

A Study of Antecedents of Sense of Presence in Virtual World: Virtual Presence vs. Social Presence

Full Paper

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Abstract

Virtual World as an electronic artificial environment, enables users to have an identity while interacting with others is one of the new instances of Computer-Mediated Communications environment. Our study aims to elaborate the two types of presence in virtual world and their effects on users' satisfaction and loyalty in second life. In addition we try to elaborate the factors that affect virtual and social presence. We used survey in order to collect data from a student sample frame. Our samples are students who at least have three weeks experience with second life in order to measure our model. Results of the research suggested that cognitive absorption positively influence virtual presence and sense of belonging positively influence social presence. In addition our results suggested that sense of presence in virtual world increase satisfaction and loyalty among virtual world users.

Keywords

Virtual worlds, sense of presence, social presence, virtual presence, satisfaction, loyalty.

Introduction

Virtual World as an electronic artificial environment, enables users to have an identity while interacting with others (Sproull and Faraj 1997) is one of the new instances of Computer-Mediated Communications environment. On the one hand, virtual world is very important for researchers since this environment contains new concepts in the area of CMC which did not existed before. New concepts such as using personalized avatars, presence in a virtual world. On the other hand, Virtual world is going to be an important business area for practitioners since it can be a place for people to play game and spend money. In addition, some companies such as Mercedes-Benz and IBM are present in virtual worlds such as Second Life (SL, WWW.secondlife.com). Indeed, they use their virtual stores in SL more for product demonstration and marketing purposes.

Sense of presence is a concept which has been investigated in terms of social presence in several researches in different contexts. For example, in the area of online learning environment as an example for CMC, social presence was suggested as an important indicator for learners' satisfaction. There is a gap in the literature in the area of virtual presence since most of theories in the literature such as Social presence theory by and media richness theory have discussed social presence as an important concept in CMC literature that affect users. In this paper we try to examine the effect of virtual presence and social presence together on satisfaction and loyalty in virtual world as one of the new environment that introduce virtual presence in CMC. So the first research question will be:

RQ1: How sense of presence having two elements of social and virtual presence affects users' satisfaction and loyalty in virtual world?

Because of the importance of virtual presence in virtual world we try to find the antecedents of virtual presence which was not investigated in previous researches. Applying presence as immersion based on Lombard and Ditton (1997) , we suggests cognitive absorption as a multi-dimensional constructs that predict virtual presence in virtual world. Cognitive absorption was discussed as a multi-dimensional construct by Agarwal and Karahana (2000). In fact absorption refers to attention to something (Agarwal

and Karahanna 2000) such as virtual world so we used it as a factor that affects this type of presence for the first time.

In addition, our research suggests the positive relationship between sense of belonging to virtual world and social presence which was discussed in other computer mediated communication environment such as online learning environment (e.g. Rovai 2002). We believe that this relationship exists in virtual world. So our second research question will be:

RQ2: What factors affect social and virtual presence in virtual world?

This research illustrated that cognitive absorption positively affects virtual presence while sense of belonging positively influence social presence. In addition, our empirical results suggested that sense of presence in virtual world users increase satisfaction and loyalty in virtual world. This study has several contributions to the literature. This article is the first paper that explains the effect of virtual presence and social presence separately on users' satisfaction and loyalty virtual world while proposing cognitive absorption and sense of belonging as indicators of virtual presence social presence in virtual world. In addition, our research used the sample that has experience with the virtual world that can provide more reliable statistical results.

Literature Review

VW-Loyalty and Satisfaction

Virtual world loyalty (VW-Loyalty) is a construct that its root is in consumer behavior literature. Marketing literature defined loyalty as a commitment to repurchase and patronized a product or service in the future (Oliver 2010). Rowley and Dawes (1999) conceptualized consumer loyalty is a positive attitude toward three concepts: repeating patronage to a retailer, willingness to repurchasing from a retailer, and willingness to recommend the retailer to others. Customer satisfaction in virtual world defined as "user's specialized form of judgment resulting from the previous experiences of the virtual world" (Kim and Zhang 2011, p. 34). The positive relationship among satisfaction and loyalty has been studied in a number of researches in different contexts (e.g. Oliver and Burke 1999; Singh and Sirdeshmukh 2000). As an example, Customer satisfaction theoretically justified as an antecedent for loyalty in marketing research (Newman et al. 1973).

