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MODELLING USE CONTINUANCE IN VIRTUAL WORLDS: THE CASE OF SECOND LIFE

Abstract

There are now many virtual worlds in existence, a number of which have built considerable user bases. However, there is little empirical evidence to suggest what factors underpin their continued usage and success. This study set about determining why users continue to use virtual worlds, using the example of the popular virtual world of Second Life. The study adopts continuance theory and extensions to the basic model to examine the effects of enjoyment, habit and absorption. The results (n=339) suggest that continuance intention is driven by perceived usefulness, habit, absorption and enjoyment, which together provide a comprehensive explanation for virtual world behaviour (R^2=0.565). Interestingly, satisfaction did not appear to play a direct strong role in determining intentions. The paper rounds off with conclusions and implications for future research and practice in this very new area of inquiry.

Keywords: virtual world; continuance; enjoyment; absorption; habit; Second Life.

1   INTRODUCTION

The notion of a 'virtual world' is a relatively novel phenomenon that emerged from the juxtaposition of recent advancements in computer graphics, online gaming and social networking technologies. A 'virtual world' may be defined as "an electronic environment that visually mimics complex physical spaces, where people can interact with each other and with virtual objects, and where people are represented by animated characters" (Bainbridge 2007, p. 472). Such ideas were, until relatively recently, restricted to rather crude graphical representations and enabled limited interactivity. However, virtual worlds have become very sophisticated and increasingly realistic – often integrating advanced 3-D rendering, in-world currencies, avatar and object customization and development, property ownership and permissions, text and voice communication, and social networking tools – and the number of virtual worlds has increased dramatically in the last five years. Gartner (2007) predict that 80 per cent of active Internet users will be members of at least one virtual world by 2012.

If we restrict our discussion to virtual worlds that are not purely massively multiplayer online games (Barnes & Mattsson 2008), i.e. they have a freeform element, then there were around 70 virtual worlds in existence or under development as of the third quarter of 2008 (KZero 2008a). : 23 worlds aimed at the under 10s (the largest being Poptropica with 20 million users and Barbie Girls with 15 million), 14 aimed at the pre-teens (the largest being Habbo with 100 million users, Neopets with 45 million and Club Penguin with 19 million users), 14 aimed at the groups from 13 to 20 (including Stardoll with 21 million users, IMVU with 20 million users and Gaia with 15 million users), and 21 aimed at the over 20s (the largest being Second Life with 15 million users). Some of these are centred around a specific brand (e.g. Neopets, Stardolls, Disney Fairies, Virtual MTV, Barbie World, Fusion Fall (Cartoon Network), Hello Kitty, Club PonyPals and Lego Universe) while others are more general (e.g., Second Life, Multiverse, Active Worlds, There, Qwaq and Kaneva). Further, they vary considerably in their content focus (KZero 2008b), including content creation (Second Life, Active Worlds, HiPiHi and Multiverse), Socializing/chat (Utherverse, There and IMVU), fashion/lifestyle (Frenzoo, Stardoll and GoSupermodel), education (Whyville, Medikidz and Jumpstart), music and media (vMTV, Onverse and vSide) and sports (Football Superstars, Empire of Sports and Sportsblox).

The combined population of users of the virtual worlds discussed above is well in excess of 300 million. The virtual goods sector is estimated at more than $1.5 billion per annum (Wu 2007). Second Life, the best known and broadest virtual world platform, has grown rapidly from 2 million residents in January 2006 to nearly 15 million residents in August 2008 (Second Life 2008a). In August 2008, there were nearly 20 million transactions and more than US$338 million were spent in the year to June 2008 (Second Life 2008b). Residents owned 1,714 million square meters of land and the million or so residents that logged in July 2008 spent 34.7 million hours in Second Life, nearly nine times that of July 2006 (Second Life 2008c). Evidence suggests that there is a high level of continued usage of virtual worlds such as Second Life.

