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Impact of intangibility on perceived risk associated with online games

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Online computer gaming is growing at a rapid pace. However, this phenomenon is stigmatised by many negative connotations. This study investigated the influence of intangibility on perceived risks (social, time, financial, physical, performance and psychology) among online gamers. The self-completed market survey questionnaire employs the Intangibility and Perceived Risk scales. Data were gathered in Taipei city, the biggest metropolitan area in Taiwan. Both public (1018) and online (400) voluntary interviews were conducted. The collected data were analysed with a structural equation model. There is a significant positive relationship between intangibility and all dimensions of perceived risk. The findings have managerial implications and future research is suggested.

Keywords: online gaming; online game; intangibility; perceived risk

1. Introduction

In the past decade, with intensified market competition and the emergence of the world wide web (WWW), the context of the channel system has changed (Cheng *et al*. 2007), leading to the rapid growth of the Internet-based simulated environment or virtual world (Teo 2002, Wu *et al*. 2008, Huang *et al*. 2009). Despite the economic downturn in the Internet and information and communications technology (ICT) sectors, electronic business, though a new form of online exchange is the medium in which most transactions occur among entities unknown to each other (Belkhamza and Wafa 2009). By quicker and broader expansion of online service delivery, institutions can increase net benefits to stakeholders (Johnson 2007). Most importantly, the e-business, the virtual world created by computer systems, is generating telepresence, enjoyment, immersion and distance participation (Jakala and Pekkola 2007).

Based on participation rate, price insensitivity and future potential, online gaming as an e-business is the most popular entertainment application in the virtual world (Lu and Wang 2008). This finding is supported by the fact that over 450,000 users play online computer games in Taiwan during peak hours (Wang *et al*. 2008, Chen *et al*. 2009). Further evidence indicates that online gamers display a high psychological rather than technical attachment to playing (Lu and Wang 2008, Lee 2009). Online computer gaming in Taiwan is growing at a rapid pace (Chen *et al*. 2009).

However, this phenomenon is stigmatised by many negative connotations (Brian and Wiemer-Hastings 2005, Chuang 2006, Cole and Griffiths 2007, Liu and Peng 2009). Risks identified with online game use are psychological dependency (Caplan 2002), physical problems such as fatigue due to prolonged exposure, reduction in offline contact with people (Liu and Peng 2009), preference for a virtual life with other online gamers rather than face-to-face communication (Caplan 2005), offline social control skills problems, loneliness, depression and deficient online gaming self-regulation (Liu and Peng 2009).

Approximately 55% of the players reported that they had problem and were highly dissatisfied (Lu and Wang 2008, Kim and Kim 2010). This factor influences players' risk perception. This finding is inconsistent with the generally accepted view that customers' acceptance is the key to satisfaction. This contradiction between popularity and risk perception (Lu and Wang 2008) deserves further empirical examination. Understanding the reasons informs practical strategy. Previous research argued that popularity is artificially increased by an interesting story which encourages gamers to explore the game, continuously return to the virtual world and see the end of in-game characters (Pearce 2003, Wu *et al*. 2008). In addition, players tend to immerse themselves in online games in which their

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fantasies are indulged and sense of curiosity aroused (Ryan 2001). However, for this leisure industry with immersion characteristics, previous research is scant regarding player risk. The factors that will influence online game risks and what the risk category players will perceive are investigated in this study to fill in the research gap.

Risk perception is one of the most important determinants of online purchasing behaviour (Noort *et al*. 2008). Libermann and Stashevsky (2002) affirmed that perceived risk is a potential barrier to internet and e-commerce usage, particularly to users who consider expanding use. Understanding consumers' perceived risk perspective not only helps understand their behaviour, but also has important marketing strategy implications. By understanding the factors that cause individuals to perceive risks, marketers can develop pertinent strategies to decrease the risks and hence improve purchase likelihood. Extensive research has indicated that intangibility is one of the main influences on perceived risk (Finn 1985, Murray and Schlater 1990, Zeithaml and Bitner 2000, Laroche *et al*. 2003, 2004). In comparison to goods, the lack of information and perceptions of variability, inseparability and perishability render services decisions more risky (Bebko 2000, Eggert 2006). Services are generally intangible, sold without guarantees and require experience before they can be assessed (Cunningham *et al*. 2005). Therefore, intangibility of services may lower consumer confidence and increase perceived risk (Mitchell 1999). Research also indicated that intangibility is the main characteristic of services that generate a higher degree of uncertainty, hence increasing risk for services (Murray and Schlacter 1990, Eggert 2006). In an online environment, intangibility concerns such as privacy, security, assurance and trust are also likely to cause perceived risks (Miyazaki and Fernandez 2001, Zeithaml *et al*. 2002, Laroche *et al*. 2003, 2004). Online gaming, one form of online services, is riskier because of the inherent intangibility (e.g. website trust, privacy and virtual currency security concerns) associated with it, and therefore, also warrants further empirical investigation. Regarding the scope of the study, an extensive literature review identified limited empirical studies on the relationship implications of the online gaming industry. In this study, an effort is made to investigate these issues.