Sense of Presence

Presence in virtual world was studied in a number of researches (e.g. Slater et al. 1994; Witmer and Singer 1998). Although there are a number of terms associated by presence in virtual world, there are two broad categories representing this term in virtual world: Virtual and social presence (Kim and Zhang 2011, p. 32). Social presence defined as "degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (Short et al. 1976, p. 65). Indeed, social presence indicates the degree to which an individual perceive himself as a real person in virtual environment (Gunawardena and Zittle 1997). Virtual presence and telepresence are terms which has been used in literature with the same meaning (Lee 2004). Sheridan (1994) suggested that telepresence is used in the case of remote control or teleoperation.

Research Model and Hypotheses

Sense of presence was mentioned in the literature by two interrelated phenomena: virtual presence and social presence. Virtual presence refers to sense of "being there" in a mediated space that create illusion of place while social presence refers to sense of "being together" with others. A number of researches elaborated the effect of social presence on satisfaction in computer-mediated environments designed for distance learning (e.g. Gunawardena and Zittle 1997; Richardson and Swan 2003; So and Brush 2008).

There are two theories in the literature try to explain the concept of social presence. Social presence theory by Short et al. (Short et al. 1976) and media richness theory by Daft and Lengel (Daft and Lengel 1986). These two theories were concerned about the capacity of media to support social presence. Using face-to-face interactions as a benchmark these theories try to compare different medias (Kehrwald 2008).

By advancement of computer-mediated communication technologies users experienced a very rich communication in case of media named lean media (Walther 1992). After this development in communication technology researchers considered the limitation in definition of social presence based on media and they extended previous definition by considering social presence as the quality of communication (Shin 2002). Rourke, Anderson, Garrison, and Archer (Rourke et al. 2007) suggested emotional and social relations in community to define social presence. In addition, Individual's ability to perceive others (Murphy and Collins 1997) and degrees of affective connections (Swan and Shih 2005) was mentioned as important concepts should be considered in social presence definition.

Expectation-confirmation theory (ECT) by Bhattacharjya (2001) suggested that satisfaction affected by cognitive evaluation of the difference between expectation and performance. When the product or service satisfy customers expectations, customers will continue their behavior to purchase. So we suggest that users satisfaction affect them to continually use virtual world since ECT was applied in several researches in the context of IS in order to support the relationship between satisfaction and continual use of IS systems.

According to the following extension to the definition of social presence which was based on social presence theory we found that social presence should be considered as important factor affecting social presence. In order to do that sense of belonging or community was considered as a construct that reflect both social and emotional factors of communication in groups was added to our model.

Murray et al. (2007) suggested that absorption affects presence in virtual reality. They defined level of presence in virtual reality environment as having a virtual body, natural navigations such as walking and inclusion of dynamic shadows. This is obvious that this definition of presence by Murray et al. (2007) is similar to our definition for virtual presence in virtual worlds such as second life. In addition, Banos et al. (Banos et al. 1999) suggested that absorption as an indicator for virtual presence. These authors argued that absorption can affect users' perception about the extent to which they perceive the virtual world realistic. They found a significant correlation between absorption and reality judgment, realism of the experience.

Based on the results of the following researches, we considered cognitive absorption as an indicator for virtual presence in our model. According to Agarwal et al. (Agarwal and Karahanna 2000) cognitive absorption has five dimensions including: temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity. Our research model suggests that these dimensions positively affect virtual presence in virtual world. Finally, we suggest our research model presented in Figure 1:

Satisfaction

Relationship between satisfaction and loyalty was discussed and tested in several contexts (e.g. Oliver and Burke 1999; Yoo and Alavi 2001). People who are satisfied with a service have more intention to use that service (Bolton and Lemon 1999) because they perceive that if they continue to use the service they will receive more value than they use competitors' services (Sirdeshmukh et al. 2002). As we discussed earlier satisfaction comes from previous judgments and experiences with virtual world. When you judge virtual worlds as a beneficial online environment you continue to use and suggest others to use it and receive its benefit. In addition, after others who an individual suggested them to participate in virtual world participated in it the individual perceive responsibility about them so he or she cannot easily leave this environment. So we posit that:

H1: Users' satisfaction with virtual world positively affects their VW-Loyalty.

Sense of Presence

Lombard and Ditton (1997) discussed six types of presence that were created by emerging computer technology: presence as social richness, realism, immersion, a social actor within a medium, medium as a social actor, and medium as transportation. In our research we just focus on presence as social richness and immersion. Presence as social richness has route in social presence theory by Short, Williams, and Christie (1976) and refers to the extent that the interaction in medium is warm and social. On the other hand, Presence as immersion refers to the degree of user's engagement in the virtual world (Biocca and Levy 1995).