Academic research into virtual worlds is still at a very early stage. With the massive recent growth in virtual worlds and their users and the very high sustained level of usage of these virtual worlds, we were very interested to find out why this might me the case. Thus, the research question for this study was: "Why do users continue their usage of virtual worlds?" As a basis for the research, we use continuance theory and three related theories that are likely to drive continuance: habit (Limayem et al., 2007), absorption or 'persistent flow' (Csikszentmihalyi 1990, Schaufeli et al. 2002) and enjoyment (van der Heijden 2003). As the context for the investigation, we focus on the largest and best-known of the freeform adult virtual worlds, Second Life.

The structure of this paper is as follows. In the next section we examine the theoretical development of a model of continuance in virtual worlds. The third section describes the methodology used in the study. Section four presents the results of the study. In the final section, the paper rounds off with a discussion, limitations, implications for research and practice, and conclusions.

2   THEORY AND RESEARCH MODEL

In this section we pull together the various strands of theoretical literature that we use to create our research model. In particular, we examine the salient literature on the concepts of use continuance, enjoyment, habit and absorption. Each of these is now examined in turn.

2.1   Continuance theory

The roots of continuance theory, as applied to information systems research, are from the marketing literature. Expectation-confirmation theory (ECT) emerged from the consumer behaviour and services marketing literature and has proven broadly robust in a number of service contexts (Dabholkar et al. 2000, Oliver 1993). The general thrust of ECT is the assessment of post-purchase intentions, as influenced by initial expectations about a product or service, subsequent adoption and use (consumption) and the formation of perceptions about performance as influenced by the confirmation or not of initial expectations, the latter determining the level of satisfaction with a purchase and subsequent repurchase or use discontinuance. Bhattacherjee (2001) was the first to fully formalize the theory into an ex-post framework that could be applied to the domain of information systems, adapting the theory to be applied post-acceptance and to encapsulate perceived usefulness (Davis et al. 1989, Davis 1993) as a replacement construct for expectations. Perceived usefulness has consistently proven to be an important construct in longitudinal adoption to post-adoption behaviour (Davis et al. 1989, Karahanna et al. 1999). Thus Bhattacherjee's (2001) model relates the constructs of perceived usefulness and satisfaction to the extent of confirmation of a user's expectations about an IS, whereby expectations that are fulfilled drive greater satisfaction and perceived usefulness. High levels of perceived usefulness are also posited to lead to greater satisfaction with a system. In turn, the outcome variable of continuance intention is determined by the level of satisfaction with an IS and the perceived usefulness of the system.

Bhattacherjee's model has been successfully applied to individual user contexts involving the Web, such as online banking, and the Internet more broadly (Bhattacherjee 2001, Limayem et al. 2007). Virtual worlds are also distributed systems reliant on Internet technology, and the focus of this study is on individual users; Bhattacherjee's theory (which appears to have broader application and generalization in any case) is adopted as a suitable core for a model examining continuance behaviour in this context.

2.2   Enjoyment

The applications of virtual worlds for organizations are potentially very broad, including product branding, promotional events, product development and testing, collaboration, process rehearsal and simulation, employee recruitment, education and training, commerce, and communication. However, at the individual user or consumer level, which is the focus for this study, virtual worlds can be construed as hedonistic systems where users experience pleasure or fun when using the system. Such uses may include, for example, socializing, romantic encounters, shopping for desirable personal items, customizing one's personal appearance, playing games, fantasy, the creation of an alter-ego (Hemp 2006) and other experiences that may for example contribute to building self-esteem, social bonding and self-actualization. To have a pleasurable experience, individuals often seek sensations on multiple sensory channels (van der Heijden 2003), and clearly virtual worlds are equipped to provide such multimedia experiences by design.

Unfortunately, the IS continuance theory described above is built primarily on the utilitarian paradigm of providing instrumental value to the user. The consumer behaviour literature has determined strong support for repurchase and use intentions driven by both utilitarian and hedonic value in products or services (Bauer et al. 2005). Recently, the extension of this hedonic value conceptualization, hereinafter referred to as enjoyment, to the user acceptance of hedonic information systems has been

formalized and empirically tested by van der Heijden (2003). Early research in virtual worlds has also confirmed the relationship between enjoyment and behavioural intention (Wu et al. 2008). This study adopts this theoretical development and the related theoretical relationship between enjoyment and intention to continue using a hedonic information system (as clearly implied, although not longitudinally tested in van der Heijden's study). Further, in the spirit of the expectation-confirmation theory, as discussed above, the inclusion of a hedonic construct (enjoyment) as well as a utilitarian one (perceived usefulness) has clear implications for the fulfilment of expectations. Here, we theorize that hedonic value expectations are manifested or not in the same way as utilitarian ones. Thus, a user will hold expectations about the hedonic value of a system, in other words its perceived enjoyment, which will be confirmed or not by the adoption and use of the system, thereby triggering an evaluative response in the form of satisfaction.

