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UNDERSTANDING COLLABORATIONS IN VIRTUAL WORLD

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Abstract

Virtual worlds (VW) have paved a new and important channel for workplace collaborations. However, analysts have noted that several organizations that made a strong entrance into using VW as a nouveau channel for communication and collaboration are stepping back due to limited user response. Motivated by this fact, we propose a trust-theoretic 'virtual world collaboration model' for collaborations in virtual worlds. The model, grounded in literature on 'technology adoption' and 'trust', theoretically examines the role of trust in motivating users for using this rich virtual communication medium for collaborations. Results establish the important roles of perceived social presence and perceived structural assurance for fostering user trust in VW. Further, results also indicate that user trust is significantly related to both extrinsic and intrinsic motivations, which in turn influence the behavioural intention to use the VW. Implications for research and practice are discussed.

Keywords: Motivations, virtual worlds, trust, behavioural intention, Singapore

1.   INTRODUCTION

Virtual Worlds (VW), referred to as the 3D simulated virtual environments, have existed largely as game-oriented environments such as World of Warcraft, Sims Online and Everquest. However, enterprise version of online VW such as second life, are becoming highly interactive and collaborative. Information technology research and advisory firms such as Gartner and Forrester research note the major benefits of VW as a collaboration tool compared to the current collaboration tools such as web/video conferencing and teleconferencing suggesting a bright future of VW for workplace collaborations (Gonsalves, 2008; Lynch, 2008). However, many companies that made a strong entrance into VW during the first wave of creating virtual presence are stepping back. Despite a high failure rate, experts sense a big future of VW for workplace collaborations and compare the current problems in VW as the problems faced by the web in 1990s. Though the analysts believe that the VW mini-dot com boom has begun, many companies are still struggling to successfully use VW (Wagner, 2007). Researchers and practitioners are concerned with the user reactions for the usage of VW. Davis et al. (2009) clearly state the need to understand the user behaviours in VW. Further, Gartner comments that 90 percent businesses fail in VW as these companies give extra emphasis to technology rather than understanding the needs, behaviours and motivations of VW communities (Gonsalves, 2008).

The usage of VW involves several IT related security risks and problems of identity authentications as individuals interact via *avatars,* which are computer generated representations of individuals (Gartner, 2007). Hence, it is imperative to develop adequate user trust so as to motivate users to use VW for collaborations. Motivated by the imperative need to understand the usage of VW as a collaborative tool, we posit user trust manifesting in VW as the key enabler for usage intentions of VW for collaborations. Though user trust has been studied in several contexts (Pavlou, 2003; Teo et al., 2009), its role in the context of VW has received scant attention. An understanding from the trust perspective can provide insights for usage of this new rich medium of communication for collaboration.

Past empirical studies (e.g. Pavlou, 2003) have demonstrated the role of user trust in developing the extrinsic motivational factors of perceived usefulness (PU) and perceived ease of use (PEOU) in the acceptance of information systems by users. Extrinsic motivations are some benefits outside user-system interaction which drive the users to use the system (Van der Heijden, 2004). However, as the work-play boundaries are dissolving and current technological systems are striving to merge serious tasks with motivation of games so as to retain, rather than lose, the present virtual gaming generation's interest and attention (Prensky, 2003). Intrinsic motivations or benefits derived from the interaction with the system per se like perceived enjoyment (PE) (van der Heijden, 2004) are becoming significant in explaining the usage of information systems (Davis et al., 1992). Hence, we analyze the role of user trust in explaining the extrinsic and intrinsic motivations of VW communities and propose a 'VW collaboration model' for BI to use VW in the workplace for collaborative tasks. In addition, by taking a trust-theoretic stance, we first theorize and then empirically examine the facilitators of user trust in the context of VW. This study specifically addresses the following research questions:

- What constitutes 'user trust' in VW?

- Is the 'BI' of VW collaborations related to the extrinsic and intrinsic motivations?

- Is trust a proximal antecedent of extrinsic and intrinsic motivations in VW collaborations?