We categorized sense of presence in two types of presence in virtual world: virtual presence and social presence (Table 1). Before evolution of computer mediated communication systems most of researchers analyzed presence as the social presence (Walther 1992). After that by development of rich Medias that are used in different types of communications such as virtual world researchers introduced telepresence or virtual presence as another type of sense of presence in communications (Shin 2002). In this section we discuss the effect of social and virtual presence on users' loyalty and satisfaction in virtual world.

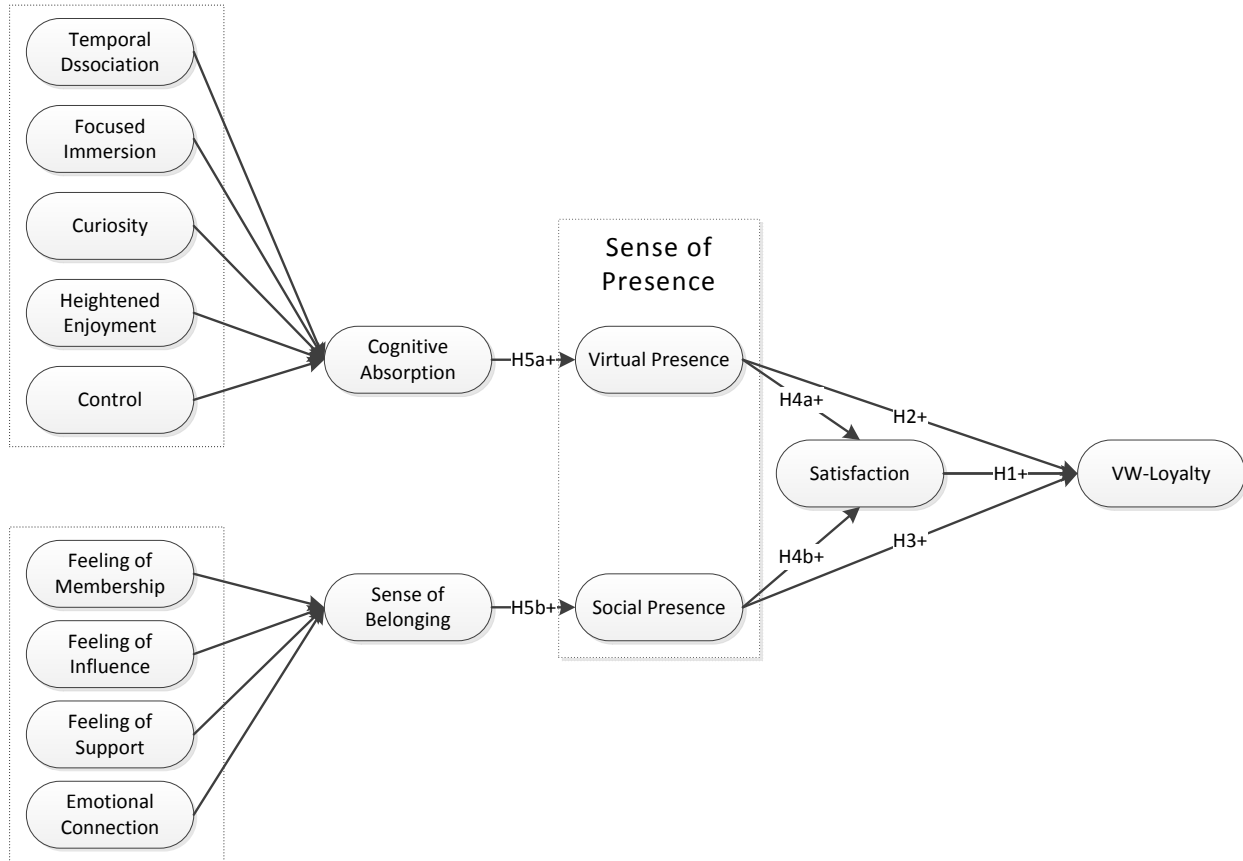


Figure 1: Research Model

Construct	Definition
Virtual presence	A psychological state in which virtual objects are experienced as actual objects in either sensory or non-sensory ways (Lee 2004, p. 37).
Social presence	Degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships (Short et al. 1976, p. 65).

Table 1: Sense of presence in virtual world

Virtual presence was named in several researches as telepresence and mentioned as an important factor in video communications environments (e.g. Muhlbach et al. 1995; Prussog et al. 1994). Feeling of being there in virtual world helps individuals to believe that they are actually live in this world so they may develop some connections with others. These connections can be same as real world so they will perceive responsibility related to the connection they developed and this increase their intention to continue to use virtual world. In addition, in case of virtual presence individuals can believe the group's interests such as

their goals and thoughts because they feel that they are among them and this can increase their intention to continue to use virtual world.

