MODELING GAME USAGE, PURCHASE AND PERCEIVED COMPLEXITY

ABSTRACT

Existing theory posits that perceived complexity is an important driver of the usage and purchase of computer games. However, there is no empirical evidence to support this proposition. Therefore, this research models the relationship between the consumer's game purchase and usage behavior and perceived complexity. In, 2009, 493 consumers in New Zealand responded face-to-face to complete a structured questionnaire. The analysis tested the conceptual model with confirmatory factors analysis (CFA) and structural equation modeling (SEM). The modeling tested game usage and purchase across 4 competing model types: (1) the original model (all games) and alternative models: (2) Sports/Simulation/Driving, (3) Role Playing Game (RPG)/Massively Multiplayer Online Role-Playing Game (MMORPG)/Strategy and (4) Action/Adventure/Fighting. In our confirmatory factor analysis and structural equation modeling, all of our models had adequate fit with the exception of the original model. Our path coefficients concluded that the complexity of a game does not impact usage and/or purchase behavior. The only exception related to complexity and game usage for Action/Adventure/Fighting games. Research implications are discussed.

INTRODUCTION

Existing theory proposes that consumers will use and purchase games that are easy to use and are less complex, that is, the

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perceived difficulty and/or barriers to playing the game are lower (Tao et al., 2012; Grammenos et al., 2009). This hypothesis is based on the argument that the consumer “believes that using a particular system would be free of effort” (Venkatesh et al., 2003; Vijayasarathy, 2004; Gentry and Calantone, 2002; Davis, 1989, pg. 320) and that they can manipulate the controls of the game to experience a higher level of interactivity (Davis and Sajtos, 2008). However, there is no evidence to support this proposition in the consumers’ consumption of games.

Therefore, this research models the relationship between the consumers’ game purchase and usage behavior and, perceived complexity (Prugsamatz, Lowe and Alpert, 2010; Molesworth, 2006). This research is important for two reasons. First, games are an important form of entertainment (Grammenos et al., 2009; Stenbacka 2008; Boyle and Hibberd, 2005). According to the Entertainment Software Association in the U.S.A, computer and video game software and hard sales generated $US 24.75 billion in 2011 and sixty-seven percent of households play games. Total sales have surpassed those of the US box-office (Khan, 2002; Guth, 2003). Comparatively, in the United Kingdom the interactive entertainment industry in the UK grew by 7.5% between 2009 and 2012 (UKIE, 2011).

Second, apart from its economic contribution, we also examine the importance of computer gaming to academic research (Tychsen et al., 2008b). Historically, game research has been treated as a subcategory, for example, of films, digital texts and interactive media. Conceptual models have tended to be oriented around research based on games that lacked graphical richness and realism: limited to exploration in design and psychological interaction (Choi, et al., 2004; Juul, 2001). The apparent weakness of these studies is in their conceptual base, that is, there tends to be no agreed definition regarding ‘what a game is’ and ‘why people engage in the game’ (Kücklich, 2003; Woods, 2003; Aarseth, 2003; Eskelinen, 2001; Frasca, 1999).

More recently, game research has become more important in consumer behavior. Most of the research to date measures the effect of advertising within a game on the consumer (Prugsamatz, Lowe and Alpert, 2010; Molesworth, 2006). For example, Schneider and Cornwell (2005), Mackay et al., (2009), Cauberghe and De Pelsmacker (2010), and others (Chaney, Lin and Chaney, 2004; Nelson, Keum and Yaros, 2004; Winkler and Buckner, 2006; Yang et al., 2006; Mau, Silberer and Constien, 2008). Nicovich (2005) extended this measure to include consumer involvement, while others have explored avatar-based advertising (Jin and Bolebruch, 2009). Our major criticism of this work is that they do not help marketer or developer understand what motivates consumers to use and buy games and/or seek to understand deeper cognitive issues.

In relevant games research we reveal that the central question about why consumers engage in games is still not well understood (Boyle et al., 2012). However, some researchers such as Connolly et al., (2012) and Boyle et al., (2011) have taken the position that the benefits of games often play an important role in usage and purchase. They posit that constructs such as perceived complexity will effect knowledge acquisition and content understanding.