2.   RESEARCH MODEL, THEORY AND HYPOTHESES

Drawing upon the literatures on Technology Acceptance Model (TAM) (Davis et al., 1989; Davis, 1989) and user trust, this paper theoretically develops and empirically validates a research model that predicts usage intentions of VW for collaborations. The proposed research model (Figure 1) extends the original TAM (Davis et al., 1989; Davis, 1989) by adding the intrinsic motivation of 'perceived enjoyment' and also proposes user trust as the proximal antecedent of the dominant motivational factors to study the BI to use VW for collaboration. In addition, the research simultaneously investigates the facilitators of user trust (McKnight et al., 1998; Leimeister, 2005).
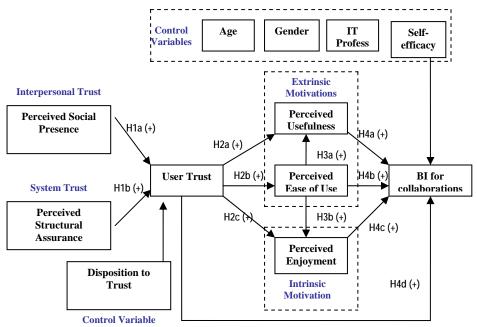
Figure 1 Research Model

2.1 BI to Use VW for Collaborations

Collaborations through VW can be perceived as the users' acceptance of VW as a means to discuss and share ideas and information. Users need to be adequately motivated to develop the behavioural intentions to use VW for collaborations. VW have several IT related security risks, problems of confidentiality and lack of verifiable identity control as users can open several accounts and easily hide their true identities (Gartner, 2007). Consequently, users perceive several behavioural and environmental risks. Behavioural risks are present due to the spatial and temporal separation between the interacting users and the lack of identity control. Environmental risks are a concern in VW as it is a technology-enabled interaction. Uncertainties and ambiguities inherent in interactions through virtual environments might influence people to revert to traditional face-to-face meetings and collaborations and thus may constrain virtual interactions. Trust, by definition, mitigates such constrains (Brown, 2004). In the VW, trust is a way to manage people whom you do not see (Handy 1995, p. 41). Hence, 'User Trust', which reflects the user's concerns about not revealing their true identities and the risks with technology-enabled interactions, seems to be essential for understanding interpersonal behaviour in virtual environments and motivating them to use this nouveau 'collaboration tool' (Paul and McDaniel, 2004).

Pavlou (2003) examined user trust as the antecedent of the two Technology Acceptance Model (TAM) beliefs of PU and PEOU for user acceptance of online transactions. However, TAM suggests the substantial importance of the extrinsic motivators alone. Extrinsic motivation is defined as the motivation to perform an activity for some external benefit or reward. Some of the extrinsic motivations for users to use VW include enhanced convenience, greater access to information and lower search costs which are similar to the TAM beliefs of perceived usefulness (PU) and perceived ease of use (PEOU) (van der Heijden, 2004). Numerous past researchers have extensively investigated and corroborated the TAM constructs (PU and PEOU) as important extrinsic motivational factors explaining system usage (Subramanian, 1994). However, Davis et al., (1992) highlighted the importance of considering both extrinsic as well as intrinsic motivations for the acceptance of a new system. Intrinsic motivation refers to no apparent outside instrumental reason to perform the activity rather it is dependent on the internal feeling of fulfilment achieved by the completion of the task (Teo et al., 1999). Intrinsically motivated users experience interest and enjoyment in performing an activity, feel self-determined and often get engrossed to the state of complete involvement and flow (Deci, 1985). We believe intrinsic motivation like perceived enjoyment (PE) is an important motivating factor in 3D virtual environments due to the visual and aural cues it provides for interaction among

the avatars. Hence, we integrate extrinsic and intrinsic motivations with trust to determine the BI to use VW for collaborations and propose trust as a proximal antecedent of both extrinsic (PU and PEOU) and intrinsic motivations (PE). We further contextualize the trust antecedents to the virtual world situations.