2.3   Habit

Previous research has found that use continuance in information systems and other contexts can be predicted by the extent to which a behaviour has become automatic because of prior learning – typically conceptualized as habit (Limayem et al. 2007). Research has variously examined habit as a moderator between intention and actual behaviour, as a direct effect on actual behaviour, and as an indirect effect on behaviour that primarily determines intentions. Our focus in this research is on use intentions rather than actual behaviour, and so naturally we focus on that latter of these formulations. Our focus on intentions is in line with a core body of previous IS literature (Legris et al. 2003), whilst the focus on indirect habit effects is a view that is held in a number of previous studies that have examined the effects of habit (and the much used proxy construct of experience) on behavioural intentions (Legris et al. 2003).

In addition to the effect of habit on intention to continue using an IS, we also posit that habit is significantly influenced by satisfaction. Limayem et al. (2007) in their comprehensive definition, application and analysis of the habit construct in continuance theory find very strong support for the linkage between satisfaction and habit. Further, they find that frequency of prior usage has a positive association with habit, an assertion that we also make for the purposes of model development.

The creation of habit requires a stable context conducive to its formation through repetition or practice (Orbell et al. 2001); we would hold that such a context exists when focusing on individuals' behaviour with respect to a single system such as a virtual world. This position is in line with that of Limayem et al. (2007) in their study of habitual use of the Internet.

2.4   Absorption

Csikszentmihalyi (1990) examines experiences that are ends in themselves and are not tied to external considerations; within such experiences, an individual is caught up in the "flow" of an activity and subsequently absorbed into it (Wang & Calder 2006). This work emphasizes the role of pleasure and enjoyment in the flow experience. Indeed, Hoffman and Novak (1996) describe flow as an intrinsically enjoyable state, which others have found to be strongly related to feelings of pleasure and arousal (Csikzentmihalyi 1990, Wang et al. 2007). Further, flow theory suggests that users absorbed in a flow experience may tend to lose behavioural control and get locked into patterns of greater usage and habitual behaviour (Csikzentmihalyi 1990). Turning to the use context in this study, previous work on flow in the context of Internet use and online gaming has found a significant relationship between flow and use intentions (Hsu & Lu 2004).

Flow is purported to be a multidimensional construct that has variously been defined in terms of concepts such as concentration, control, challenge, attention focus, curiosity, enjoyment and intrinsic interest (Webster et al. 1993, Wang et al. 2007). However, the concept of flow has some issues worthy of note. As Schaufeli et al. (2002, p. 75) suggest: "… [flow is a] complex concept that includes many aspects and refers to rather particular, short-term 'peak' experiences instead of a more pervasive and

persistent state of mind, as is the case with engagement." Since our aim is to measure more persistent states of mind that influence intentions to continue use of an information system it would seem logical to focus on the concept of engagement rather than traditional flow, or more particularly the dimension of engagement that represents persistent flow states – that of absorption. As Schaufeli et al. (2002) state in their application of the absorption construct to the work context:

> *… absorption is characterized by being fully concentrated and deeply engrossed in one's work, whereby time passes quickly and one has difficulties with detaching oneself from work. Being fully absorbed in one's work comes close to what has been called 'flow', a state of optimal experience that is characterized by focused attention, clear mind, mind and body unison, effortless concentration, complete control, loss of self-consciousness, distortion of time, and intrinsic enjoyment …* (p. 75)

From a theory perspective, we posit that an individual's intention to continue using a virtual world will be driven by the level of absorption, or persistent flow, experienced in the media environment. In turn, absorption will be determined both by the level of enjoyment experienced in the virtual world and the level of habitual behaviour that has been established.