Social presence was introduced as a factor that affects users' intention to participate in virtual communities (Jung 2008). Feeling of being together in virtual world motivate people to interact with others in different ways such as sharing information, emotions and etc. when people make relationships by doing these types of activities they have more intention to continue their relationship so they will continue their participation in virtual world. So we posit that:

H2: Users' perceived virtual presence positively affects their VW-Loyalty.

H3: Users' perceived social presence positively affects their VW-Loyalty.

Satisfaction is a measure of IS success and is a critical factor in IS research (Verhagen et al. 2011). When individual perceive that they are in virtual world while physically they are in the real world it can affect their satisfaction in virtual world. The reason is that people, who participate in virtual world and perceive this world as real world, can achieve their goals in virtual world easier. For example, they can easily suppose themselves in a place that they wanted to be there in real life but they could not go there because of different reasons.

Social presence was suggested as an important factor affecting student's satisfaction in online learning (e.g. Cobb 2009; Gunawardena and Zittle 1997; Hostetter and Busch 2006; Richardson and Swan 2003). Social presence indicates psychological aspects of presence in virtual world related to communications and interactions of people in this environment. People mainly join groups for reasons such as feelings of belonging and affiliation, information sharing and helping each other to achieve different purposes such as exchanging valuable things like information and making long term relationships (Ridings and Gefen 2004). Therefore we hypothesize that:

H4a: Users' perceived virtual presence positively affects their satisfaction.

H4b: Users' perceived social presence positively affects their satisfaction.

Cognitive Absorption

In order to establish the role played by cognitive absorption in increasing perceived virtual presence first we need to define Cognitive absorption and its dimensions. As we discussed in literature review section of this article cognitive absorption is defined as a multidimensional construct by Agarwal et al. (2000) (Table 2). These five dimensions including: temporal dissociation, focused immersion, heightened enjoyment, curiosity, and control. In this section we first discuss each dimension and how each of them is related to virtual presence then elaborates the relationship between cognitive absorption and virtual presence.

Dimension	Definition
Temporal dissociation	The inability to register the passage of time while engaged in interaction.
Focused immersion	The experience of total engagement where other attentional demands are, in essence, ignored.
Heightened enjoyment	Capturing the pleasurable aspects of the interaction.
Control	Representing the user's perception of being in charge of the interaction.
Curiosity	Tapping into the extent the experience arouses an individual's sensory and cognitive curiosity.

Table 2: Cognitive Absorption Dimensions (Agarwal and Karahanna 2000, p. 673)

Although time is objectively defined as the clock time, psychological time perception as a subjective measure for time passage is defined as the amount of memory used to performing a task. In fact, when an

individual cognition matches task demands passage of the time will be perceived longer (Li and Browne 2006). In virtual world environment when people lose track of time they use lower amount of memory to do their task so they only sense the environment of virtual world. One study by Slater, Sadagic, and Usoh suggests the relationship between immersion and virtual presence in virtual world (Bulu 2012; Slater et al. 2000). According to Trevino and Webster (1992) people who have focused immersion will focus on a limited number of stimulus and filter out all the relevant thoughts and perception in their environment. This will decrease the amount of cognitive burden that can affect perceived ease of use of virtual world's users (Agarwal and Karahanna 2000). This also affects their cognitive power which is devoted to the virtual world.

Heightened enjoyment refers to the perceived pleasure and enjoyment when people participating in virtual world (Lin 2009). There are a number of studies suggesting that presence affect enjoyment in online environment (e.g. Skalski et al. 2011; Skalski and Whitbred 2010) but we believe that this relationship should be reverse and enjoyment positively affect virtual presence. According to Loewenstein (1994) curiosity is an intrinsic motivation that shows the desire of an individual for information and learning. Sense of curiosity can be aroused by varied, novel and surprising stimuli (Berlyne 1960). these stimuli could be technological characteristics such as color and sound (Trevino and Webster 1992) which all are available in virtual world. Another thing that can amplify curiosity in users is excitement about available possibilities in a software (Webster and Martocchio 1993). Therefore several factors such as visual features, novel and new possibilities and features in virtual world arouse curiosity in people. Control is related to the amount of responsibility people perceive from using information systems. People who desire for higher control of their activities and environment will push more effort on thinking of their environment so they will focus only in their current activity (Li and Browne 2006).

