Exploring Key Determinants of Gamer Behavior for Somatosensory Video Games: An Application of the Extended Technology Acceptance Model and Game Flow Theory

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Abstract

The rapid growth of the somatosensory video games (SVGs) market has successfully attracted more and more purchasers. In this study, we use Wii Sports games as a case to study an extended technology acceptance model (TAM), which integrates the factors of Game Flow theory to determine their relevance in the playing of the games. The proposed research model is tested empirically based on a sample of 442 gamers by using structural equation modeling (SEM). The research results demonstrate the effects of flow experience (including the factors of autonomy, challenge and social interaction) as being external variables critical to the gamers' behavioral intentions through perceived ease-of-use, perceived playfulness and attitudes toward play. This study may contribute to proposing a model predicting the gamers' intention to play SVGs and to providing valuable information regarding the design principles of SVGs and the game marketing strategies.
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Keywords: Technology acceptance model (TAM), Extended TAM, Game Flow theory, Somatosensory video games, Gamer behavior.

1. Introduction

With the rapid development of technology, the various kinds of contexts in which games are played have changed. There is a growing emergence of somatosensory video games (SVGs) that are being played as part of a person's daily life as a leisure activity. Nintendo launched Wii Sports in the USA and Japan in 2006 and it very quickly became a successful showpiece of software in 2007. Following on from that, the Wii Series was further developed and included Wii Fit, Wii Sports Resorts, and Wii Fit Plus. Even though Wii Sports has had a limited life span and has been criticized as being short on depth and visuals (Casamassina, 2006), it has brought about a new era of gaming, as reflected by a new way of interacting with the games and the players that offers a natural, intuitive and realistic feel (Davis, 2006). Furthermore, the game revolution has commenced from that time on. A couple of innovative SVGs such as Kinect for Xbox 360, PS3 and PS4 have been introduced into the market both continuously and rapidly, which has resulted in a family-centred media entertainment (Chambers, 2012). Recently, the SVGs for the mobile module (Samsung Smart TV F8000) have been developed for smartphone users. The rapid growth of the market has made the game industry highly profitable.

The market opportunities have driven an investigation into why the SVGs have been so popular. However, there are few studies that focus on to the reasons why players adoption certain games. By using Wii Sports as a case study, we contribute to the technology acceptance literature by examining the influential factors that determine the SVG players' behavioral intention and actual usage. Wii Sports can be viewed as a type of entertainment-oriented information technology (IT). Previous research has already demonstrated the validity of the technology acceptance model (TAM) (Davis, 1989) across a wide range of IT, including the hedonic context of information system such as online game (Hsu and Lu, 2004). The model verifies that the user's perception of usefulness and ease-of-use are the critical determinants for IT adoption. However, it is doubtful whether these two critical factors may reflect the motivation of SVG players who may mainly play games for fun and pleasure. Perceived playfulness (PP) has been found to be positively related to attitude toward using and perceived ease-of-use (PEOU) in the WWW context (Moon and Kim, 2001). Likewise, fantasy plays a crucial role in enhancing motivation in gameplay in particular (Choi, Huang, Jeffrey and Baek, 2013). Other antecedent variables, in particular flow theory, have been found to have an influence on the belief constructs (PEOU, perceived usefulness (PU), or PP) (e.g., Shang, Chen and Shen, 2005; Chang and Wang, 2008; Lee and Chen, 2010). Therefore, the TAM may need to be revised and extended for a better explanation and understanding of the usage behavior of SVG.

Based on the above reasoning, by adopting the multidimensional flow construct derived from Csikszentmihalyi (1975) as the external variables and integrating the constructs of PP, PEOU, attitude and the intention to use referred to in the extended TAM, this study is expected to propose an intention-based model to identify the cause and effect relationships between the relevant factors to enhance gamers' attitudes and intention to play. The research findings and implications may assist game developers in designing popular entertainment software or help venders make adjustments to their marketing strategies.

In the remainder of this paper, we begin by briefly introducing Wii Sports games. To achieve the aim of this study, we develop a conceptual model by previous research regarding WH tourism and backpackers' motivations. We then develop a conceptual model by identifying and integrating constructs from extant literature on TAM/extended TAM and GameFlow theory. Next, we present the results of validating/testing the model by empirical data. We conclude by discussing the implications of these findings for future research and application.