The theoretical developments above were combined with the basic IS continuance model for the basis of this study. Together these theories provide an extension to the typically utilitarian approach of continuance theory, which may be limited in its application, to capture broader elements related to hedonistic use (enjoyment), automatic behaviour (habit) and persistent 'flow' (absorption), all of which are likely to impact on the use of virtual worlds. The full research model tested in the research is provided in Figure 1.
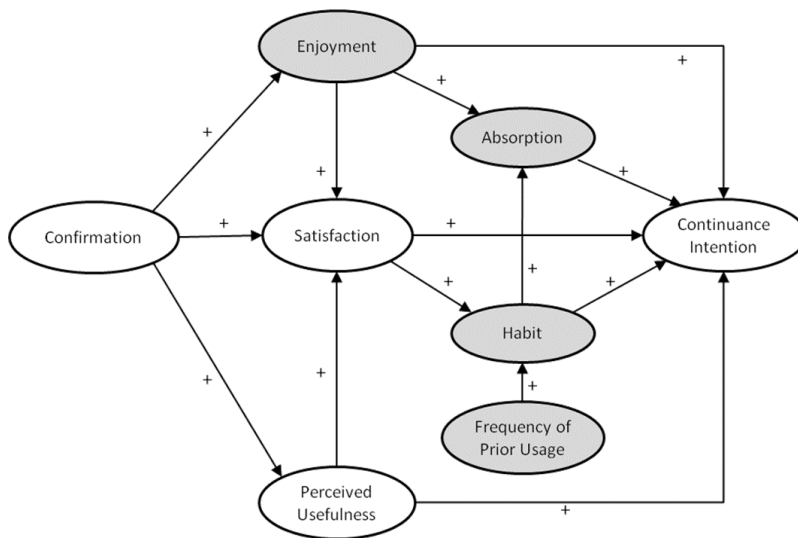

Figure 1.   Research model.

3   STUDY DESIGN AND METHOD

The sections below describe in detail the data collection process, the measurements used, and the type of data analysis executed.

3.1   Data Collection

We chose the context of Second Life since it is the largest virtual world for the adult age group and the most well-known of the freeform virtual world environments. Evidence also suggests that it is the virtual world platform with the broadest user base and range of applications (KZero 2008c).

Data collection involved the use of two traffic 'bots' in Second Life operating at busy traffic points. Each bot is essentially an avatar automated to deliver a survey advertisement and a URL in text form in-world. Each bot had an advertisement for the survey in its group name, above the avatar. Details of the survey were also provided in the profile of the avatar and respondents were requested to IM (instant message) the bot. Respondents initiate contact and are given details of the survey and the URL to begin the survey. The survey was provided using QuestionPro. To collect sufficient responses, each bot was placed at a high-traffic location selected from Second Life's 'popular locations' list. The locations were chosen to be as generic as possible (to appeal to both genders, different ages and nationalities) and each focused on providing both free and paid-for digital content and on generating traffic through paid 'camping' activities (where individuals are paid small amounts of money for time spent 'sitting' at a particular location).

A monetary incentive (of L$250 or approx. $0.95) was provided to respondents for each completed survey. A non-conditional incentive was used, since there is evidence that this is likely to improve response rates in social science research over conditional incentives such as a prize draw (Church 1993). Further, evidence suggests that incentives do not necessarily bias sample composition or data quality (Brennan 1992) and are more likely to attract harder to reach groups, by providing motivation (Groves et al. 2000). There is no guidance on the recommended value of incentives for virtual world surveys, but we felt that L$250 was favourable compared to market research surveys delivered through Second Life by HippiePay and other companies. This is much smaller in monetary terms than the typical $10-$20 provided in other modes of social science research (Simmons & Wilmot 2004). The survey ran for approximately six months. After filtering for duplicates and invalid responses we had a total of 339 survey responses.

3.2   Measurement

All of the constructs and scale items used in the research were adopted from previously validated sources. The core of the model and measures for confirmation, perceived usefulness, satisfaction, continuance intention, habit and frequency of prior usage are adapted or adopted from Bhattacherjee (2001) and Limayem et al. (2007). The semantic differential measure for enjoyment employed in the instrument is that of van der Heijden (2003). Finally, the measure for absorption is taken from the engagement inventory of Schaufeli et al. (2002).