2.2   User Trust

Lewis and Weigert (1985) describe trust as a cognitive process that discriminates amongst persons and institutions that are trustworthy, distrusted and unknown. Luhmann (1979) suggested "One should expect trust to be increasingly in demand as a means of enduring the complexity of the future which technology will generate" (p: 16). VW are technology-enabled complex worlds. Trust is an effective complexity-reduction tool and a key enabler of virtual collaborations (Paul and McDaniel, 2004). Yet, trust in VW is difficult to build as compared to face-to-face interactions. Hence, understanding the factors accounting for trust in VW is critically important for developing VW usage.

Zucker (1986) emphasized on institutional trust while Rousseau et al., (1998) argued that trust can be relational or institutional. Relational trust is established by repeated interactions between trustor and trustee while institutional trust is formed by providing assurances through various institutional structures that supports the risk-taking ability and develops trust behaviour in the user. Interpersonal trust, system trust and disposition to trust are identified as three main types of trust that lead to forming trusting beliefs and finally decisions to trust (McKnight et al., 1998). *Interpersonal trust* is between the interacting parties or individuals on a personal level and applies to specific parties and contexts, *system trust* is based on the reliance of a system and *disposition to trust* is a personal tendency of individuals that applies across all situations and is independent of any other party or context (Leimeister et al., 2005; McKnight et al., 1998; Pennington et al., 2003).

In this study, we explore the trust building factors in VW for collaborations by examining user trust under two broad domains of *interpersonal* and *system* trust. Nonetheless, we control for the disposition to trust in the research model. According to McKnight et al. (1998), there can be no factor that can have direct effect on disposition to trust. In contrast, interpersonal and system trust are supported by specific factors. *Interpersonal Trust* or the confident positive expectations regarding others' conduct has been shown by previous IS researchers as an important factor in determining information sharing behaviours and a desire for future interactions (Naquin and Paulson, 2003). It reflects trust that has been cultivated over time (Pennington et al., 2003). IS research has extensively examined the effect of various internet based communications on social interactions. As the previous internet communications have been broadly text based with voice alternatives such as e-mail, instant messaging and chat rooms, they constitute a fairly lean form of media due to the lack of perceptions of presence (Naquin and Paulson, 2003). The lack of verbal and non verbal cues present during communication (Rice, 1993) results in reduced interpersonal trust. Thus interpersonal trust is largely constituted by the perceptions of social presence of the participants. Hence, *interpersonal trust* is proposed to be described by the *perceived social presence (PSP)* of the interacting parties. *System Trust* is the trust in the party established by assuring that all impersonal structures are in place for secured virtual interactions without any risk and privacy issues. Thus system trust gives assurance to the user that proper impersonal structures are in place (Pennington et al., 2003). Perceived structural assurance (PSA) describes the efficacy of the institutional environment (here VW), that all structures like guarantees, regulations, and promises are operational for safe, secure and reliable transactions (Zucker, 1986). Hence *system trust* is largely described by *perceived structural assurance (PSA)*.

2.3   Antecedents of User Trust : PSP and PSA

Perceived social presence (PSP) is the extent to which a communication medium is perceived to convey the presence of the communicating participants (Rice, 1993). It is a richer medium of communication which results in higher levels of interactivity due to immediate feedback and more cues by the medium (Daft and Lengel, 1986). Thus PSP is a significant factor accounting for interpersonal trust. Various studies have investigated that virtual environments and 3D avatars

enhance consumers' feelings of telepresence (a perceptual illusion of the user to be present in a remote environment by means of a communication medium; Choi et al., 2001) and these avatars can significantly influence consumers' perceptions of presence. Due to media richness and enhanced levels of PSP in virtual environments, the collaborating members would build user trust (Gefen and Straub, 2004). Luhmann (1979) suggested that trust is increased when the trusted party shows verbal and non verbal cues in accordance with one's expectations. Hence it follows,

Hypothesis 1a: Perceived Social Presence is positively associated with user trust in VW.