2. Wii Sports Games

Wii Sports games consist of 5 sports simulations (including tennis, baseball, bowling, golf and boxing), which have been designed to demonstrate the motion-sensing capabilities of the Wii Remote to new players. The game playing is computer controlled by players using the Wii Remote to mimic actions performed in real life sports. That is, the player's movements constitute the realistic motion control by the Wii while swinging the controller as if it were the tennis racket itself (Davis, 2006).

The feature of Wii Sports that is particularly worth noting is the ease of play (use) (Casamassina, 2006). Emphasis should be placed on its simplicity. Rather than featuring professional athletes or having realistic graphics, the game is designed to be simple so that anyone can play. The rules for each game are easy to understand and designed to make them more accessible to new players. The only thing which the player needs to do is to beat the scores and have fun participating. Each Wii Sports game features both the standard and training modes to allow players to practice certain aspects of the sports and monitor their progress. The basic mechanism remains the same throughout each level. As players improve, the challenge will be stretched to a higher level of difficulty in order for them to obtain higher scores. Their skill levels will increase and they will be able to see exactly how much better they have become as well.

Wii Sports is a popular device for social gatherings and competitions. The multiplayer mode usually allows two players to compete against each other or even play together. Its worldwide success contributes to providing a bonding experience among family members (Collins, 2007) as well as to serve as a means of exercise and weight-loss when played regularly (BBC News, 2007; Boyes, 2007). The games also have the additional charm due to the

integration of Mii characters whereby gamers can import a virtual version of themselves, their family members or friends into the game. Using their own Mii caricatures, gamers can play against others' Miis for a more personalized experience.

3. Theoretical Background and Research Model

3.1 TAM and the Extended TAM

Adapted from the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), the TAM assumes that beliefs about the information system influence attitudes, which in turn lead to intention, and then generate the actual usage of a system (Davis, 1989). Both theories assert that the influence of external variables on user behavior is mediated through user beliefs and attitudes. Beliefs refer to people's subjective assessments regarding performing a behavioral action with a specific consequence, whereas attitudes refer to people's positive or negative affective feelings toward exhibiting the behavior. Two important constructs regarding beliefs, PU and PEOU, have been introduced in the TAM to replace the attitudinal determinants in the TRA. Based on Davis (1989), PU is defined as "the degree to which a person believes that using a particular system would enhance his/her job performance," and PEOU refers to "the degree to which a person believes that using a particular system would be free of physical and mental effort". The TAM has been validated in numerous empirical studies to explain a substantial proportion of the variance in user behavioral intention and actual usage (King and He, 2006).

However, the TAM has been revised to incorporate additional variables for specific contexts. In a later study, Davis, Bagozzi and Warshaw (1992) introduce perceived enjoyment in the model as an intrinsic motivation and it results in a better explanation of the Internet usage. In addition, the IS literature shows that playfulness has stronger effects regarding the individual's acceptance of IT, for example, WWW usage (Moon and Kim, 2001), online game playing (Hsu and Lu, 2004) and e-learning continuance intention (Roca and Gagné, 2008). This extending variable has been regarded as an intrinsic motivation in these above-mentioned studies and has good prediction in activity engagement (Gagné and Deci, 2005). Hsu and Lu (2005) argued that PU in TAM should be replaced by perceived enjoyment to predict the online gamer behavior because PU can not reflect feelings of favorableness or unfavorableness toward gameplaying. Accordingly, instead of using PU, we propose PP to explain the Wii Sports gamers' continued behavioral intention in this study.

Furthermore, the belief constructs in the original TAM are subject to external variables. Some studies have empirically indicated that different external variables significantly affect PU and PEOU in specific IT contexts (e.g., Chang and Wang, 2008; Lee and Chen, 2010). By manipulating the external variables, the system developer may be able to better control users' beliefs regarding the system and their behavioral intention as well as the actual behavior (Shang, Chen and Shen, 2005). Flow experience has been introduced into the extended TAM and it has

shown the significant influence on PEOU, PU, or PP (Agarwal and Karahanna, 2000; Saadé and Bahli, 2005; Shang, Chen and Shen, 2005; Sun and Zhang, 2006; Chang and Wang, 2008). Therefore, in this study, flow experience during the course of playing Wii Sports will be examined in terms of its effectiveness as a motive for gamers.