3.3   Data Analysis

Data analysis was performed using a variance maximization approach to structural equation modelling (SEM) and associated statistics for validity and reliability. More specifically, we used the partial least squares (PLS) technique with reflective indicators in Smart-PLS 2.0 (Ringle et al. 2005). The PLS technique has become increasingly popular in information systems research, marketing and in management research more generally in the last decade or so, influenced by its flexibility; indeed, PLS does not have the same distributional assumptions of normality for data, is able to handle small- to medium-sized samples (Chin 1998).

4   RESULTS

4.1   Respondent Characteristics

Of the 339 responses, approximately three-fifths were male (58.4%). The median age was 25-34 years, with only a third of the sample being 35 years or over. The average use experience was between one and three months, with around two-thirds using the virtual world for less than six months. However,

actual usage was high amongst the sample, with a median usage of between 4 and 10 hours per week, over five or six sessions per week.

4.2 Tests for Validity and Reliability of the Measures

Table 1 examines convergent validity – the extent to which theoretical scale items are empirically related. The loadings of the measures on their respective constructs in the model range from 0.756 to 0.946, with all being significant at the 0.1% level. Further, all of the constructs fulfil the recommended levels with reference to composite reliability (CR) and average variance extracted (AVE); as shown in Table 1, all items were higher than the cut-off of 0.50 recommended by Fornell and Larcker (1981). All the values of AVE are considered acceptable, ranging from 0.672 to 0.865. Similarly, the values of composite reliability are very good, ranging from 0.892 to 0.962, well above the reliability values of 0.70 and 0.80 that are typically advised for building strong measurement constructs (Nunnally 1978, Straub & Carlson 1989).

Construct	Item	Loading	St. Error	t-value
Absorption				
CR=0.925	When I am in Second Life I forget everything else around me.	0.807	0.026	31.327
AVE=0.672	Time flies when I am in Second Life.	0.756	0.028	27.359
	I get carried away when I am in Second Life.	0.850	0.020	43.030
	It is difficult to detach myself from Second Life.	0.826	0.025	33.215
	I am immersed in Second Life.	0.853	0.021	40.853
	I feel happy when I am using Second Life intensely.	0.825	0.019	43.664
Confirmation				
CR=0.919	My experience with using Second Life was better than I expected.	0.907	0.014	65.250
AVE=0.791	The benefit provided by Second Life was better than I expected.	0.909	0.014	67.417
	Overall, most of my expectations from using Second Life were confirmed.	0.852	0.023	37.266
Continuance Intention				
CR=0.931	I intend to continue using Second Life rather than use any alternative technology.	0.927	0.013	74.001
AVE=0.818	My intentions are to continue using Second Life rather than use any alternative technology.	0.912	0.014	65.240
	If I could, I would continue my use of Second Life.	0.874	0.016	53.646
Enjoyment				
CR=0.962	I would describe my overall experience of using Second Life as…			
AVE=0.865	a. Enjoyable to disgusting	0.936	0.012	77.093
	b. Exciting to dull	0.925	0.011	84.309
	c. Pleasant to unpleasant	0.946	0.009	101.341
	d. Interesting to boring	0.912	0.016	56.598
Habit				
CR=0.924	Using Second Life has become automatic to me.	0.893	0.017	51.438
AVE=0.802	Using Second Life is natural to me.	0.916	0.012	76.785
	When faced with a particular task, using Second Life is an obvious choice for me.	0.879	0.015	60.465
Perceived Usefulness				
CR=0.935	Second Life is of benefit to me.	0.918	0.011	84.018
AVE=0.827	The advantages of Second Life outweigh the disadvantages.	0.898	0.016	54.748
	Overall, using Second Life is advantageous.	0.912	0.011	84.166
Frequency of Prior Behaviour				
CR=0.892	In the last 7 days, how much time would you say you spent using Second Life?	0.909	0.015	62.741
AVE=0.804	In the last 7 days, how many times did you use Second Life?	0.885	0.021	41.816
Satisfaction				
CR=0.942	How do you feel about your overall experience of Second Life use?			
AVE=0.802	a. Dissatisfied to satisfied	0.887	0.020	43.894
	b. Displeased to pleased	0.910	0.015	60.844
	c. Frustrated to contented	0.885	0.018	48.083
	d. Terrible to delighted	0.901	0.016	56.254
Note: CR=Composite Reliability; AVE = Average Variance Extracted				

Table 1.   Psychometric table of measurements.