Perceived structural assurance (PSA) for VW can be developed by building the institution-based trust which can be achieved by developing adequate legal and technological safeguards that assure and make the virtual members feel safe depending on the other interacting members, hence enabling trust. Tan and Thoen (2000) suggested that the perception of security and privacy control through building PSA helps in developing user trust for online transactions. Hence we hypothesize:

Hypothesis 1b: Perceived Structural Assurance is positively associated with user trust in VW.

2.4 Consequences of User Trust: Extrinsic (PU and PEOU) and Intrinsic (PE) Motivations

Research has shown that trust is related to the perceptions of ability of an IS to accomplish a pre-defined task (Teo et al. 2009). In the context of VW, ability refers to the competence belief which means that the user should believe that the VW is useful in achieving the desired goals and thus meeting the perceived performance levels. Thus, trust plays a critical role in enhancing the perceptions of usefulness for using VW as a 'collaboration tool' (Mc Evily et al., 2003). Various researchers have demonstrated the significant relationship of trust with perceived usefulness (PU) and perceived ease of use (PEOU) in the context of online transactions (Gefen, 1997; Pavlou, 2003). Similar to other online contexts, trust is a significant determinant of PU in the VW scenario due to the impersonal nature of the virtual environment and the uncertainties involved. Hence we hypothesize:

Hypothesis 2a: User trust in VW is positively associated with the perceived usefulness of VW.

In VW, the users interact and share information through the virtual environment as avatars, and thus may avoid disclosing their true identity. Thus, the virtual medium of interaction is full of uncertainties and risks. Drawing from Pavlou's (2003) argument we posit, that the user trust in VW would reduce the users need to understand and monitor their use, thereby making the VW usage simple and easy. On the other hand, if the user trust in the system is low, the users will be concerned about the prevailing uncertainties and risks in sharing information through this virtual medium (Teo et al., 2009). This will lead them to spend extra time and effort in understanding the system resulting in making the system harder to use (Pavlou, 2003). Hence, we hypothesize,

Hypothesis 2b: User trust in VW is positively associated with the perceived ease of use of VW.

The interacting members as well as the technology used and their reliability are of prime concern for VW. If the members and technology are perceived as trustworthy, users are more likely to get deeply involved and experience the immersive environment of VW. On the contrary, if the trust in members and trust in technology is low, s/he will tend to doubt the reliability of the members and technology. VW operations involve constant interaction among the members. Hence users with low user trust would constantly worry about the efficiency and reliability of VW which would discourage the users from getting into the state of deep involvement and absorption into the VW. Thus, the lack of user trust in VW would hamper their level of enjoyment. Hence it follows,

Hypothesis 2c: User trust in VW is positively associated with perceived enjoyment.

2.5 Relationships of Extrinsic (PU and PEOU) and Intrinsic (PE) Motivations

PEOU is posited to influence BI to use VW directly as well as indirectly through PU. Usefulness is the degree to which the performance improves in the workplace by the usage of a technology. While

usefulness is the outcome of an online interaction experience, ease of use is the process leading to the outcome (Childers et al., 2001). The relationship between PU and PEOU is supported by the fact that lower cognitive burden by the technology frees the user to focus on other important matters thereby serving the instrumental purpose of the user (Davis et al., 1989). Thus, it follows,

Hypothesis 3a: Perceived ease of use of VW is positively associated with perceived usefulness of VW.

Davis et al. (1989) introduced the concept of PE as an intrinsic motivation factor. They reported PE and PU as significant factors influencing intention to use a word processing program. PE is the extent to which the activity of using the technology is perceived to provide reinforcement in its own right, apart from any performance consequences that may be anticipated (Davis et al., 1989). IS researchers have added enjoyment to the original TAM to study usage of several technologies. Van der Heijden (2004) added PE to the original TAM and verified its influence on BI towards personal website adoption. Teo et al. (1999) have demonstrated the positive influence of PEOU on PE arguing that systems that are difficult to use are less likely to be perceived as enjoyable. In a similar vein, PEOU is expected to have positive influence on user's PE in their interaction in VW. Hence, it follows,

Hypothesis 3b: Perceived ease of use of VW is positively associated with perceived enjoyment of VW.