3.2 Flow Theory and Game Flow Theory

Flow theory, which was introduced by Csikszentmihalyi (1975), has been regarded as one of the most frequently mentioned concepts among the discussions on game players' self-motivation and psychological status and a key criterion in determining a game's effectiveness (e.g., Fu, Su and Yu, 2009; Admiraal, Huizenga, Akkerman and Dama, 2011; Procci, Singer, Levy and Bowers, 2012). According to his definition, flow is considered to be the critical enjoyment and represents the holistic sensation that people feel when they act with total involvement. The definition suggests that flow consists of four components: control, attention, curiosity and intrinsic interest. In the flow state, individuals become absorbed in the activity in which they are engaged: their perception focuses on the activity itself, as they lose their self-consciousness, and feel in control of the environment. The concept has been applied in the context of sports and gaming (Csikszentmihalyi and LeFevre, 1989) and online consumer behavior (e.g., Novak, Hoffman and Yung, 2000; Koufaris, 2002; Hoffman and Novak, 2009). However, when considering game playing and multimedia operation within the Wii Sports environment, a game-specific construct is required in terms of flow experiences. GameFlow, which was developed by Sweetser and Wyeth (2005) and grounded in flow theory with additional heuristics on usability and user experience in computer games, has been mainly used to assess a player's level of game enjoyment (e.g., Inal and Cagiltay, 2007). It consists of a series of criteria, including immersion, clarity of goal, autonomy, feedback, concentration, challenge, skill and the additional factor of player interaction. An EGameFlow scale, which has been developed to measure the enjoyment offered by e-learning games (Fu, Su and Yu, 2009), may serve as the antecedents in explaining the Wii Sports gamers' experience.

3.3 Conceptual Model and Research Hypotheses

The model integrating the TAM and flow theory has been applied to examine how various factors influence the user acceptance of cyworld usage (Shin and Kim, 2008). In referring to the rationale, the conceptual model of this study is depicted in Figure 1. The research model has adopted the TAM belief-attitude-intention relationship so that the following TAM hypothesized relationships are proposed in the context of Wii Sports games:

H1: Perceived ease-of-use is positively related to gamers' attitudes toward playing SVGs.

H2: Attitude is positively related to gamers' intention to play SVGs.

Figure 1: Original Research Model
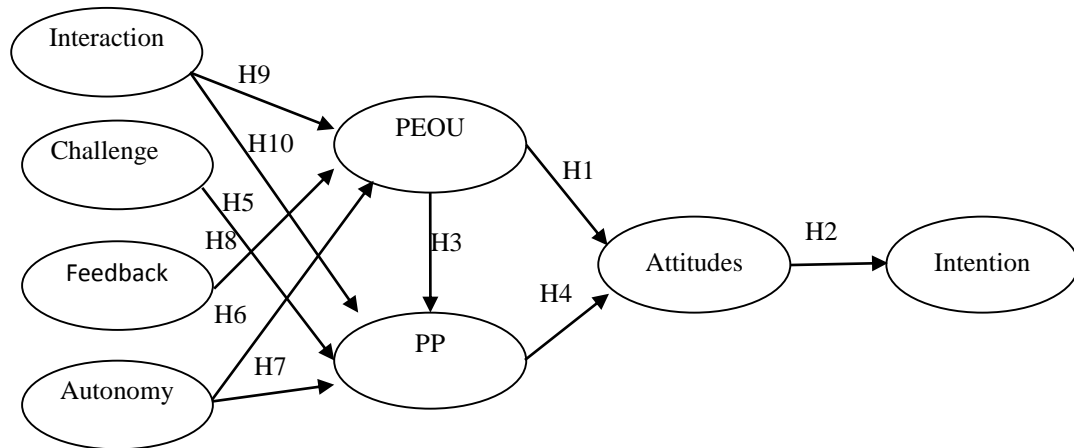
Prior research has studied the impact of PU or PEOU on perceived enjoyment, similar to perceived playfulness in our model. Heijden (2003) integrated perceived enjoyment with TAM to demonstrate that it influenced consumer attitudes and intentions toward personal website adoption. In the online game context, Lee and Tsai (2010) showed that PEOU has a significant effect on perceived enjoyment. It also found support for perceived enjoyment as a significant determinant of attitude toward playing online games (Lee, 2009; Lee and Tsai, 2010). Therefore, we hypothesize the following:

H3: Perceived ease-of-use is positively related to the perceived playfulness of Wii Sports games.

