledge processes (such as knowledge codification) and investigate whether they influence flow experience. Second, because self-efficacy plays an important role in predicting perceived ease of use and perceived usefulness, future research can investigate the impact of flow experience on user beliefs with self-efficacy as a control variable. Finally, future research can develop more reliable and valid items to measure perceived usefulness and perceived ease of use.

This study also has some key implications for practice. First, the results show that knowledge generation and knowledge utilization can predict enjoyment. Such findings indicate the desirability of 1) supporting knowledge generation processes to

allow players to generate new knowledge necessary for online gaming activities, and 2) supporting knowledge utilization processes to facilitate effective user interaction with an online game. Second, this study suggests that enjoyment is an important antecedent to behavioral intention to use, user satisfaction, and user beliefs. This implies that it is fundamental for online game vendors to provide players with truly enjoyable products.

In conclusion, the purpose of this study is to empirically examine the impact of knowledge on flow and the subsequent effects of flow, as well as to investigate factors important to behavioral intention in online gaming contexts. Based on an empirical study, partial support is found for the prediction that knowledge, as the underlying basis of skill execution, can also be a significant antecedent to flow. The results of this study also confirm the significant impact of flow experience on user satisfaction, user beliefs, and behavioral intention, and the important role of perceived ease of use in perceived usefulness. The findings of this study indicate the need for continuing research efforts on knowledge and flow experience in the context of electronic commerce and technology usage.

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Appendix A: Survey Items	
Knowledge Generation (KNG)	
KNG1	I obtain useful information and suggestions about playing online games from other players.
KNG2	I search information to improve my skill of playing online games.
KNG3	I read game guidance/introduction to help me play online games.
Knowledge Sharing (KNS)	
KNS1	It is important for online game players to share information and experience.
KNS2	Online game players share information and experience necessary for playing online games.
KNS3	Players improve their skills of playing online games by sharing information and experience.
Knowledge Utilization (KNU)	
KNU1	I use information and knowledge to solve online game puzzles.
KNU2	I can play online games efficiently by utilizing information and knowledge.
KNU3	Knowledge utilization is important to online game players.
Enjoyment (ENJ)	
ENJ1	Playing online games is exciting.
ENJ2	I enjoyed playing online games.
ENJ3	Playing online games gives me a lot of pleasure.
User Satisfaction (SAT)	
SAT1	I am satisfied with the story of the online game.
SAT2	I am satisfied with the quality of the online game.
SAT3	I am satisfied with the graphics of the online game.
SAT4	I am satisfied with the sound of the online game.
SAT5	I am satisfied with the length of the online game.
Perceived Usefulness (PUF)	
PUF1	Playing games at online game website enhances my skill of playing game.
PUF2	Online game website gives player a lot of useful information about online game.
PUF3	Online game website provides product with high value.
Perceived Ease of Use (PEU)	
PEU1	It is easy to use online game website.
PEU2	It is easy to learn how to play online game.
PEU3	The user interface of online game website is easy to follow.
Behavioral Intention to Use (BIU)	
BIU1	I will play online games frequently in the future.
BIU2	I intend to play online games.
BIU3	I will play online games for a long time.