In understanding motivation, a lot of attention recently has been placed on enjoyment and the flow experience (Procci et al., 2012; Jegers, 2009; Cowley et al., 2008). These studies espouse the importance of concentration, challenge and immersion. However, they fail to acknowledge mediating variables such as ease of use and perceived complexity (Theng et al., 2011). For example, to achieve the state of emersion and the experience of effortless involvement in the game, the consumer should perceive low barriers to playing the game. This research has only focused on hedonic motivation, ignoring the importance of utilitarian consumption. Other researchers have also suggested that player motivation goes beyond flow and is a function of deeper psychogenic needs (Bostan, 2009).

A key issue with understanding the interaction between complexity and motivation leading to usage and purchase is the inherent flexibility and adaptive qualities of games and their consumers. For example, the variability arises from the adaptive ability of non-player characters (NPCs) (Hartley et al., 2009), avatars (Tychsen et al., 2008a; Tychsen et al., 2008b) and culture and usability issue (Zaharias and Papargyris, 2009). This challenge has been recognized by some model developers who seek universally accessible games. They propose that a game is like a mold: it fits seamlessly to the consumer (Grammenos et al., 2009).

While these perspectives are valuable for our understanding, fundamental questions about the consumers' perceptions of complexity and its relationship to game purchase and game usage have not been answered ((Davis and Lang, 2012; 2011a; 2011b),. Therefore, our research question is:

> What is the relationship between perceived complexity, purchase and usage?

We model these two relationships (use and purchase) in the context of 4 game groups (Prensky, 2005) based on Myers (1990): (1) all games representing our original model and then the alternative competing models, (2) Sports/Simulation/Driving, (3) Role Playing Game (RPG)/Massively Multiplayer Online Role-Playing Game (MMORPG)/Strategy and, (4) Action/Adventure/Fighting. This approach is consistent with Apperly (2006).

The contribution of this research is important as fundamental questions about perceived complexity and game purchase and usage behavior have not been answered. The traditional view would suggest that complexity would have a negative relationship with game purchase and use. In the gaming context there is no empirical evidence of this proposition. The results have implications for game designers in the design of co-creation processes and possible virtual worlds. For marketers: a better understanding of what consumers' value in terms of perceived complexity may enhance brand recall, awareness and game-self congruity (Cummins, 2002).

This paper is organized as follows. First, the conceptual model is developed with hypotheses. We then describe the methodology and our results which details a 2 stage process of model development and analysis. The paper concludes with a discussion of the importance of perceived complexity and subsequent managerial and research implications.

CONCEPTUAL MODEL

We define a game as play within a digital medium over a screen-based platform that provides feedback and response (Davis and Lang, 2012). Ultimately, game and gamer co-create another world of experience: between imagination and reality (Jessen, 1999). Experience is consumed in this world to form an outcome that is unique to the immediate situation (Ong, 2004). The nature of this experience is variable in process and outcome and may include; narratives and interactive texts (Juul, 2001; Ryan, 2001; Aarseth, 1997), experiences and simulations (Newman, 2004; Manninen, 2003; Aarseth, 2003), cultural artifacts (Prensky, 2001) and technological drivers (Woods, 2003; Bushnell, 1996; Aarseth, 2003).

From the consumption perspective, games are an experience that varies with the users and their level of interaction. Both with the game and other game players (Chen, 2009; Holbrook and Hirschman, 1982). A game has an explicit structure that defines how it should be played, yet it is open to interpretation and experimentation (Davis and Lang, 2011a). The functional and recreational desires of the immediate user are embodied in the game experience: hedonic and utilitarian experience will help to assess the game's value from the consumer's perspective, and the estimation of value may drive use and purchase behavior.

In one-way as a subjective experience, a game is composed of semi-structured interactions (Choi et al., 2004) and the choice to interact is propelled by the consumers' hedonic need (Eber, 2001). This enforces the concept brought forward by Mortensen (2002) and

Fromme (2003) that the attraction of the game depends on the subjective interpretation and desire of the users, as well as their social context and self-concept (Ong, 2004). In contrast, Walther (2003) defines a game as framed of actions and the act of 'organized play' (Ong, 2004) with an end state (Gottschalk, 1995). There are defined constraints, motivations and outcomes. This view argues that a game is not an uninhibited exploration (Walther, 2003).