H4: Perceived playfulness is positively related to players' attitudes toward playing Wii Sports games.

Four components of EGameFlow, including challenge, autonomy (control), feedback and social interaction, have been proposed as the external variables of PEOU and PP in the current study. These constructs have been regarded as the important characteristics in playing games (e.g., Barendregt, Bekker, Bouwhuis and Baauw, 2006; Hamlen, 2011). They may exert significant direct effects jointly on PEOU and PP, which are the most critical antecedents of the intention to play games. The other four constructs of GameFlow are excluded as the antecedents, in considering the characteristics of Wii Sports games and the research findings of the past studies.

A good game should have the qualities of challenge and control (Malone and Lepper, 1987). Providing an adequate level of challenge has been viewed as a key reason why players experience flow from a particular game (Csikszentmihalyi, 1975). The gamers may feel bored or frustrated if their existing skills exceed or fall short of the challenge at hand (Lazzaro, 2004; Barendregt, Bekker, Bouwhuis and Baauw, 2006; Hamlen, 2011). The factor of autonomy

indicates that gamers feel a sense of control over their actions in the game (Weibel, Wissmath, Habegger, Steiner and Groner, 2008). The action should be adjusted according to the gamers' capabilities so that they may feel it is easy to play games and have fun (Hamlen, 2011). The above reasoning leads us to establish the following hypotheses:

H5: Challenge is positively related to gamers' perceived playfulness.

H6: Autonomy is positively related to gamers' perceived ease of use.

H7: Autonomy is positively related to gamers' perceived playfulness.

It has been found that interactivity is one of the drivers for children playing video games (Hamlen, 2011). Feedback may be viewed as a kind of interactivity in playing games that is given regarding the gamers' responses. There is clear information provided as to how gamers are doing in a Wii Sports game. The gamers' skill level can be improved by receiving appropriate feedback at the proper time. This will facilitate flow during the course of game playing to ensure that gamers maintain a high level of interest. Hence, the relationship is hypothesized as follows:

H8: Feedback is positively related to the gamers' perceived ease-of-use.

Based on Tiger (2000) and Rosas et al. (2003), a game's entertainment value, the engagement in a virtual reality, and sensory pleasures lead to gamers' unwitting involvement. Games often offer the chance to compete or cooperate with fellow players (Lazzaro, 2004). Besides, while acquiring the skills from the others, gamers enjoy game-playing and engage in pleasure derived from social interactions (e.g., Lim, Cha, Park, Lee and Kim, 2012; Cairns, Cox, Day, Martin and Perryman, 2013). The interaction processes not only spur on the gamers' competitive and cooperative instincts, but also stimulate further enjoyment. Thus, the following hypotheses are proposed:

H9: Social interaction is positively related to gamers' perceived ease of use.

H10: Social interaction is positively related to gamers' perceived playfulness.

4. Methodology

The questionnaire was developed from the literature. The scale items for PEOU, attitudes and the behavioral intention to play were developed from the study by Davis (1989), which has been validated in numerous studies. The scales were slightly modified to suit the context of Wii Sports games. The items for PP were selected from prior work by Moon and Kim (2001). Furthermore, the items regarding the EGameFlow experience were adapted from the measure defined by Fu, Su and Yu (2009). Each scale item was measured on a 7-point Likert scale, ranging from "disagree strongly" (1) to "agree strongly" (7). Besides, the basic information about respondent characteristics (including gender, age, education level, occupation, income level and marital status) and the usage of Wii Sports was collected as well.

Both the pre-test and the pilot test were undertaken to validate the instrument. The pre-test involved 15 respondents who were Wii Sports gamers. Respondents were asked to comment on the length of the instrument, the format and wording of the scales. After the pilot test that involved 50 respondents, the survey was conducted.

The research subjects in this study were SVG players, and in particular players of Wii Sports games. However, the samples were quite difficult to obtain from the market. The following parameters guided our sample selection. First we wanted our respondents to have played Wii Sports games in the 3 months prior to the date on which they were surveyed. Secondly, we wanted our respondents to be over 16 years old so that we could make sure the sample consisted of players responsible for their answers related to SVG playing. The respondents in this study were selected using the convenience sampling method through the assistance of friends of the second author in 13 cities and towns across Taiwan. The students at the places in which the friends worked were invited to participate in the data collection. The participants were restricted to those who owned Wii Sports games in their household. The questionnaires were carried back to their homes by the family member who met the criteria for the sampling selection to fill out the survey.