The major objective of this research is to investigate the impact of intangibility on six dimensions of perceived risk in online games in the context of e-commerce research to fill the knowledge gap. The remainder of the article is organised as follows: section 2 provides a review of related literature on intangibility and perceived risk and the development of the research hypotheses; section 3 shows the research methodology; section 4 presents data analysis and results; and lastly, section 5 offers a conclusion with suggestions for future research.

2. Literature review and conceptual framework

2.1. Intangibility

Intangibility is one of the distinctive characteristics of service (Santos 2002), referring to the total lack of perception of the service prior to consumption (Eggert 2006). The Oxford Dictionary of Current English (1996) defines intangibility as something that cannot be touched or seen, precisely assessed, defined or grasped mentally.

In a recent article, Laroche *et al*. (2001) suggested that the construct 'intangibility' comprises three dimensions: physical, mental and generality. Physical intangibility can be understood as the lack of physical evidence or 'impalpable' and 'not corporeal' (Shostack 1977). It represents the extent to which a product is untouchable and immaterial, having no physical body. Mental intangibility refers to the lack of a clear and mentally tangible representation of a particular good or service. This decreases as experience and familiarity with the evaluated product increase (Eggert 2006). Generality refers to how consumers generally perceive a product, and is expressed as the consumer's difficulty to precisely describe or define a service (Laroche *et al*. 2004). Three dimensional Intangibility scales are used in this study.

2.2. Perceived risk

Perceived risk has two components: uncertainty (the likelihood of unfavourable outcomes) and consequences (the importance of a loss) (Bauer 1960). Previous studies (Fraedrich and Ferrell 1992, Liao *et al*. 2010) revealed that individuals perceive risk in situations where the outcomes are uncertain and are concerned with the consequences of a bad decision. Literature recognised that perceived risk was a significant explanatory factor that influences consumer behaviour (Mitchell 1992, Dowling and Staelin 1994, Eggert 2006). Bauer (1960) initiated the notion that consumer behaviour was influenced by their perception and the relativity of various types of risk. Extant literature and empirical evidence indicate that a relationship exists between consumers' risk perception and evaluation and purchasing behaviour (Dowling and Staelin 1994, Link and Marxt 2004, Johnson *et al*. 2008, Aldás-Manzano *et al*. 2009). Consumers seek out cues from the online environment to minimise loss while making an online purchase (Chang and Chen 2008). The perceived risk, which is associated with

online transactions, may diminish perceptions of behavioural and environmental control, and this shortage of control is apt to negatively influence e-commerce usage (Pavlou 2003).

Risk perceptions occur on a multidimensional construct, reflecting a person's perception of the risk inherent in purchasing products in a specific product category (Dowling and Staelin 1994, Forsythe *et al.* 2006). Researchers identified six prevalent dimensions of perceived risk: social, time/convenience, financial, physical, performance/functional and psychological (e.g. Stone and Grønhaug 1993, Liebermann and Stahevsky 2002, Forsythe *et al.* 2006). This research adapts the definition of perceived risk dimension provided by Murray and Schlacter (1990) and Schiffman and Kanuk (1997). Social risk is defined as the potential loss of respect, esteem and/or friendship offered to the consumer by other individuals (Murray and Schlacter 1990). Time risk is the combined perception of lost time and effort spent purchasing any product or service should the product not perform to expectations (Roselius 1971, Murray and Schlacter 1990). Financial risk captures the unworthiness of a product's cost associated with its purchase (Murray and Schlacter 1990). Physical risk is the perception that the products will be harmful (Murray and Schlacter 1990). Performance risk describes the product's failure to fulfil its function as anticipated (Murray and Schlacter 1990). Psychological risk reflects the perception that a bad purchase will bruise self-image or self-concept, leading to frustration, disappointment, worry and regret (Murray and Schlacter 1990). The six-dimensional risk perception scale is used in this study.