2.6   Relationships of Motivations and Trust with BI to use VW for collaborations

The association between PU and adoption intention of IS has been empirically validated by several studies (Davis, 1989; Davis et al., 1989; Venkatesh, 2000). VW offer several benefits to its users like enhanced interactivity, information sharing and collaboration among users. This leads us to expect that users will adopt VW for collaboration if they perceive VW would help them to achieve better performance levels. In this context, we propose the following hypothesis.

Hypothesis 4a: Perceived usefulness of VW is positively associated with the BI to use VW for collaborations.

Several studies in IS have proved the significant effect of PEOU on usage intention (Davis et al., 1989). Teo et al. (1999) suggested that information systems which users perceive easy to use and less complicated increase the intentions of its adoption and usage. Users would use VW efficiently, effectively and satisfactorily if the systems are easy to learn and use. Hence, it follows,

Hypothesis 4b: Perceived ease of use of VW is positively associated with BI to use VW for collaborations.

PE is an intrinsic motivation variable that has shown a significant direct influence on an individual's BI to use new technologies and information systems (van der Heijden, 2004). In the context of VW, PE refers to the fun or enjoyment user expects to derive with usage of VW for collaboration. We believe that when a user perceives that serious tasks like collaboration and other business activities can be a fun-filled and enjoyable experience, s/he would be willing to adopt this technology for collaborations. Thus, PE should significantly influence BI to use VW.

Hypothesis 4c: Perceived enjoyment in using VW is positively associated with BI to use VW for collaborations.

Hoffman et al. (1999) argued that lack of user trust would prevent users from getting involved in online activities mainly because the users are concerned about the uncertainties involved in the technological infrastructure. Trust has been shown to be related to positive attitudes which are more likely to influence the user's intention to adopt the technology (Gefen, 1997). Following Theory of Reasoned Action, which posits that beliefs lead to attitudes which in turn lead to behavioural intentions, trust is a belief that creates positive attitudes and affects behavioural intentions to use VW. Hence we hypothesize:

Hypothesis 4d: User trust in VW is positively associated with BI to use VW for collaborations.

3. RESEARCH METHOD, DATA AND ANALYSES

Survey methodology was used to collect data for testing the research hypotheses. The measures for our study were taken from existing literature and adapted to the context of VW so as to ensure content validity. We also included control variables in the study as age, gender, IT professional orientation as these are the respondents' self-reported demographic characteristics. Another control variable of self-efficacy is included as it is an individual characteristic that reflects the confidence in oneself to perform a task. Self efficacy is measured in this study through pre validated scales (Compeau and Higgins, 1995). 'Disposition to trust', is included as a control variable for user trust, as previous studies have highlighted that people who have a higher propensity to trust will general be more trusting (e.g. McKnight et al., 2002). The sampling frame for this study comprised of 'VW users who use VW for recreational activities'. For conducting the survey, the first step was to pre-screen users of VW who had prior experience of VW for recreational activities. Using these criteria we distributed paper-based survey questionnaires to more than 300 part time and full time students in two large university campuses in Singapore. Subsequently, we had responses from 226 respondents out of which we considered only 197 for data analysis. The average age of the respondents was 29.3 with a standard deviation of 5.8. The respondents self-reported if they use VW frequently. The sample consisted of 36.5% frequent users termed as 'mature VW users' and 63.5% not very frequent users termed as 'non mature VW users'.

The study was conducted in Singapore as we believe it provides a good location for conducting VW related research. Many Singapore firms are eyeing VW to sell their real-life goods and services (Wai-Leng, 2007). IBM has also dedicated sales staff at its virtual IBM business centre to serve customers from Singapore. In addition, Singapore is a popular place for researchers to test out new technologies and government has set aside several million dollars for companies like Linden Labs, the creators of Second Life, to consider locating here (Siew, 2007).