5. Results and Discussion

The survey yielded 442 usable responses in total. Three main statistical analyses were performed to analyze the collected data. We initially employed descriptive statistical analysis to summarize the characteristics of the respondents and the results for the relevant research variables. Table 1 presents the profiles of the sample regarding their principal socio-demographic and Wii Sports usage characteristics. Next, we used AMOS 18.0 software to analyze the measurement model, which contained an assessment of goodness of fit, convergent validity and discriminant validity. Finally, structural equation modeling (SEM) was applied to verify the goodness of fit of the research model and to describe the relationships among the construct variables.

Table 1: Profiles of the Respondents   (N=442)

Variables	Percentage	Variables	Percentage
Gender		Avg. monthly income	
Male	52.3%	Non	30.8%
Female	47.7%	NT$20,000 or below	12.0%
Age		NT$20,001-30,000	10.2%
17-19 years old	29.4%	NT$30,001-40,000	12.2%
25-29 years old	8.6%	NT$40,001-50,000	10.4%
30-34 years old	8.4%	NT$50,001-60,000	11.1%
35-39 years old	15.6%	NT$60,001-80,000	9.0%
40-49 years old	18.1%	NT$80,001 or above	4.3%
50 years old or above	1.2%	Occupation	
Marital status		Administration	9.2%
Single	51.6%	Engineering	7.2%

Married (with children)	42.8%	Education/Research	15.6%
Married (without children)	3.6%	Military/Public administration	5.9%
Other	2.0%	Business services	6.6%
Education		Professional /Personal services	7.2%
High school or below	44.0%	Housewife	5.2%
2-year college	11.8%	Retired/ Unemployed	1.1%
4-year college degree	30.8%	Student	33.5%
Graduate school	13.3%	Other	4.1%
Wii Sports usage experiences		Avg. time spent playing Wii Sports games	
A month or less	5.2%	15 minutes or less	7.0%
1-3 months	11.3%	16-30 minutes	22.6%
3-6 months	13.6%	31-45 minutes	19.7%
6-12 months	14.7%	46-60 minutes	18.6%
1-2 years	35.6%	1-2 hours	22.4%
2 years or above	19.7%	2 hours or above	9.7%
Gameplaying status			
Always alone	8.6%		
Mostly alone & sometimes having accompany	16.3%		
Half-and-half	14.9%		
Mostly having accompany & sometimes alone	28.7%		
Always having accompany	31.4%		

To assess the reliability and validity of the constructs, an eight-factor measurement model was assessed through confirmatory factor analysis (CFA). This measurement model revealed a good fit, with χ^2=592.61, χ^2/df=2.41, GFI=.90, AGFI=.87, NFI=.92, CFI=.95, and RMSEA=.057, according to the usual conventions (Hu and Bentler, 1999). Table 2 presents the measurement model estimation. The values of composite reliability (CR) were all clearly above .70 for all constructs, providing internal consistency. The values of AVE were in the 0.54-0.68 range, providing convergent validity. Table 3 provides an overview of the correlation coefficients matrix of the constructs under study. A comparison of AVE with squared multiple correlations showed AVE values exceeding correlations in all cases, thereby demonstrating discriminant validity for each individual construct (Fornell and Larker, 1981). Overall, the measurement model indicated that there was a high degree of reliability as well as convergent and discriminant validity.

Table 2: Measurement Model

Constructs	Scale items	Mean	SD	Factor loadings	t-value	CR	AVE
Social interaction	Interaction 1	5.76	1.08	.786		.840	.636
	Interaction 2	5.84	1.08	.826	17.41		
	Interaction 3	5.65	1.08	.781	16.07		
Challenge	Challenge 1	5.68	1.02	.739		.777	.539