In this study we will focus on the game experience as rational thought based upon functional benefits (Ong, 2004; Batra and Athola, 1990) and decision making that is logical (Holbrook and Gardner, 1998). Perceived complexity plays an important role in this objective experience as it measures the perceived difficulty and/or barriers to playing the game (Igbaria et al., 1996; Thompson et al., 1991). This includes both the internal process of learning the game rules and the external elements, such as the physical usability of the videogame interface (i.e. input controls) (Ong, 2004; Te'eni 1989). It "reflects perceptions of internal and external constraints on behavior and encompasses self-efficacy, resource facilitating conditions, and technology facilitating conditions" (Venkatesh et al., 2003, pg. 454). Given that the game experience is highly dependent on the level of interactivity generated by the user (Davis and Sajtos, 2008), the user must be able to manipulate the controls of the game with sufficient ease and be able to learn the simulation rules in order to meet their goal-oriented outcomes (Ong, 2004).

In recent years games have become increasingly more complex, dynamic and virtual (Merrick, 2008; Prensky, 2005). The evolution of games in this way has been largely driven by the desire of the gamer for higher and higher levels of perceived complexity. Therefore, complexity is an important measure of the gamer's optimal experience because it supports adaptable game play (Te'eni, 1989). Recent work has also show that perceived complexity is also more important in an offline context compared to online (Francisco-Jose et al., 2012)

Therefore, across our four game categories it is hypothesized that:

H1u: Perceived complexity has a positive relationship with game usage

H1p: Perceived complexity has a positive relationship with game purchase.

METHOD

493 complete responses were collected face to face from consumers in Auckland, New Zealand (Davis and Lang, 2011a). A random sampling method was applied. All consumers were asked to participate when randomly intercepted by the interviewer. Data collectors were rotated around 4 geographically disparate locations In Auckland; east, west, south, and north. Respondents who agreed to participate were screened with two questions to ensure that they were regular gamers and that they played games purchased from a retail outlet or online that were not preloaded on a computer such as Solitaire (Davis and Lang, 2011b). The sample characteristics are show in Table 1 and are generally consistent with the recent research by INZ (2010) on the New Zealand gaming consumer market (N = 1958) (Davis and Lang, 2012).

TABLE 1. SAMPLE CHARACTERISTICS (N=493)

VARIABLE	CATEGORIES	PERCENT OF SAMPLE
GENDER	MALE	82.2
	FEMALE	17.8
AGE	≤ 10	0.4
	11-15	4.3
	16-20	40.2
	21-25	37.1
	≥ 26	18.1
ETHNICITY	NZ PAKEHA	29.4
	MAORI	7.5
	PACIFIC ISLANDER	6.5
	ASIAN	38.5
	EUROPEAN	9.9
	OTHERS	8.1
MARITAL STATUS	SINGLE	77.3
	WIDOWED	0.2

	LIVING WITH PARTNER	13.8
	MARRIED	7.3
	DIVORCED/SEPARATED	1.4
EDUCATION	NON-DEGREE	66.1
	DEGREE	33.9
EMPLOYMENT	STUDENT	47.7
	FULL TIME	25.4
	SELF-EMPLOYED	4.9
	UNEMPLOYED	4.3
	HOMEMAKER	0.4
	PART-TIME	6.7
	STUDENT/PART-TIME	10.8
ANNUAL INCOME	< 10,000	47.5
	10,000-20,000	16.6
	20,001-30,000	7.5
	30,001-40,000	11.4
	40,001-50,000	9.5
	50,001-60,000	3.2
	60,001-80,000	2.4
	≥ 80,000	1.8

The questionnaire was designed to measure multi-item constructs. Throughout the whole questionnaire, a seven-point scale was used to measure the constructs of interest (1 = “Strongly Disagree”, 7 = “Strongly Agree”). To operationalize for perceived complexity we used Venkatesh et al.’s (2003) and Vijayasarathy (2004) analysis of user experiences with online shopping websites.