We used Partial Least Squares (PLS), specifically, SmartPLS 2.0 to analyze the data in this study (Ringle et al., 2005; Vance et al., 2008). Various IS studies have employed PLS and have found it to be an effective method of analysis (Subramani, 2004; Teo et al., 2009).

3.1 Measurement Model

Convergent validity was tested by examining the composite reliability (CR) and average variance extracted (AVE). Many studies using PLS have taken 0.5 as the threshold for CR of the measures, however, 0.7 is the suggested threshold for reliable measurement (Chin, 1998). The AVE should be greater than 0.50 to justify using a construct (Barclay et al., 1995). Table1 shows that CR values ranged from 0.86 to 0.96 and AVE ranged from 0.62 to 0.87, which are all above the acceptable values. The discriminant validity was examined by checking that values of the square root of the AVE (reported on the diagonal in Table 1) are all greater than the correlations between the construct and others, thus indicating that the construct shares more variance with its own measures than with other constructs (Barclay et al., 1995).

VAR	Nos. Items	Mean	SD	CR	AVE	BI	DTR	PE	PEOU	PSA	PSP	PU	SEF	UTR
BI	4	4.22	1.50	0.91	0.72	**0.85**								
DTR	5	4.45	1.49	0.92	0.68	0.24	**0.83**							
PE	4	4.54	1.41	0.96	0.86	0.41	0.46	**0.93**						
PEOU	5	4.37	1.40	0.93	0.72	0.49	0.32	0.62	**0.85**					
PSA	4	3.87	1.54	0.96	0.87	0.56	0.29	0.40	0.43	**0.93**				
PSP	4	3.95	1.53	0.93	0.77	0.25	0.48	0.57	0.25	0.45	**0.88**			
PU	5	4.15	1.43	0.96	0.82	0.67	0.25	0.62	0.62	0.60	0.44	**0.91**		
SEF	4	4.01	1.60	0.86	0.62	0.57	0.49	0.62	0.67	0.47	0.50	0.54	**0.79**	
UTR	5	3.48	1.49	0.96	0.82	0.59	0.42	0.30	0.39	0.76	0.47	0.53	0.50	**0.91**

Table 1 Results of Confirmatory Factor Analysis, Descriptives and Correlations

3.2   Structural Model

The results of the analysis are depicted in Table 2. Examining the trust building antecedents, we find that the relationship of PSP with trust in VW (path=0.30, t=4.24, p<0.01) is significant thereby supporting H1a. Also, the relationship of PSA with trust in VW (path=0.43, t=5.70, p<0.01) is significant rendering support to H1b. The two trust-building antecedents explain 59% of the variance in 'user trust'. This suggests the high explanatory power of the theorized antecedents of user trust, providing empirical validation for the proposed research model. From the results in the relationships of user trust with motivations, we find that user trust has a strong relationship with PU (path=0.41, t=5.73, p<0.01), and PEOU (path=0.47, t=6.98, p<0.01) showing a strong support for H2a and H2b. User trust also has a strong association with PE (path=0.24, t=2.83, p<0.01), strongly supporting H2c. Among the control variables, the relationship of disposition to trust (path=0.19, t=2.67, p<0.01) with user trust and self-efficacy (path=0.14, t=2.64, p<0.01) with BI are significant. Next, we observe that PEOU has a strong relationship with PU (path=0.42, t=5.50, p< 0.01) and PE (path=0.43, t=5.16, p< 0.01) supporting H3a and H3b. Further, examining the relationship of extrinsic and intrinsic motivations with BI, we observe that although the extrinsic motivations of PU (path=0.35, t=4.70, p< 0.01) and PEOU (path=0.17, t=2.38, p< 0.01), have a strong relationship with BI supporting H4a and H4b, the intrinsic motivation depicted as PE has a non-significant relationship with the BI (path=0.05, t=0.73, ns), hence H4c is not supported. This is indeed an anomalous result and requires a deeper investigation to understand the differences in the impact of extrinsic and intrinsic motivations in the context of VW. Also, user trust has a strong relationship with BI (path=0.29, t=5.13, p<0.01), rendering strong support to hypothesis H4d. Further, the proximal antecedent of user trust along with the dominant motivational factors explain 63% variance in BI for VW collaborations highlighting the key role of user trust in forming these motivations for BI.