	Challenge **2**	5.58	1.11	.685	13.63		
	Challenge **3**	5.62	1.08	.776	15.53		
Feedback	Feedback **1**	5.72	1.04	.790		.725	.569
	Feedback **2**	5.80	1.01	.718	15.57		
Autonomy	Control **1**	5.77	1.03	.790		.816	.597
	Control **2**	5.64	1.07	.781	17.43		
	Control 3	5.71	1.10	.748	16.60		
Perceived ease of use	PEOU **1**	5.46	1.18	.755		.881	.651
	PEOU **2**	5.67	1.14	.833	17.82		
	PEOU **3**	5.75	1.10	.840	17.99		
	PEOU **4**	5.61	1.15	.798	16.90		
Perceived playfulness	PP **1**	5.52	1.14	.861		.841	.640
	PP **2**	5.68	1.03	.843	21.29		
	PP **3**	5.86	0.98	.686	15.69		
Attitudes	ATT **1**	5.42	1.11	.815		.872	.630
	ATT **2**	5.59	1.00	.803	18.88		
	ATT **3**	5.43	1.11	.776	17.23		
	ATT **4**	5.63	1.10	.846	18.33		
Behavioral intention	BI **1**	5.57	1.06	.874		.865	.683
	BI **2**	5.61	1.11	.755	18.80		
	BI **3**	5.44	1.15	.857	22.52		

Table 3: Descriptive and Bivariate Correlations between Main Constructs and Square Roots of Average Variance Extracted

Constructs	SI	Challenge	Feedback	Autonomy	PEOU	PP	Attitudes	BI
SI	.806							
Challenge	.449	.734						
Feedback	.484	.516	.754					
Autonomy	.506	.535	.612	.773				
PEOU	.367	.458	.452	.617	.807			
PP	.466	.529	.434	.502	.564	.800		
Attitudes	.439	.511	.513	.503	.468	.741	.794	
BI	.434	.485	.443	.434	.399	.664	.765	.826

Diagonal elements are the square root of average variance extracted. These values should exceed the inter-construct correlations for adequate discriminant validity.

SI: Social interaction; PEOU: Perceived ease-of-use; PP: Perceived playfulness; BI: Behavioral intention

The structural model, which hypothesized the relationships among the variables, was estimated by employing structural equation modeling using AMOS. The goodness-of-fit

statistics indicated that the model fitted the data within an acceptable level (χ^2=446.1, χ^2/df=1.82, GFI=.93, AGFI=.90, NFI=.94, CFI=.97, RMSEA=.043). However, several anomalies including negative error variance (social interaction→PEOU with t-value = -3.620; autonomy → PP with t-value = -4.548) and an extremely large parameter estimate (feedback → PEOU with β = 1.015, greater than 1) were found to exist, and were likely to result in model specification errors or identification problems. A possible reason for explaining the phenomena may contribute to the scale items regarding EGameFlow being a second-order factor structure, instead of being specified as one level of factors that are mutually independent. That is, EGameFlow experiences may be viewed as a whole rather than in isolation.

Nevertheless, based on Bagozzi and Yi (1988), these three hypotheses (H7, H8 and H9) should be deleted from the proposed model. Confirmatory factor analysis was again conducted to test the remaining perspective hypotheses in the model. The new model is presented in Figure 2. The goodness-of-fit statistics (see Table 4) indicated that the model fitted the data within an acceptable level. Figure 2 also presents the results of the structural model and the standardized path coefficients between constructs. The model as a whole explained 67% of the variance in PEOU and 50% of the variance in PP. The explained variances in attitudes and behavioral intention were 63% and 83%, respectively.

Table 4: Hypotheses Testing for the Revised Model

Hypothesized path	Coefficient	t-value	Result
PEOU →Attitudes	0.297	4.486[a]	Supported
Attitudes → Behavioral intention	0.909	18.943[a]	Supported
PEOU → PP	0.419	4.718[a]	Supported
PP → Attitudes	0.699	11.045[a]	Supported
Challenge → PP	0.151	3.550[a]	Supported
Autonomy → PEOU	0.821	13.871[a]	Supported
Social interaction → PP	0.237	4.326[a]	Supported

χ^2=397.2, χ^2/df=1.94, GFI=.93, AGFI=.91, NFI=.94, IFI=.97, CFI=.97, RFI=.93, PNFI=.76, PGFI=.69, RMSEA=.041.
[a] $p < 0.001$