ANALYSIS

The analysis tested the proposed conceptual model with confirmatory factors analysis (CFA) and structural equation modeling (SEM) (Davis and Lang, 2011a; Anderson and Gerbing, 1988).

CONFIRMATORY FACTOR ANALYSIS

In accordance with Kline (1998) a two-step modeling procedure was adopted. First, the individual constructs that underlie the full structural equation model were analyzed. Initial data screening was done for missing values, outliers and the normality of the dataset was tested. Only 7 responses were removed because they contained incomplete responses. We used a combination of PASW Statistics 18, AMOS 18 (Airbuckle, 2009) and Microsoft Excel 2007 software packages to carry out the analyses. We examined all scale items and reverse-coded when applicable to reflect the hypothesized directions. Before a CFA was conducted the KMO (Kaiser-Mayer-Olkin) value was measured to estimate the overall goodness-of-fit (KMO=.78; sig=0.00). KMO values between 0.7 and 0.8 are considered acceptable (Hutcheson & Sofroniou, pp. 224-225). This indicates that a confirmatory factor analysis is appropriate for this data set. KMO values for individual variables were also examined. The individual KMO values are in the range of 0.6 to 0.8, which is above the minimum of 0.5. We also conducted a Bartlett's test to test for multivariate normal distribution and this was significant ($p<0.001$). Our kurtosis values were also under the required minimum value.

Convergent and discriminant validity of the constructs were tested using the confirmatory factor analysis that combined all constructs concurrently (Davis and Lang, 2012). Construct refinement was enabled by an analysis of covariance residuals and modification indices and exclusion of items until the goodness-of-fit was achieved. Composite reliability is an indicator of the shared variance among the set of observed variables used as indicators of a latent construct (Kandemir et al 2006; Bacon et al 1995). The construct reliability was 0.85, well above the recommended value. In addition, the coefficient alpha value was 0.84, above the threshold value of 0.7 that Nunnally (1978) recommends. Moreover, the average variance extracted (AVE) value was 0.66. It reflects the average communality for each latent factor and is used to establish convergent validity. The AVE value is above the threshold value of 0.5 (Chin, 1998; Höck & Ringle, 2006: 15, Fornell & Lacker, 1981). Initially all of the 6 items under perceived complexity were used as indicators. After assessing fit and path estimates and loadings only three (PX2, PX3 and PX4) were included in perceived complexity (game usage and purchase). The number of indicator for the complexity construct was in line with extant literature (Hair et al. 2009).

TABLE 2 MODEL FIT

	GAME GROUP	X_2	DF	X_2 / DF RATIO	P	CFI	TLI	GFI	RMSEA	SRMR
GAME USAGE	SPORTS SIMULATION DRIVING	16.79	8	2.10	0.03	0.99	0.98	0.99	0.05	0.03
GAME PURCHASE	SPORTS SIMULATION DRIVING	20.60	8	2.56	0.01	0.99	0.98	0.99	0.06	0.03
GAME USAGE	RPG MMORPG STRATEGY	23.52	8	2.94	0.00	0.98	0.96	0.99	0.06	0.04
GAME PURCHASE	RPG MMORPG STRATEGY	17.44	8	2.18	0.03	0.99	0.98	0.99	0.05	0.03
GAME USAGE	ACTION ADVENTURE FIGHTING	15.08	8	1.89	0.06	0.99	0.99	0.99	0.04	0.03
GAME PURCHASE	ACTION ADVENTURE FIGHTING	6.98	8	0.87	0.54	1.000	1.002	0.995	0.000	0.02
GAME USAGE	ORIGINAL	363.76	53	6.86	0.00	0.79	0.74	0.89	0.109	0.083
GAME PURCHASE	ORIGINAL	412.26	53	7.80	0.00	0.826	0.783	0.870	0.118	0.076