2.3. *The relationship between intangibility and perceived risk*

Based on the literature review, the objective of this study is to explore the relationship between intangibility and perceived risk in the context of online gaming services. This study aggregated three dimensions from the intangibility scale by Laroche *et al.* (2001) and the dimensions of perceived risk from Stone and Grønhaug (1993) to investigate the relationship between intangibility and perceived risks. The conceptual framework of this research is postulated in Figure 1. Theoretical perspectives supporting the hypothesised linkages are discussed below.

Previous literature mainly ascribed the low level of trust in online environments (because of internet intangibility) to low adoption rates rather than to any other factor with the exception of relative advantage (Gefen *et al.* 2003, Laroche *et al.* 2004). The abovementioned statement is supported by prior

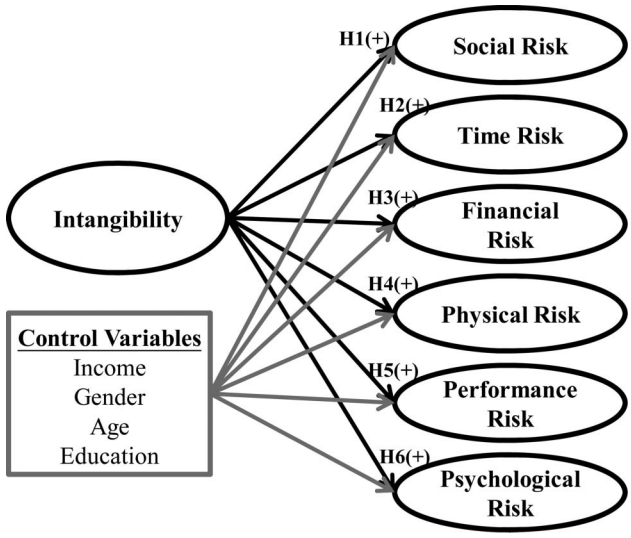

Figure 1. A conceptual framework of the effects of intangibility on perceived risk.

empirical findings that demonstrated that intangibility is positively related to perceived risk (Bobbit and Dabholkar 2001, Laroche *et al.* 2003, 2004, Eggert 2006). Since most online services contain a high amount of intangible attributes, intangibility increases consumer perception of risk more so than in other channels (Bobbit and Dabholkar 2001, Eggert 2006). This conclusion can be confirmed in the online gaming industry.

Social risk may occur when players are concerned with negative comments from relatives or friends who do not comprehend the consequences of playing online games. Furthermore, evidence indicates that mental intangibility has a significant positive effect on social risk while purchasing (Laroche *et al.* 2004). Therefore, based on the preceding discussion, the following hypothesis is proposed:

> H1: Intangibility is positively associated with social risk for online game services.

Online gamers are afraid of the potential time wasted to understand online game characteristics, given the lack of information. The above statement was supported by prior empirical findings that demonstrated that mental intangibility and generality had a significantly positive effect on time risk of service (Laroche *et al.* 2004). Furthermore, mental intangibility had a significantly positive effect on time risk of brands and product categories (Laroche *et al.* 2010). Therefore, based on the preceding discussion, the second hypothesis is proposed:

> H2: Intangibility is positively associated with time risk for online game services.

Financial risk may occur when online gamers fear misappropriation of their accounts (credit card, virtual money/treasure). This is supported by online consumers who fear that online companies may misuse their credit card information to make illegal purchases for which they would be liable (Bobbit and Dabholkar 2001). Therefore, based on the preceding discussion, a third hypothesis is proposed:

H3: Intangibility is positively associated with financial risk for online game services.

Physical risk may occur when no clear operational instructions are provided. For example, without clear operational instructions, physical damage to eyes or wrists may occur. The evidence for the relationship between intangibility and physical risk is supported by Murray and Schlacter (1990), who suggested that a lack of tangible evidence in services offered through stores may cause a heightened perception of physical risk. Therefore, based on the preceding discussion, a fourth hypothesis is proposed:

H4: Intangibility is positively associated with physical risk for online game services.

Perceived performance risk mainly originates from the asymmetry of the information and arouses doubts on service effectiveness and reliability (Yang and Zhang 2009). Internet users frequently cited their difficulty in judging quality (a product performance risk) as the main reason for not purchasing online (Forsythe and Shi 2003). Performance risk may occur when players' expectations are not realised because they are unable to correctly judge quality online. The abovementioned statement is supported by prior empirical findings that demonstrated that the intangibility of mobile services makes participants feel it is difficult to measure performance (Yang and Zhang 2009). Therefore, based on the preceding discussion, the fifth hypothesis is proposed:

H5: Intangibility is positively associated with performance risk for online game services.