Table 2 examines discriminant validity – the extent to which question items measure the construct intended or other related constructs. A standard test for discriminant validity was used whereby the square root of average variance extracted for each construct is compared with the correlations between it and other constructs; discriminant validity is demonstrated if the square root is higher than the correlations. Table 2 clearly indicates that each construct shares greater variance with its own measurement items that with other constructs with different measurement items, with a good margin

of difference, the closest margin being 0.122. To further confirm the discriminant validity of the scale items used in testing the research model we utilized the cross-loading method of Chin (1998); the method prescribes a requirement for measurement items to load higher on a construct than the scale items for other constructs and for no cross-loading to occur. Item loadings in the relevant construct columns were all higher than the loadings of items designed to measure other constructs; similarly, when glancing across the rows the item loadings are considerably higher for their corresponding constructs than for others.

	ABS	CONF	CONTINT	ENJ	HABIT	PU	PRIORBEH	SATIS
Absorption(ABS)	0.820							
Confirmation(CONF)	0.583	0.890						
Continuance Intention(CONTINT)	0.584	0.753	0.905					
Enjoyment(ENJ)	0.397	0.455	0.433	0.930				
Habit(HABIT)	0.698	0.683	0.645	0.405	0.896			
Perceived Usefulness(PU)	0.546	0.693	0.691	0.453	0.666	0.909		
Frequency of Prior Behaviour (PRIORBEH)	0.463	0.365	0.364	0.282	0.450	0.369	0.897	
Satisfaction(SATIS)	0.447	0.481	0.403	0.636	0.485	0.462	0.320	0.896

Table 2.   Correlations between constructs (diagonal elements are square roots of the average variance extracted).

Overall, these tests for validity and reliability provide us with a high degree of confidence in the scale items used in testing our research model.

4.3   Test of the Research Model

Figure 2 presents the results of PLS path modelling (Centroid Weighting Scheme) in Smart-PLS (Ringle et al. 2005). The shaded items are those that have been added to Bhattacherjee's (2001) basic continuance model. A power analysis in G*Power 3.0 (Faul et al. 2007) shows that the sample (n=339) is sufficient for explaining even small population effects ($f^2 \geq 0.044$; $\alpha=0.05$; $\beta=0.2$) in our model, with a power of 1.000 for moderate population effects ($f^2=0.15$).
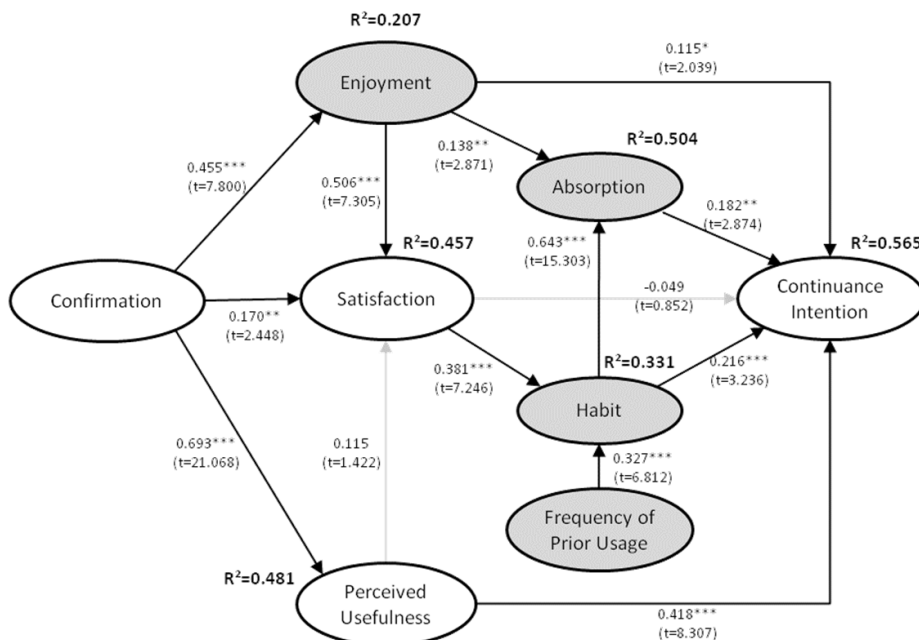

Figure 2.   Results of PLS analysis.