Figure 2: Hypotheses Testing Results of the Revised Model: Structural Equation Model
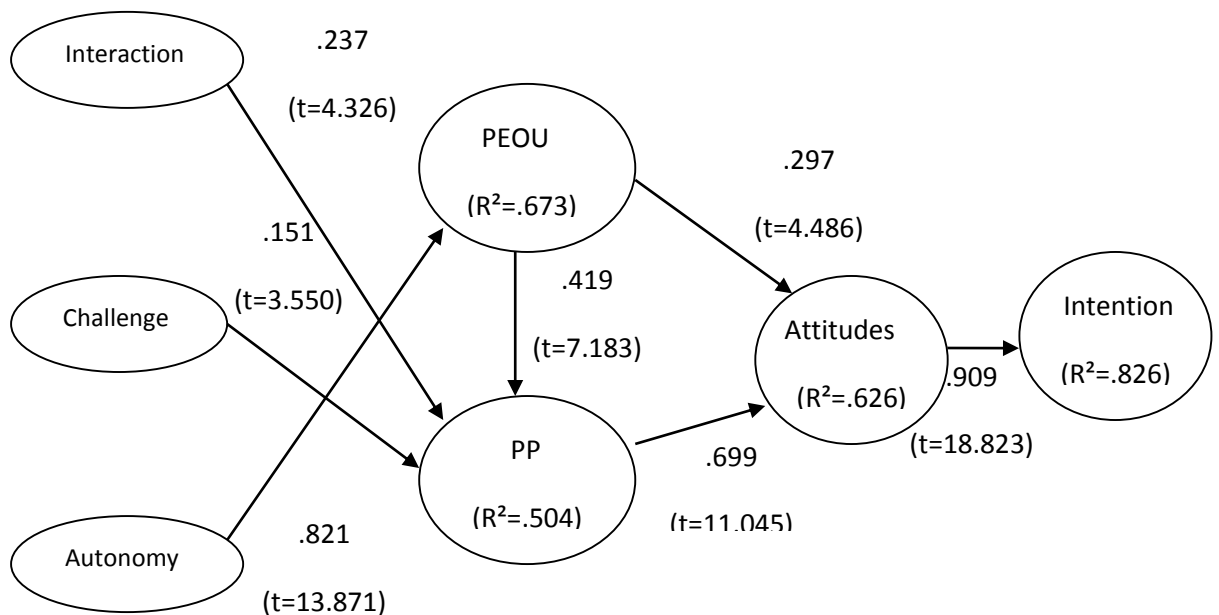
Within the model, the estimates of the structural coefficients provided the fundamental tests of the hypothesized causal relationships. As expected, PEOU had a positive effect on attitudes (β=0.297, P<0.001). Furthermore, the effect of players' attitudes on their intention to play games was strong, as shown by the path coefficient of 0.909 (P<0.001). PP was found to be a significant predictor of gamers' attitudes toward playing games by the path coefficient of 0.699 (P<0.001). Consistent with our expectations, PEOU was positively related to PP, as indicated by the path coefficient of 0.419. The hypothesis was supported at the 0.001 level of significance. In addition, PEOU had an indirect effect through attitude on the intention to play Wii Sports games (see Table 5).

Finally, as hypothesized, challenge was positively related to PP (γ=0.151) and also had an indirect effect on attitudes. In support of the related hypothesis, autonomy was positively related to PEOU (γ=0.821) and the indirect effect of PEOU on attitude was also significant (0.293). Finally, the estimate of social interactions was found to be positively related to PP (γ=0.237). This hypothesis was thus supported. The indirect effect of social interactions on gamers' attitudes was significant (0.166).

Table 5: Effects on Constructs

Independent construct	Dependent construct	Direct effects	Indirect effects	Total effects
Autonomy	PEOU	.821		.821
SI	PP	.237		.237
Challenge	PP	.151		.151
PEOU	PP	.419		.419
Autonomy	PP		.344	.344
SI	Attitudes		.166	.166
Challenge	Attitudes		.105	.105

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Autonomy	Attitudes		.484	.484
PEOU	Attitudes	.297	.293	.590
PP	Attitudes	.699		.699
SI	BI		.151	.151
Challenge	BI		.096	.096
Autonomy	BI		.440	.440
PEOU	BI		.536	.536
PP	BI		.635	.635
Attitudes	BI	.909		.909