Psychological risk is defined as a feeling of disappointment due to poor product selection. With the Internet's intangible nature, psychological risk remains a challenge in comparison to the customer experience in traditional retail stores (Griffin and Viehland 2010). Therefore, psychological risk may occur because a user believes that websites can capture personal information (Bobbit and Dabholkar 2001) or does not know the entity nor what they can really achieve from online gaming. Based on the above discussion, this study proposes a sixth hypothesis:

H6: Intangibility is positively associated with psychological risk for online game services.

3. Research methodology

3.1. Research instruments

Modifications to research construct measures developed from previous literature were made to facilitate the current research.

The Intangibility Scale was adapted from the scale by Laroche *et al.* (2001) and used its three sub-measurement tables (physical, mental intangibility and generality). Each sub-measurement comprises three items to measure its specific intangibility separately. This scale, which demonstrated strong reliability and validity, was modified to adequately provide a measurement standard for determining online gaming intangibility.

Perceived risk was measured using the scales by Stone and Grønhaug (1993). This research selected the 18-item measures that were extensively validated by prior studies (Sterm *et al.* 1977, Laroche *et al.* 2004) and modified these to create a measurement standard to determine risk perception. A 7-point Likert scale in each case was used, where 1 denoted 'strongly disagree' and 7 represented 'strongly agree'.

3.2. Questionnaire design and pre-testing

A draft questionnaire was designed based on the aforementioned scales to examine the respondents' perceptions of intangibility and risk perception. The multi-item questionnaire was used as the data collection instrument, and the levels of Intangibility and perceived risk were specified.

Before distributing the questionnaires, the researcher conducted a pre-test on 30 users in Taipei, Taiwan. This was to test the validity of the instrument concerning readability and logical arrangement of the questions. Participants suggested removing two of the Intangibility Scale items (one from physical intangibility and the other from mental intangibility) and one from the physical risk items that were either confusing or redundant. The clarity and completeness of the modified questionnaire was strengthened by incorporating all noted comments. The items in the final analysis are shown in Appendix.

3.3. Sample and data collection

Street survey interviews were conducted in Taipei City, the biggest metropolitan area in Taiwan, and combined with online questionnaire feedback. Two

completely different surveys were employed to collect the completed data. The online questionnaires' respondents are potential online gamers, and the face-to-face interview respondents are possible light gamers or non-gamers.

Taipei is a densely populated city of approximately 2.6 million people with many migrants from other parts of Taiwan. This demographic approximates the full population spectrum, and hence is a suitable proxy for Taiwanese perception. Thus, the people in Taipei were considered qualified research subjects and, thus, were chosen to represent the target population in the current research. People who entered the railway station and MRT, and those who were surfing websites were voluntarily requested to participate in this research. In the public interview, only willing participants were solicited. Interviewers answered queries from the participants. Participants were asked to read the questionnaire instructions carefully and confirm that they understood online gaming.

The 104 Survey Company, which owns a professional survey database in Taiwan, collected the online questionnaires. Sample members who were willing to participate clicked through the URL address. A total of 1418 useful questionnaires (1018 public and 400 online) were collected for final data analysis.

3.4. Data analysis method

The data were analysed after obtaining the survey data results to verify the research goal. With the LISREL statistical analysis software, survey structure and reliability were analysed and composite reliabilities (CR) were produced. The value of CR is directly proportional to the reliability. The validity of the researcher's dimensions and measurement items were checked as follows: factor loadings were checked for convergent scale validity, and the average variance extracted (AVE) was checked for discriminant validity. This was followed by relationship verification between online gaming intangibility and risk perception. A structural equation model (SEM) was used to test the conceptual framework and the moderating effects of gender. Finally, a group of socio-demographic control variables are included (income, age, gender, level of education) to test the impact of the presence of other significant variables on perceived risks.

4. Data analysis and results

4.1. Respondents' profiles

Approximately 58% of the respondents were male and 42% were females, with most being less than 25 years of age. Approximately 63.1% held a college/university degree or above. Approximately 64.4% had a job. Approximately 27.9% earned total monthly incomes of 15,001 TWD to 30,000 TWD. Most of them were single. Finally, more than 80% had online gaming experience, indicating the popularity of this industry. Detailed descriptive statistics relating to the respondents' profiles are shown in Table 1.