While Sas and O'Hare (2003) were not able to empirically prove the relationship between absorption and presence, they suggest that absorption influence imagination in virtual environments. When users have more imagination they may imagine that they are in the virtual world so this can increase their virtual presence. Attention was discussed as an important factor that affects presence in virtual world (Sas and O'Hare 2003). When people have cognitive absorption to virtual world they will focus on this environment and this can increase their attention and perceived virtual presence. Therefore we hypothesize:

H5a: Users' cognitive absorption affects their perceived virtual presence in virtual world.

Sense of Belonging

McMillan et al. (1986, p. 9) named sense of belonging as sense of community and defined it as “a feeling that members have of belonging, a feeling that members matter to one another and to the group, and a shared faith that members' needs will be met through their commitment to be together”. They posited four dimensions for this construct including: feeling of membership, feeling of influence, feeling of support, and emotional connection (Table 3). In this section we aim to explain each dimension and justify the effect of sense of belonging on social presence.

Dimension	Definition
Feeling of membership	Feeling of belonging or of sharing a sense of personal relatedness.
Feeling of influence	A sense of mattering of making a difference to a group and of a group mattering to its members.
Feeling of support	Feeling that members' needs will be met by resources received through their membership in the group.
Emotional connection	The commitment and belief that members have shared or will share history, common places, time together and similar experiences with each other.

Table 3: Four dimensions of sense of belonging (McMillan and Chavis 1986, p. 9)

As we discussed earlier level of intimacy and immediacy (physical distance) as two factors that indicate social presence in different types of communications so both medium type and communicators can affect perceived social presence. Membership is related to feeling of being part of a group (Beckman and Secord 1959) so when people feel that they are part of a group they will be at least more intimate with each other since they should communicate with themselves as a group. In addition people who believe that feel relatedness to others in virtual world will be more intimate with them and this relatedness increase

Feeling of influence is a bidirectional constructs. In one direction a member of the group need to have influence over what group does in order to be attracted to the group (Peterson and Martens 1972). In another direction, the ability of the group to influence group members is crucial (McMillan and Chavis 1986). Individuals who perceive influence from other members in virtual world perceive that they are related with each other In order to reach to their different goals in virtual world. In order to create sense of being together in each group's members needs should be fulfilled in other word the relationship between members and group should be rewarding. One of the reasons that people participate in communities such as virtual world is that they want to fulfill their needs by communicating and interacting with others. In other words, when people feel that other people in virtual world support them by fulfilling their needs they will feel that they are among others in the group.

Emotions are considerable factor in virtual world because of special presence of people who participate there (Ravaja et al. 2006). We consider emotions not only as members' share experiences but also as members' emotional communications such as eye contact, smile, and etc. in this environment. According to the first view when members in virtual world may think that they are all together since they can share their common interests and experiences that they had in the past with each other. In another view people who have emotional contact such as smile in virtual world may think that they are with others in this environment since they have several types of contacts they had in reality.

Virtual world users who have sense of belonging perceive that they are member of the community that they can benefit from others support and emotionally connect them to other members. All of these perceptions affect them to perceive themselves in a community with other members. Therefore we posit that:

H5b: Users' sense of belonging in virtual world affects their perceived social presence in virtual world.

Methodology

Instrument Development

We reviewed the literature to develop relevant measures (See Appendix 1). Most of the Items were measured on a 7-point Likert scale ranging from Strongly Agree to Strongly Disagree.

Data Collection

We used our items in order to conduct a survey using undergraduate students in a university in US and collected 157 responses. We collected data from users of SecondLife.com as one of the most popular and important current virtual worlds (Messinger et al., 2009). This virtual world provides advanced three dimensions interface for users and let them to have personal avatars. Users may be able to create 3D objects and perform virtual tasks.

Results

We used Partial Least Square (PLS) with Smart PLS as our statistical analysis tool. PLS uses metric properties of the scales to measure variables and strength and direction of relationships among them (Barclay et al. 1995). A two-step analysis procedure was conducted which consisted of (1) an assessment of the measurement model to assess item reliability and validity, and (2) a structural model assessment to assess the model's predictive power.

Measurement Model

The adequacy of the measurement model is an important concern which is examined by analyzing reliability and validity (Hulland 1999). The reliability of each construct was assessed by analyzing Cronbach’s alpha and, composite reliability, in which values above the benchmark of 0.70 are typically deemed as adequate. (Nunnally Jum and Bernstein Ira 1978) Convergent Validity was assessed by Average Variance Extracted (AVE). Values of 0.5 or above indicate sufficient convergent validity and demonstrate that the latent variable explains more than half of the variation of its indicators (Fornell and Larcker 1981). In the correlation table in Appendix 2, the diagonal values represent square root of AVE which is a measure for variance shared between a construct and its indicators, or convergent validity. According to the Appendix 2, Cronbach’s alpha, composite reliability, and AVE values demonstrate the internal consistency and convergent validity of constructs based on the above constraints.