The data supports all relationships in the model except two – the linkages between perceived usefulness and satisfaction and between satisfaction and continuance intention. Interestingly, these are core relationships in the basic continuance model. Not surprisingly, confirmation strongly influences and contributes to explaining perceived usefulness ($p<0.001$, $R^2=0.481$). Confirmation also strongly relates to enjoyment, with modest explanatory power ($p<0.001$, $R^2=0.207$), whilst confirmation and enjoyment together strongly influence satisfaction ($p<0.001$ and $p<0.01$ respectively) and explain a rather substantial 45.7 percent of variance.

Habit in our model appears to be significantly determined by satisfaction and the frequency of prior usage behaviour (both $p<0.001$ in our model); these two variables together explain a healthy 33.1 percent of variance in habit. Absorption has strong relationships with habit ($p<0.001$) and enjoyment ($p<0.01$), which together contribute to explaining a very considerable level of variance (50.4 percent).

Overall, the research model explains a very considerable level of variance in continuance intention – 56.5 percent. Four determinants contribute to explaining behavioural intention, specifically, in order of the strength of their relationships: perceived usefulness ($p<0.001$), habit ($p<0.001$), absorption ($p<0.01$) and enjoyment ($p<0.05$). In sum, users build their behavioural intentions to continue to use the virtual world of Second Life based on utilitarian assessment of value (perceived usefulness), hedonistic assessment of value (enjoyment), chronic disposition (habit) and via the persistent "flow" of the virtual world experience within which users are absorbed.

DISCUSSION AND CONCLUSIONS

This study has tested an extended continuance model in the context of virtual worlds, or more specifically, in the context of the virtual world of Second Life. The tested research model combines the ex post continuance intention model of Bhattacherjee (2001) with additional constructs for habit (Limayem et al. 2007), enjoyment (van der Heijden 2003) and absorption (Schaufeli et al. 2002), that are each posited to play an important role in continued virtual world usage. Using a sample of 339 respondents collected in Second Life we find strong support for the validity and reliability of all constructs. Furthermore, the model is tested using PLS and four of the determinants of continuance intention are clearly supported in the model (perceived usefulness, habit, absorption and enjoyment), along with all of the extended relationships proposed. However, although aspects of the expectation-confirmation theory are supported, including the extension to include hedonic value (enjoyment), the traditional link from utilitarian value (perceived usefulness) to satisfaction is not supported by the data. Similarly, the link from satisfaction to continuance intention is also not supported – only a linkage that is mediated by habit. This would appear to suggest that the standard continuance model is not supported in this context, and that a construct such as enjoyment (which bears some similarity to satisfaction) may be more suitable as a measure of the confirmed value derived from virtual world adoption and use than that of satisfaction per se. Users of the virtual world do not continue their use based directly on whether they are 'satisfied', but rather on an assessment of hedonic value and of utilitarian value, and based on established patterns of automatic behaviour and the chronic disposition to be absorbed in system use. Indeed satisfaction is mediated by habit in its path to continuance intention. Satisfaction appears to be a term more suited to non-hedonic product or service evaluation and is rather telling of the context from which it is derived – services marketing. Users of virtual worlds may be too bound up in the experience and the use of the system to be able to detach themselves and make an objective assessment of how satisfied they are or not with the virtual world within which they are habitually absorbed and use this as the basis for further usage decisions.

The nature of virtual worlds is clearly quite different to other product or service contexts within which ECT marketing theory is generally applied. The closest group of products/services would appear to be online gaming; although virtual worlds such as Second Life are not strictly games there is striking similarity to other hedonic systems such as online games and this is a domain that is likely to help in informing practice. Users of virtual worlds clearly place an emphasis on hedonic and utilitarian value derived, and these are areas within which developers can contribute to the success of virtual worlds.