4.2. Accuracy of the information

Table 2 reports the means and standard deviations for three intangibility dimension scales and scale correlations. A confirmatory factor analysis (CFA) was conducted to lend support to the accuracy of the scales in an intangibility context.

The criteria for the CFA are considered a good fit when GFI, CFI, IFI and NFI are greater than 0.90, the

Table 1. Descriptive statistics of the participants' profiles.

	Freq.	%
Gender		
Male	822	58
Female	596	42
Age		
13–18 (adolescence)	159	11.2
19–25	617	43.5
26–35	390	27.5
36–45	194	13.7
>=46	58	4.1
Education		
<=Junior high school	97	6.9
Senior high school	426	30
>=College/university	895	63.1
Occupation		
Non-student (jobholder)	913	64.4
Students	505	35.6
Income		
<=TWD$5000	338	23.8
TWD$5001–10,000	187	13.2
TWD$10,001–15,000	154	10.9
TWD$15,001–30,000	396	27.9
TWD$30,001–45,000	240	16.9
>=TWD$45,001	103	7.3
Marriage		
Unmarried	1081	76.2
Married	337	23.8
Usage		
Non-user	275	19.4
User	1143	80.6

Note: TWD 1 = USD 0.03.

Table 2. Mean, SD and correlation matrix of intangibility.

Intangibility dimensions	Mean	SD	1	2	3
1. Physical intangibility	2.94	1.64	1.00		
2. Mental intangibility	3.37	1.53	0.26	1.00	
3. Generality	3.57	1.44	0.46	0.35	1.00

Chi-square/df is smaller than 5, RMSEA is less than 0.8, and SRMR <0.05 (Hair *et al*. 2006). The CFA model had an overall Chi-square/df of 3.29, a GFI of 0.99, CFI of 0.99, an IFI of 0.99, an NFI of 0.99, an RMSEA of 0.04 and an SRMR of 0.02. An acceptable fit was achieved with a negligible impact on the substantive content of the affected dimensions. CR and AVE for each dimension were good (Table 3). Since the types of intangibility involved in an online purchase are often intuitive, one construct measure of intangibility appeared to be sufficient. For subsequent measurement model evaluation, this research aggregated the Intangibility Scale to three indicators (i.e. physical intangibility, mental intangibility and generality) by summing the measurement items at the first-order construct level.

After conducting a CFA for the intangibility dimensions, this research conducted a second-order CFA (intangibility was the second-order factor with three first-order factors, physical intangibility, mental intangibility and generality) to assess whether these three constructs were an adequate reflection of a single higher-order construct. Simultaneously, a CFA was conducted on the perceived risk measurement model to validate the internal and external consistencies among the factors.

Table 4 reports the mean and standard deviations for research scales and scale correlations of intangibility and perceived risks. Individual scale items and test summaries related to research scale accuracy, i.e. reliability and validity are shown in Table 5.

The CFA model had an overall Chi-square/df of 4.85, a GFI of 0.95, CFI of 0.97, an IFI of 0.97, an NFI of 0.97, an SRMR of 0.049 and an RMSEA of 0.053. All these were above the threshold recommended by the literature (Hair *et al*. 2006). Thus, the fit of the model is good. All the CR, ranging from 0.6041 to 0.8481 (Table 5), exceeded the minimum threshold of 0.6 (Bagozzi and Yi 1988).

The test of convergent scale validity was executed by examining significant *t*-value factor loadings. Table 5 shows significant *t*-values, ranging from 12.69 to 37.01. This study also assessed the AVE following the process recommended by Fornell and Larcker (1981). Though the AVE of intangibility is a little low, each latent factor AVE value exceeded squared correlations between each of the latent factors. This indicates that all discriminant validity indicators fell within acceptable ranges. Research scales conclusively captured distinct components. The estimates of CR and AVE demonstrate that the scales are generally reliable and valid.

Based on the acceptable results of a CFA, the three-item scale was aggregated into a single measure for social risk, time risk, financial risk, performance risk and psychological risk, respectively. The two-item scale was aggregated into a single measure for physical risk. The three-dimensional scale was aggregated into a single measure for intangibility.

Table 3. Measurement accuracy analysis statistics (Improved Second-Order Intangibility Scale).