Paths	Hypothesized Model			Alternative Model		
	β	t	R^2	β	t	R^2
PSP→UTR	0.30***	4.24	0.59	0.30***	4.24	0.59
PSA→UTR	0.43***	5.70	0.59	0.43***	5.70	0.59
UTR→PU	0.41***	5.73	0.51	0.41***	5.73	0.51
UTR→PEOU	0.47***	6.98	0.22	0.47***	6.98	0.22
UTR→PE	0.24***	2.83	0.33	0.24***	2.83	0.33
PEOU→PU	0.42***	5.50	0.51	0.42***	5.50	0.51
PEOU→PE	0.43***	5.16	0.33	0.43***	5.16	0.33
PU→BI	0.35***	4.70	0.63			0.54
PEOU→BI	0.17***	2.38	0.63			0.54
PE→BI	0.05	0.73	0.63	0.21***	3.12	0.54
UTR→BI	0.29***	5.13	0.63	0.46***	8.80	0.54
*p < 0.1; **p <0 .05; ***p < 0.01; R^2 values of the paths are for the target variables						

Table 2 Results of the Hypothesized Model and Post-hoc Analyses

3.3   Post Hoc Analysis

Although the current research proposed that the relationship between 'user trust' and BI is mediated through the extrinsic (PU and PEOU) and intrinsic (PE) motivations, the results (Table 2, Hypothesized Model) do not exhibit this phenomenon for intrinsic motivational factor of PE. In fact, in the hypothesized research model, though mediating role of the extrinsic factors of PU and PEOU are significant but the relationship between PE and BI is not significant (path=0.05, t=0.73, ns) despite past studies establishing this PE→BI as a significant relationship in other contexts (van der Heijden, 2004). To test if there is any relationship of 'trust' with BI through PE (in the absence of the mediating path from extrinsic factors of PU and PEOU to BI), we tested a revised model (Table 2, Alternative Model) in which the mediating path from PU to BI and PEOU to BI were dropped. In the

revised model, the path from PE to BI becomes significant (path=0.21, t=3.12, p<0.01) but the R^2 value of BI drops significantly from 0.63 (in the hypothesized model) to 0.54 (in the alternative model 2). The non significant path from PE to BI can be because the variance in BI is pre-dominantly explained by extrinsic motivations. This is consistent with previous research in other contexts suggesting that extrinsic motivations (PU and PEOU) play a much stronger role than PE in the usage of technologies (Igbaria et al., 1995; Teo et al., 1999). This highlights the key role of extrinsic motivations in VW usage for collaborations. We also observe that in the revised model, variance drops significantly, suggesting that the hypothesized mediated model with both extrinsic and intrinsic motivations provides a better explanation of the relationships between the theorized constructs.

3.4 Sub Group Analysis

Sub group analysis was performed to understand the differences in the BI to use VW by different user groups. We did this by splitting the total sample into two sub-samples based on the differences in the level of usage of VW. The respondents self reported in the questionnaire as to whether they use VW frequently or not. We identified the two user groups' viz. 'mature users of VW', and 'non-mature users of VW'. Mature users of VW are described as users who use VW actively for gaming and socializing. On the contrary, non mature users of VW are the users who are aware of VW; however they do not use VW frequently. In our sample of 197 respondents only 36.5% users were mature users. Results of this sub-group analysis for the hypothesized (Table 3), exhibit some remarkable differences between the groups and help us better understand the behavioural intention of VW for collaborative workplace tasks.