Two methods were used to examine discriminant validity. First, square roots of AVEs are supposed to be greater than off-diagonal correlations (Fornell and Larcker 1981). This is true in almost all cases as shown in the appendix 2. Second, each construct’s related items must load highly on the construct it will measure and cross-loadings are supposed to be lower than the within-construct item loadings (Ko et al. 2005). Appendix 3 reflects loading values of all the items used in the measurement instrument. The two criteria for examination of discriminant validity are acceptable.

Structural Model

In order to assess the structural model we examined path coefficients and the R-square values. Path coefficients test the strength of the relationships between independent and dependent variables in the model and R-square value indicates the predictive power of the model for dependent variables (see Figure 2).

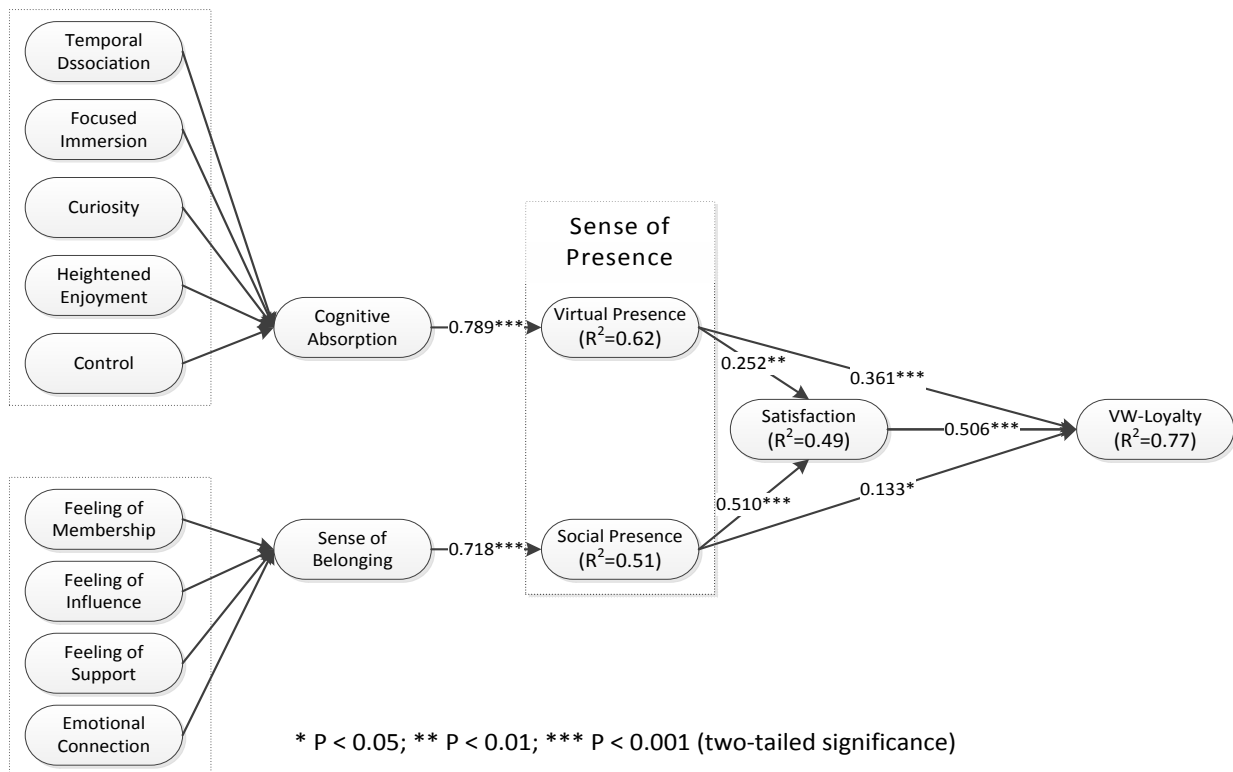


Figure 2: Structural Model Assessment Results

Discussion

This study provides several important findings. First, cognitive absorption was discussed as a multi-dimensional construct that affect virtual presence in virtual world. This finding can be very important since it can elaborate antecedents for virtual presence which is very important in virtual environments. In fact, most important theories in the area of presence were in CMC context; Social presence theory just emphasized on social presence in this context (Short et al. 1976). The media richness theory as another important theory in this context that concentrates on the media capability to increase social presence (Daft and Lengel 1986). After the evolution of virtual world these theories that concentrate on social aspect of media should be considered again. We believe that virtual presence which can be affected by cognitive absorption can be an important factor that affects users' satisfaction and loyalty in virtual world. This can be the second finding of our research.