Core constructs	Measurements	Factor loading	*t*-value	CR value	AVE
Physical intangibility	PHYS-INT1	0.71***	23.44	0.8475	0.7405
	PHYS-INT2	0.99***	29.76		
Mental intangibility	MENT-INT1	0.88***	22.30	0.7942	0.6603
	MENT-INT2	0.74***	20.49		
Generality	GENERAL1	0.81***	34.29	0.8537	0.6607
	GENERAL2	0.79***	33.47		
	GENERAL3	0.84***	36.10		
CFA model fits		Absolute-Fit measures GFI = 0.99, CFI = 0.99, RMSEA = 0.04 Incremental-Fit measures AGFI = 0.98, NFI = 0.99, IFI = 0.99			

Notes: ***$p < 0.001$.

Table 4. Mean, SD and correlation matrix of intangibility and perceived risk.

Research constructs	Mean	SD	1	2	3	4	5	6	7
1. Intangibility	3.30	1.11	1						
2. Social risk	3.19	1.39	0.216	1					
3. Time risk	4.33	1.49	0.223	0.408	1				
4. Financial risk	4.25	1.49	0.210	0.313	0.555	1			
5. Physical risk	5.05	1.44	0.045	0.043	0.429	0.454	1		
6. Performance risk	4.44	1.28	0.001	0.233	0.538	0.521	0.512	1	
7. Psychological risk	3.65	1.46	0.306	0.439	0.446	0.382	0.293	0.429	1

4.3. Hypotheses testing

The conceptual framework of Figure 1 is simultaneously estimated in a SEM using LISREL to test the research hypotheses constructed. SEM is the preferred method of analysis compared to other methodologies (e.g. regression) since it allows the analysis of multiple relationships simultaneously, providing the relationships between the construct and other constructs tested without the bias that measurement error introduces (Boshoff 2006, Stock *et al.* 2010). The fit indices (CFI = 0.95, IFI = 0.95, NFI = 0.94, GFI = 0.91, RMSEA = 0.073) reveal that the final structural model is good because it reproduces the population covariance structure with an acceptable discrepancy between the observed and predicted covariance matrices.

Table 6 shows the results of the hypothesis testing. Consistent with H1, the results indicate that intangibility has a highly significant positive and direct impact on social risk ($\gamma = 0.46$, $p < 0.05$). Similarly, as predicted by H2, the perception of intangibility has a significantly positive impact on time risk ($\gamma = 0.77$, $p < 0.05$). As expected, both H3 and H4 are also confirmed. A highly significant direct impact was found regarding the effects of intangibility on financial risk ($\gamma = 0.71$, $p < 0.05$) and physical risk ($\gamma = 0.56$, $p < 0.05$). H5 and H6, relating to the positive direct impact of intangibility on performance risk ($\gamma = 0.69$, $p < 0.05$) and psychological risk ($\gamma = 0.62$, $p < 0.05$), are confirmed. In summation, the findings show that all the six predicted direct relationships are significant at the 0.05 level. Thus, all the research hypotheses were supported. Table 6 also shows the moderating effects of gender. Strong relationships are found between intangibility and perceived risks for the female group.

Table 5. Measurement accuracy analysis statistics.

Core constructs	Measurements	Factor loading	*t*-value	CR value	AVE
Intangibility	Physical intangibility	0.52***	15.06	0.6041	0.3222
	Mental intangibility	0.42***	12.69		
	Generality	0.72***	18.38		
Social risk	SOC-RISK1	0.85***	34.72	0.7966	0.5752
	SOC-RISK2	0.84***	34.32		
	SOC-RISK3	0.54***	20.34		
Time risk	TIM-RISK1	0.80***	33.56	0.8239	0.6118
	TIM-RISK2	0.86***	37.28		
	TIM-RISK3	0.67***	26.64		
Financial risk	FIN-RISK1	0.71***	28.13	0.8049	0.5804
	FIN-RISK2	0.84***	34.62		
	FIN-RISK3	0.73***	29.27		
Physical risk	PHY-RISK1	0.77***	27.22	0.7714	0.6280
	PHY-RISK2	0.81***	28.49		
Performance risk	PER-RISK1	0.73***	29.01	0.7875	0.5548
	PER-RISK2	0.83***	33.92		
	PER-RISK3	0.66***	25.53		
Psychological risk	PSY-RISK1	0.77***	32.27	0.8481	0.6509
	PSY-RISK2	0.85***	37.01		
	PSY-RISK3	0.79***	33.55		
CFA model fits	Absolute-Fit measures GFI = 0.95, CFI = 0.97, RMSEA = 0.053 Incremental-Fit measures AGFI = 0.93, NFI = 0.97, IFI = 0.97				

Notes: Significance levels: ***$p < 0.001$.