We have assessed the impacts of gamers' perceptions and beliefs on Wii Sports, and have explored their intention to play by employing the TAM. Our major finding is that two beliefs (PEOU and PP) and attitudes are predictors of the gamers' behavioral intention to play games. Furthermore, PP has a more significant effect on gamers' attitudes than PEOU. This means that intrinsic motivational factors have a more powerful effect than extrinsic factors in forming positive attitudes toward SVGs. In other words, gamers tend to focus on fun and enjoyment when engaging in Wii Sports, rather than on their ease of use. The role of PP in this study corresponds to the findings reported in Roca and Gagné (2005). Our findings indicate that PEOU is a strong predictor of PP and the attitudes of gamers profoundly affect the intention to play. In line with the findings of Boyle, Connolly, Hainey and Boyle (2012), the psychological benefits gained from playing games, including being provided with a lot of enjoyment, becoming skillful at playing Wii Sports, and having the imagination aroused, have a positive impact on gamers' attitudes and intention. Furthermore, PP plays an important role in transferring PEOU and mediating the GameFlow effects on the SVG gamers' behavior.

On a theoretical front, this study extends the TAM using flow theory with entertainment-oriented IT. A finding that particularly deserves mentioning appears to be that the factors play critical roles in determining gamers' beliefs, and are consistent with the findings of Shang, Chen and Shen (2005) and Lee and Chen (2010). It indicates that gamers' flow experiences of challenge and autonomy in the Wii Sports game setting serve as significant determinants of the TAM's external variables. Increased levels of gamers' flow will lead to increased levels of PEOU and PP. Gamers' perceptions of the complexity of SVG are inversely related to the degree to which they feel involved. A sense of challenge and the social interactions among gamers contribute to the enjoyment in playing games. These research results also echo the opinions of some researchers in the guidance for game development (e.g., Barendregt, Bekker, Bouwhuis and Baauw, 2006; Wu, Wang and Tsai, 2010; Hamlen, 2011; Cairns, Cox, Day, Martin and Perryman, 2013).

6. Conclusions and Recommendations

This research extends and validates the TAM with EGameFlow factors affecting gamers' beliefs (PEOU and PP) in a SVG context and their intention to play. It contributes to

corresponding theoretical developments in explaining the gamers' behavior in Wii Sports. The research results also have significant implications for SVG designers and developers. They indicate that PP serves as an intrinsic motivational factor in an individual's acceptance of Wii Sports games. It is possible to increase PP by enhancing challenge in order to improve intrinsic motivation and influence the gamers' intention. The SVGs may include a set of achievable goals with optimal challenge. To enhance the fun experienced by playing games, the element of social gathering should lay emphasis on playing together and on competitions among players. Furthermore, the SVG should effectively provide the interfaces and screens to enable gamers to achieve autonomy in the game and thereby increase PEOU.

Although the findings of this study have meaningful implications for SVGs, the results should be treated with caution. First, gamers' flow may provide only transient information and may be embedded in a particular process. It could have been ignored or inaccurately reported by participants if their flow experiences had occurred sometime in the past. Thus, the self-reported data is not assured of validity in spite of its availability. To overcome such drawbacks, a field study is recommended to examine the gamers' flow and its effects in terms of data collection. Such a field study may be set up by a laboratory experiment with SVGs to record real-time information from subjects so that their psychological responses may be more accurately collected.

Secondly, the EGameFlow scale may not be an adequate assessment tool for SVG flow because the scale was designed to assess the construct in e-learning games. Facing a similar problem to that identified by Procci, Singer, Levy and Bowers (2012), our analysis indicated that the potential structure of this scale may include overlap and interaction applied in the SVG context. The interactions among the flow factors as well as their compound effects on SVG gamers' beliefs may be further examined. There may also be value in exploring other approach such as GEQ (Brockmyer, Fox, Curtiss, McBroom, Burkhart, Pidruzny, 2009) to determine how other tool can be used to identify flow factors in SVGs. On the other hand, the development of a game-specific flow scale for SVGs to measure the gaming experiences may need substantially more work for researchers in the future.

Although this study illustrates a sophisticated modelling technique used to examine links between different aspects of engagement in SVGs, as Boyle, Connolly, Hainey and Boyle (2012) have suggested, experimental studies of motivational aspects for playing games would help to provide more rigorous findings of gamer behavior. The qualitative research looking at gamers' experiences would add detail to our understanding of engagement in SVGs. Finally, the proposed model in this study may be replicated using other sampling scales to seek the validity and generalization of the research results. Future research could be conducted to compare the gamers' belief constructs by means of a longitudinal assessment.

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