Third, our results support the relationship between sense of belonging and social presence in virtual world which can be very important finding since social presence is an important factor in CMC environments that can create community in the virtual world (Jones 1997). These communities can be one of the reasons that people join virtual world so this can affect their satisfaction and presence. We believe that users who have sense of belonging or community in virtual world perceive this environment as community so they may perceive more social presence and consequently be more satisfy and loyal to the environment.

Limitations

Before we explain implications of our study we elaborate limitations of our study. Similar to other researches our study has a number of limitations that should be discussed and eliminate in future researches. First, in our research we used 113 responses for the survey. This small sample size may decrease the power of our statistical results. Future research may increase the sample size in order to solve this issue of our study.

Second, our sample frame is students that can be a limitation for our research. Although some researchers argue that student data are artificial and lack external validity (Gordon et al. 1986), some other researchers have argued that student data can be useful and have a great contribution. Indeed, student sample comprise a relatively large and important segment of virtual world in general, they may not be wholly representative of the broader population of virtual world users. Therefore, similar to other studies that use student data, future research will be needed to assess the generalizability of the findings.

Third, all of our respondents have at least three weeks experience with second life that can decrease reliability of our statistical results. Loyalty drivers will evolve over time (Reichheld and Scheffer 2000) so we need to provide enough time for users to form their loyalty and then measure it. Future research may consider this point and try to measure loyalty in later stages of loyalty formation.

Implications

Our research has several implications for academia and practitioners. This study contributes to the existing literature in a number of ways. First, our study is the first research that elaborates the antecedents for sense of presence in the context of virtual world. While there are several researches that try to elaborate the concept of presence and its effect on users satisfaction in context of online learning (e.g. Cobb 2009; Gunawardena and Zittle 1997; Hostetter and Busch 2006; Richardson and Swan 2003), the effect of social and virtual presence was not studied on the satisfaction and loyalty in virtual world at the same time. In fact, our research provides a comprehensive view of the concept of presence in virtual world and its effect on virtual world users' satisfaction and loyalty with an acceptable R-square.

Second, our research model can be used in other contexts such as online learning in order to find the importance of virtual presence and its antecedents in this context. As we discussed earlier online learning literature has not considered virtual world as an important part of motivation for students who participate in this type of learning environment.

Our research also has several implications for practitioners. For example, our research sense of presence and that factors affecting it in the context of virtual world. This can be useful for virtual world developers to consider our finding in order to increase satisfaction and loyalty. For example, they may increase users'

satisfaction and loyalty by increasing absorption and consequently increasing virtual presence among users. Antecedents of cognitive absorption and sense of belonging can be considered by practitioners as important factor increase sense of virtual presence.

Conclusion

Virtual worlds have dramatic growth during the last decade. There are several virtual world environments that are popular nowadays such as Second Life, Entropia Universe, and There. Our research explores the importance of virtual and social presence in virtual world environments as factors increase satisfaction and loyalty to virtual world by users. Results of the research suggested that cognitive absorption positively influence virtual presence and sense of belonging positively influence social presence. In addition our results suggested that sense of presence in virtual world increase satisfaction and loyalty among virtual world users.

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Appendix 1: Measurement Items