TABLE 3 PATH COEFFICIENTS

GAME GROUP	INDICATOR		CONSTRUCT	STANDARDIZED LOADING	S.E.	T-VALUE	P	HYPOTHESIS	CONCLUSION
SPORTS SIMULATION DRIVING	GAME USAGE	←	COMPLEXITY GU	0.01	0.50	.21	0.84	H_{1U}	NOT SUPPORTED
	GAME PURCHASE		COMPLEXITY GP	0.06	0.06	1.10	0.28	H_{1P}	NOT SUPPORTED
RPG MMORPG STRATEGY	GAME USAGE		COMPLEXITY GU	0.01	0.06	.14	0.89	H_{1U}	NOT SUPPORTED
	GAME PURCHASE		COMPLEXITY GP	0.09	0.07	1.57	0.12	H_{1P}	NOT SUPPORTED
ACTION ADVENTURE FIGHTING	GAME USAGE		COMPLEXITY GU	-0.13	0.06	-2.31	0.02	H_{1U}	SUPPORTED
	GAME PURCHASE		COMPLEXITY GP	-0.06	0.06	-1.10	0.27	H_{1P}	NOT SUPPORTED
ORIGINAL MODEL	GAME USAGE		COMPLEXITY GU	-0.08	0.04	-1.39	0.16	H_{1U}	NOT SUPPORTED
	GAME PURCHASE		COMPLEXITY GP	.001	0.05	.16	0.87	H_{1P}	NOT SUPPORTED

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STRUCTURAL EQUATION MODELING (SEM)

There are four forms of this model (Davis and Lang, 2011b):

1. The original model includes all the game types.
2. The alternative models focus on each game category, namely (1) Sports, Simulation and Driving; (2) RPG, MMORPG and Strategy and (3) Action, Adventure and Fighting.

The results of the SEM are displayed in Table 2 and 3. The following measures were used to assess the model fit: Goodness-of-Fit Indices, chi-squared (X2), degrees of freedom (d.f.), the comparative fit index (CFI) and normalized fit index (NFI) (Baumgartner and Homburg, 1996). For CFI and NFI values close to 1 are acceptable (Bentler, 1990). The root mean squared error of approximation (RMSEA) (Hu & Bentler, 1995): according to Bentler (1990) values below 0.08 indicate close fit. The standardized RMR (SRMR): Bentler (1990) argues that a model is regarded as having an acceptable fit if the SRMR is less than 0.10 (Browne and Cudek, 1993). Across all game types with the exception of the original model (all game types), our model indices, that is, GFI, CFI, TLI, RMSEA, SRMR and X2/DF, all reveal adequate model fit in the relationship between ease of use and game usage as well as purchase.

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DISCUSSION

In our analysis process all of our models were accepted with the exception of the original model. Our path coefficients concluded that the perceived complexity of a game does not impact usage and/or purchase behavior. The exception being: the relationship between complexity and game usage for Action/Adventure/Fighting games. This showed a significant negative path coefficient.

It is interesting that out of the 6 items under complexity only 3 were included in the final model, that is, complexity in terms: (1) playing a game is complicated and it is difficult to understand what is going on, (2) when playing a game, it is hard to understand and (3) it takes too long to learn how to play this game to make it worth the effort. We would have expected that at least these core items would have promoted usage and encouraged purchase of games that allowed consumers to experience the cognitive value of complexity. By experiencing complexity it would seem logical to assume that it would enhance the consumer's ability to interact with the game and reduce the perceived and actual barriers to interaction. Our results suggest that to positively impact usage and purchase, a computer game should be complex.

These findings support as well as challenge the work of Dellaert and Stremersch (2005) and Creusen, Veryzer and Schoormans (2010) and others (Merrick, 2008; Prensky, 2005; Te'eni, 1999). For example, Dellaert and Stremersch (2005) concluded that overall, complexity lowers product utility. However, for consumers that are more expert, complexity has less impact on product utility. A somewhat similar effect was found by Trulillo et al, (2010) in that higher product knowledge led to lower complexity expectations in consumers. Therefore, a competent gamer may not consider complexity to be an important contributing factor in their purchase and usage decisions (D'Astous and

Guevremont, 2007). This may be partly caused by expert gamers' ability to interact with and master complex games, thus reducing their perception of the games complexity. In other words, complexity is game-specific as well as an individual difference variable. The more experienced gamers are, the less likely they are to notice the high complexity of certain games due to their extensive exposure to similar games. This process may be self-reinforcing, with gamers starting out with generally less complex games from which they migrate to games that are increasingly complex to play and to master. Complexity in this sense may stretch across a number of dimensions, such as the number of objectives to be solved, the difficulty of each challenge, or the number of characters to interact with. In this sense, some gamers may be willingly or unwillingly "chasing complexity" to be able to satisfy their continuously growing ability to handle to complex games.