Table 6. Structural equation modelling results and comparison of the groups based on gender.

		Group comparisons			
		Path coefficients			
Causal paths	Total sample path coefficients	Male	Female	*t*-value	*p*-value
Intangibility → social risk	0.46**	0.42^{+}	0.51**	−0.619	0.536
Intangibility → time risk	0.77**	0.75^{+}	0.80**	−0.202	0.840
Intangibility → financial risk	0.71**	0.70^{+}	0.74**	−0.196	0.845
Intangibility → physical risk	0.56**	0.64^{+}	0.46**	0.978	0.328
Intangibility → performance risk	0.69**	0.70^{+}	0.67**	0.160	0.873
Intangibility → psychological risk	0.62**	0.60^{+}	0.64**	−0.220	0.826

Notes: $^{+}p < 0.1$, **$p < 0.01$.

Table 7. Socio-demographic variables' effect on perceived risk.

Dependent variables	Independent variables	Standardised path coefficient	*t*-value	*p*-value
Social risk	Income	−0.071	−2.308	0.021*
	Gender	0.046	1.755	0.080
	Age	0.088	2.858	0.004**
	Education	0.105	3.958	0.000***
Time risk	Income	0.037	1.215	0.224
	Gender	0.001	0.041	0.967
	Age	0.088	2.896	0.004**
	Education	0.154	5.877	0.000***
Financial risk	Income	−0.056	−1.816	0.070
	Gender	0.022	0.853	0.394
	Age	0.054	1.773	0.077
	Education	0.155	5.870	0.000***
Physical risk	Income	0.045	1.476	0.140
	Gender	−0.005	−0.194	0.846
	Age	−0.022	−0.711	0.477
	Education	0.089	3.331	0.001***
Performance risk	Income	0.000	0.013	0.990
	Gender	0.013	0.500	0.617
	Age	0.006	0.200	0.842
	Education	0.144	5.443	0.000***
Psychological risk	Income	0.001	0.036	0.972
	Gender	0.006	0.238	0.812
	Age	0.069	2.230	0.026*
	Education	0.065	2.421	0.016*

Notes: Significance levels: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

For the male group, weak relationships between intangibility and perceived risks are found. The procedure by Keil *et al*. (2000) to test the moderating effects of gender was adapted. The *t*-test does not indicate a significant difference between the male and female groups.

Finally, certain control variables significantly influence dependent variables (Table 7), specifically age and education. One possible reason for this result may be that senior and highly educated gamers are rational in decision making and this influences perceived risk.

5. Conclusion

5.1. Discussion

Building on the extensive literature on the intangibility-perceived risk paradigm (e.g. Bobbit and Dabholkar 2001, Laroche *et al*. 2003, 2004, Eggert 2006), this study provides evidence supporting the assertion that online games' intangible cues have significantly strong and direct effects on all of the perceived-risk dimensions (social, time, financial, physical, performance and psychological risks) (Table 6). Research data were collected from a solid platform (in the biggest metropolitan area, Taipei, Taiwan) and virtual environments (online questionnaire feedback). The research results are consistent with the study propositions. Therefore, electronic environmental intangibility appears to be an important contributor to online game players' risk perception.

5.2. Theoretical implications

The intangibility-perceived risk model has a strong relationship in the online game environment. This evidence suggests a theoretical foundation for identifying and categorising electronic game intangible elements, which might influence online game patronage. Intangibility has a major impact on risk while playing online games, whereas an elevated perception or risk in the online environment is triggered by consumer concerns regarding their privacy, assurance, trust, the security of their purchases and the security of the system. The finding also indicates that the players' ability to assess risk perception accurately describes the major determinant of risk perception dimensions as intangibility. The finding leads to the strategy of creating strong presentations and specific definitions of the product to enhance the tangible attribute of services (Mittal 2002, Laroche *et al*. 2004). These important findings could open new research avenues for rigorous online game element design, leading to theoretically based tangible design principles.

5.3. Managerial implications

This study provides numerous implications for online game design practitioners. The conceptual framework helps to identify the process that generates risk perception of online gamers. The results of online games' intangible effects are shown in Table 6. Strong expositions and specific definitions of online gaming are important to make online game services more tangible. Practitioners may require determining and focusing on intangibility elements that connect well with or are similar to their other service offerings, and successively attempt to add physical cues to enhance the tangibility of online gaming.