Construct	Acronym	Measure	Reference
Temporal Dissociation (TD)	TD1	When I go to Second Life, I forget about my real life problems	Koh and Kim (2003)
	TD2	I find myself spending more and more time in SL	
	TD3	I spend much time in SL	
	TD4	I spend more time than I expected navigating SL	
Focused Immersion (FI)	FI1	The interaction with the SYSTEM was interesting	Konana and Balasubramanian (2005) and Hsu and Lu (2004)
	FI2	I felt bored when interacting with the SL	
	FI3	I feel that my body was inside the SL environment	
	FI4	It's fun to interact with the SL	
Curiosity (CU)	CU1	The SL site is very interesting and appealing	Hsu and Lu (2004)
	CU2	My imagination was aroused when I was interacting with the SL	
	CU3	I felt curious when interacting with the SL	
Heightened Enjoyment (HE)	HE1	ENJ1: SL provides me enjoyment that I have not felt with other online communities	Hsu and Lu (2004)
	HE2	ENJ2: I feel pleasure while involving in SL	
	HE3	I feel excited about something that happened or might happen in SL	
	HE4	Overall, it is enjoyable to participate SL	
Control (CO)	CO1	I thought about unrelated things when interacting with the SL	Hsu and Lu (2004)
	CO2	I was absorbed in the interaction with the SL	
	CO3	My curiosity was excited when interacting with the SL	
Feeling of Membership (FoM)	FoM1	I do know many residents in SL	Ma and Agarwal (2007)
	FoM2	I don't get along with other residents in SL	
	FoM3	I feel that I am socially connected to the SL community	
	FoM4	I feel that I am a part of the SL community	
Feeling of Influence (FoI)	FoI1	People (e.g., friends, family members, etc) who are important to me in person think that I should use SL	Ma and Agarwal (2007)
	FoI2	People (e.g., teachers, project team members, colleagues, etc) who are related to me in work think that I should use SL	
	FoI3	Mass media (e.g., news, magazines, advertisings, etc) recommend me to uses SL	
Feeling of Support (FoS)	FoS1	SL is useful for me	Ma and Agarwal (2007)
	FoS2	SL provides me to conveniently communicate with others	

	FoS3	SL improves my efficiency of communication with others	
Emotional Connection (EC)	EC1	I feel at home in the SL community	Ma and Agarwal (2007)
	EC2	I am quite popular in the SL community	
	EC3	I feel that I belong to the SL community	
	EC4	I like other residents in SL that I have interacted with	
Virtual Presence (VP)	VP1	When I was in SL, I felt that I was in a same space with others	Qiu and Benbasat (2005)
	VP2	I felt that my body was in the room, but my mind was inside the SL	
	VP3	I felt that I was chatting with others in SL as face-to-face.	
	VP4	I felt that I was looking at or listening to a real person in SL	
	VP5	I felt that the SL was real world around me	
Social Presence (SP)		I felt that the interaction with the SL was:	Qiu and Benbasat (2005)
	SP1	Impersonal / Personal	
	SP2	Cold / Warm	
	SP3	Distant / Close	
	SP4	Dehumanizing / Humanizing	
	SP5	Unemotional / Emotional	
Satisfaction (SAT)		How do you feel about your overall experience of the SL use:	Bhattacharjee (2001)
	SAT1	Very displeased / Very pleased	
	SAT2	Very frustrated / Very contented	
	SAT3	Absolutely terrible / Absolutely delighted	
VW-Loyalty (LOY)	LOY1	I am likely to participate SL continually	Gefen (2000)
	LOY2	I think it is very fun to participate SL regularly	
	LOY3	If I get a chance, I would recommend other people to participate SL continually	
	LOY4	I would like to engage in SL activities (e.g., creating an avatar, purchasing virtual product, sharing ideas, etc) regular bases.	

Appendix 2: Correlation Matrix

Constructs	AVE	Composite Reliability	Cronbach's Alpha	Cognitive Absorption (CA)	Sense of Belonging (SoB)	Virtual Presence (VP)	Social Presence (SP)	Satisfaction (SAT)	VW-Loyalty (LOY)
Cognitive Absorption (CA)	0.742	0.961	0.954	0.86					
Sense of Belonging (SoB)	0.753	0.955	0.948	0.844	0.87				
Virtual Presence (VP)	0.790	0.949	0.933	0.789	0.783	0.89			
Social Presence (SP)	0.708	0.924	0.896	0.743	0.718	0.663	0.84		
Satisfaction (SAT)	0.860	0.949	0.919	0.747	0.712	0.590	0.677	0.93	
VW-Loyalty (LOY)	0.852	0.973	0.963	0.856	0.844	0.748	0.715	0.809	0.92

Appendix 3: Factor Loadings

Items	Virtual Presence (VP)	Social Presence (SP)	Satisfaction	VW-Loyalty
VP1	.818	.255	.199	.117
VP2	.760	.229	.244	.369
VP3	.817	.210	.219	.207
VP4	.800	.256	.241	.246
VP5	.740	.326	.155	.242
SP1	.360	.744	.199	.268
SP2	.192	.873	.195	.138
SP3	.210	.715	.126	.383
SP4	.353	.633	.340	.007
SP5	.272	.675	.342	.143
SAT1	.289	.310	.748	.309
SAT2	.220	.252	.823	.202
SAT3	.201	.235	.784	.372
LOY1	.399	.305	.325	.780
LOY2	.361	.291	.332	.863
LOY3	.375	.256	.403	.879
LOY4	.314	.304	.256	.886