We posit that consumers do not value the experience of complexity when gaming as a functional benefit of the product or service. In one instance, complexity may have a negative relationship with the products use. For action, adventure and fighting games which place emphasis on simulations of futuristic and historical warfare and/or violent activity. To experience the instantaneous value of the fight, games should not be overly complex. In contrast, Mano and Oliver (1993) suggest a consumer need for the game experience is not correlated with its technical value. Addis and Holbrook (2001) argue that this type of consumption is rational decision making or consumption by rules (Kahn and Wansinks, 2004). The aim is to meet a desired end-state (Babin et al., 1994).

However, we question that to experience a high level of interactivity with the game (Davis and Sajtos, 2008), whether the consumer values learning rules and how to operate the game controls. With the generic nature of game hardware and software controls, it is suggested that complexity is no longer important to a consumer's optimal experience. This suggests that in the context of gaming in general, complexity is not seen by the consumer as a barrier to playing the game (Igbaria et al., 1996; Thompson et al., 1991). Possibly, the internal process of learning the game rules and the external elements are seen as a key and positive part of the consumption experience of the game (Carù and Cova, 2003), thus challenging the dominate view espoused by Venkatesh et al., (2003, pg. 454).

Our findings are supported by Frasca (1999) and others (Prensky, 2001). Consumers play games to experience the pleasure of physical or mental activity which has no defined objective. Online and in the living room, play is often about the unplanned experience of the game with others. While games do have formal rules with a predefined end state of winning or losing, it is argued that gaming is focused on experiencing the progression of time and space. We argue that if complexity was valued by the consumer then it could disrupt their experience of the interactive story (Woods, 2003) which is co-created and discovered (Eskelinen, 2001). With consumers increasingly playing games collectively, the experience of the co-created is even more important.

Finally, it is argued that hedonic experience maybe more important in the users game experience. Perceived complexity is a rational argument but it is the work of future studies to measure the importance in contrast to subjectivity and emotion (Addis and Holbrook, 2001). This work would follow the traditions of the entertainment form in consumption; fun and play (Firat and Venkatesh, 1995; Holbrook and Hirschman, 1982).

LIMITATIONS

The main limitations of our research are as follows:

1. The study is based only on a New Zealand sample. While such samples are well accepted in international journals and conferences

on gaming and other aspects of consumer behavior (Davis and Lang, 2011a) we caution against ‘blind’ generalizability. Further replication work and extension is required.

2. Some researchers may argue against our game groupings. It would have been possible to research games at an individual level. However, such a detailed analysis would have significantly affected our ability to engage in a CFA/SEM modeling process. We argue that when compared to all games: our game groupings are supported by the literature (Davis and Lang, 2012).
3. Our analysis did not compare online vs. online game behavior. This is an important area of future research and our analysis of this data-set may take account of this model. As Francisco-Jose et al., (2012) notes; perceived complexity is different online compared to offline.
4. Our sample is biased towards males. We argue that when generally quantifying the gaming market it often includes more males than females. US market statistics from the Entertainment Software Association showed that in 2008 sixty percent of all game players are men. Similar results are shown for the New Zealand market (INZ, 2010). We encourage future work to focus primarily on gendered-behavior rather than binary comparisons of biological sex-type.

FUTURE RESEARCH

Future work may replicate the study of Creusen, Veryzer and Schoormans (2010) into the effect of visual complexity on consumption value. As they argue, the findings will have direct implications for product development. We also advise that this study be extended to other samples, for example, comparing perceived complexity and game usage/purchase between Asia, Europe and the USA. The extension, replication work may also include the collection of qualitative evidence to help explain how complexity impacts the gamer’s cognitive response.

We advise work include other utilitarian components of consumer experience.

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