Other aspects, such as habit and absorption, are dispositions of the individual and are not directly controllable; however, they can be manipulated indirectly through the design of the virtual world. Enjoyable experiences that leave users wanting more contribute to building habitual behaviour. Similarly, enjoyable experiences in realistic virtual worlds and compelling human-computer interaction can help to build persistent flow experiences and a chronic disposition where individuals find it hard to discontinue use of system – perhaps even an addictive behaviour, as has been shown for computer gaming environments.

Utilitarian value, as represented by perceived usefulness in our study, can be enhanced by creating additional instrumental value for users. Such value is created by providing additional functionality and content to virtual worlds that is clearly of benefit to residents and that will ultimately be used. This could include, for example: tools for communication, collaboration and social networking; tools for entrepreneurial or commercial endeavours; utilities for customization and creation of objects and other content; tools for the development of simulated environments; systems for establishing and managing a presence in a virtual world and in relation to the operator of the world; educational and training-oriented systems; other productivity tools; and content that appeals to the typical goals of individuals using the virtual world.

Hedonic value, as discussed by van der Heijden (2003, p. 696), can be enhanced by "the inclusion of hedonic content, animated images, a focus on colours, sounds, and aesthetically appealing visual layouts." Within the context of Second Life this means creating ever more realistic and visually appealing 3-D rendered environments, with strong visual appeal and integration of quality audio; Second Life has continued to work in this space, including, for example, more realistic representations of sky and water – originally trailed through the WindLight test version but now built into the standard client. The key is providing emotional content including images, objects and sounds that stimulate the user, provoke a response and assist in creating an absorptive experience. The provision of emotional content should be dynamic and changing, rather than static, creating a compelling reason for users to return to the virtual world and contributing to the creation of a persistent absorptive effect on the user.

Our research is limited to the extent that we have focused solely on the virtual world of Second Life. Other virtual worlds differ according to aspects such as the payment model, gaming model, sectoral customer focus and technical design. Notwithstanding, the constructs used in our model would appear generic and robust enough to be applicable in a wide variety of combinations of these virtual worlds. It is possible that the expectation-confirmation model may reveal different results – in particular a link from perceived usefulness to satisfaction to continuance intention in different virtual worlds. Given the nature of Second Life, this is perhaps unlikely and we might expect Second Life to behave more as a barometer for other virtual worlds, many of which are only beginning to establish a presence and build a customer base. Future research should aim to test the model in further virtual world environments in order to confirm this assumption.

A further limitation of our research model is the absence of demographic and other factors, such as age, gender, geographical location, experience with Second Life, use intensity, personality and so on. Although demographic and use data were captured in the study, there was not appropriate scope in this paper to examine their direct or moderating effects in a research model. For example, we are likely to have a heterogeneous sample of a global nature; capturing and analyzing information on the sample may help to understand the behaviour of different groups of global consumers. New PLS techniques such as finite mixture analysis (FIMIX) may prove to be very useful in this regard, providing a means of respondent group segmentation and analysis (Ringle et al., in press). Further, since virtual worlds have elements of hedonic and utilitarian value and can be used for many purposes (including social and work purposes, for example) it would be useful to delve deeper into the specific purposes of usage and whether these have an impact on continuance behaviour in future studies.

This paper represents an early attempt to understand behaviour in virtual worlds from an information systems perspective. There is much to learn in this new environment and IS theory needs to develop further to assess virtual world behaviour. Virtual worlds different to standard domains of theoretical

application in technology acceptance of IS which, although they may exhibit intrinsic elements, tend to be largely extrinsic in use motivation, such as individual use of organizational systems, e-commerce systems and the Internet, mobile technology, and so on. Hedonic systems and related theory are underrepresented in the overall IS acceptance literature, which is unfortunate given the hedonistic nature of the system under investigation here. Virtual worlds appear too complex to be the focus of one discipline alone. This is an issue of concern for future research, which should look towards a multidisciplinary approach towards understanding hedonistic IS such as virtual worlds; in such an approach disciplines such as psychology, human-computer interaction and consumer behaviour are likely to play important roles.

Acknowledgements

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