Therefore, online game firms should dedicate more resources to ambient online game design to lead online surfers to the current website location and guide their navigation within the website to decrease the perception of physical intangibility. Moreover, critical website features such as drop-down menus, buttons, page labels and site-maps must be easy to read, clear and located where they can direct and teach surfers how to use online game services with ease. Regarding mental intangibility and generality, practitioners must pay attention to critical website design that includes orderly presentation of information that directs navigational flow in such a manner that intangibility is reduced. Providing information

from objective/neutral media and advertising with visual and vivid pictures of online game firms' performance are useful strategies to increase the tangibility and lower the social risk (Mittal 1999, Laroche *et al*. 2004).

Finally, the online game marketers should design free trial games to enable consumers to capture the experience and increase their trust, thus decreasing intangibility. In addition, online game marketers should design free family type massively multiplayer online role playing games (MMORPGs) to increase the relatives' or friends' comprehension and mitigate social risk (Steinkuehler and Williams 2006, Charlton and Danforth, 2009, Koo 2009); short-term cheap games to mitigate time risk and financial risk (Chen 2010); free trial games to mitigate performance risk; games with time reminders to prevent harm to the wrists and eyes and mitigate the physical risk; and games with information systems security (ISS) to lower psychological risk.

5.4. Future research

Despite the encouraging results of this study regarding the positive effects of online games' intangible cues on online game players' risk perception, further research is necessary in a number of areas. A three-dimensional scale was aggregated into a single measure for intangibility in this study. Future research could investigate the influence of the multidimensional intangibility constructs individually. This study selected online gaming as the service. There are more existing intangible products, the so-called information products, which also deserve further empirical examination. Validation failure suggests the existence of research moderators, such as types of games, and that the involvement of online gaming should be considered for further research on the moderating effects on the proposed conceptual model.

Prior studies tended to adopt the Perceived Risk model independently as the foundation of analysis or as a tool for extensive analysis; however, the Intangibility-risk model has not been generally applied to academic research. Therefore, future research may validate the research model within other geographic areas, such as in other cities and countries, or by testing other product types/product categories using other distinct samples for generalisability of the findings. The potential for future research appears promising.

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Appendix. Questionnaire items

Intangibility

Physical intangibility

PHYS-INT1: Online gaming is very easy to see and touch. (R)
PHYS-INT2: I can physically grasp online gaming. (R)

Mental intangibility

MENT-INT1: It is not difficult to give a precise description of online gaming. (R)
MENT-INT2: It is easy to describe many features related to online gaming. (R)

Generality

GENERAL1: I need more information about online gaming in order to make myself a clear idea of what it is.
GENERAL2: Online gaming is a difficult service to think about.
GENERAL3: Online gaming is not the sort of service that is easy to picture.

Perceived risk

Social risk

SOC-RISK1: If I play online games, I would be viewed negatively by my peers.
SOC-RISK2: Playing online game causes me to be thought of as foolish by some people whose opinion I value.
SOC-RISK3: I will be incompatible with my friends if they do not also play online games.

Time risk

TIM-RISK1: Playing online games could lead to inefficient use of my time.
TIM-RISK2: Playing online games could involve important time losses.
TIM-RISK3: The demands on my schedule are such that playing online games concerns me because it could create even more time pressures on me that I do not need.

Financial risk

FIN-RISK1: If I play online games within the next 12 months, I would be concerned that the financial investment I would make would not be wise.
FIN-RISK2: Playing online games could involve significant financial losses.
FIN-RISK3: If I play online games within the next 12 months, I would be concerned that I would not receive my money's worth.

Physical risk

PHY-RISK1: One concern I have about playing online games within the next 12 months is that eye strain for some members of the family could result, due to overuse of the computer.
PHY-RISK2: Playing online games within the next 12 months leads to concerns about whether the activity could lead to some uncomfortable physical side effects, such as poor sleep, backaches, etc.

Performance risk

PER-RISK1: If I were to play online games within the next 12 months, I would become

concerned that online games will not provide the level of benefits that I would expect.

PER-RISK2: As I consider online game playing, I worry about whether it will really 'perform' as well as it is supposed to.

PER-RISK3: The thought of playing online games causes me to be concerned about how reliable the service will be.

Psychological risk

PSY-RISK1: The thought of playing online games gives me a feeling of unwanted anxiety.

PSY-RISK2: The thought of playing online games makes me feel psychologically uncomfortable.

PSY-RISK3: The thought of playing online games causes me to experience unnecessary tension.