Results indicate that for mature users who use VW regularly for fun and gaming, social presence (path=0.08, t=1.47, p>0.1) shows a non significant relationship with user trust. This result is in contrast to the perceptions of non-mature users for whom PSP→UTR is significant (path=0.39, t=5.44, p<0.01). Another interesting result to note is that though for non-mature users, user trust and PE has a significant association (path=0.35, t=4.15, p<0.01), but for mature users user trust has a non-significant relationship (path=0.06, t=1.00, p>0.1) with PE. Also, the non-significant relationships of PE→ BI as compared to the strong correlation of PU→BI across all user groups reiterates the findings of the previous studies (e.g. Igbaria et al., 1995; Teo et al., 1999) that perceived usefulness plays a stronger role than perceived enjoyment and implicitly diminishes the intrinsic motivational effects of perceived enjoyment in the usage of immersive virtual platforms like VW.

Paths	Results			Sub Group Analyses					
	Full Sample			Mature Users			Non-Mature Users		
	β	t	R^2	β	t	R^2	β	t	R^2
PSP→UTR	0.30***	4.24	0.59	0.08	1.47	0.63	0.39***	5.44	0.60
PSA→UTR	0.43***	5.70	0.59	0.67***	17.92	0.63	0.28***	3.08	0.60
UTR→PU	0.41***	5.73	0.51	0.34***	5.85	0.48	0.44***	6.35	0.51
UTR→PEOU	0.47***	6.98	0.22	0.39***	5.25	0.15	0.48***	7.75	0.23
UTR→PE	0.24***	2.83	0.33	0.06	1.00	0.39	0.35***	4.15	0.30
PEOU→PU	0.42***	5.50	0.51	0.48***	7.98	0.48	0.39***	5.23	0.51
PEOU→PE	0.43***	5.16	0.33	0.60***	8.97	0.39	0.29***	3.13	0.30
PU→BI	0.35***	4.70	0.63	0.48***	8.37	0.57	0.30***	3.81	0.66
PEOU→BI	0.17***	2.38	0.63	-0.00	0.01	0.57	0.23***	3.46	0.66
PE→BI	0.05	0.73	0.63	-0.10	1.33	0.57	0.09*	1.50	0.66
UTR→BI	0.29***	5.13	0.63	0.26***	6.22	0.57	0.29***	4.74	0.66
*p < 0.1; **p <0 .05; ***p < 0.01									

Table 3 Results of Sub Group Analysis: Mature and Non-Mature Users of VW

4. DISCUSSION

Results suggest 'perceived social presence' as an important trust building factor in VW. The only exception being the sub group of 'mature users' who have already developed trust in VW by its regular use and thus do not depend on social presence for developing user trust in such systems. Next,

the findings indicate 'structural assurance' as a strong trust building antecedent. In VW, users do not need to reveal their true identities and there are inherent risks with technology-enabled interactions. The results suggest that one way to reduce such technology-enabled risks in VW is to develop adequate structural assurance. The results in the consequences part of the research model indicate a strong influence of user trust in developing both extrinsic (PU and PEOU) and intrinsic motivations (PE) for using VW for collaborative tasks. This is true for all subgroups except the non-significant relationship of user trust with enjoyment for 'mature users'. This non-significant relationship may be due to the fact that mature users are regular users of VW who must be surely enjoying VW to visit it so regularly. Hence, they do not depend on developing trust in such systems to enjoy them. Trusting a system to enjoy them would be more apt for new users due to their apprehensions in system use.

Next, discussing the relationships of motivations with BI to use VW for collaborations, the results indicate a strong influence of extrinsic motivations (PU and PEOU) for users to develop intentions to use VW for collaborative tasks. Usefulness is a strong correlate of BI to use VW for collaborations across all sub-groups. Ease of use also has a significant relationship with BI for all sub-groups except for 'mature users'. Mature users are experts in using VW and thus are more likely to find VW easy to use. Due to this reason, probably they do not perceive that the complexity of using VW can de motivate the users from using VW. Finally, the results indicate that the intrinsic motivation of enjoyment is not a significant factor for developing BI to use VW for collaborations. This leads us to believe that enjoyment may not necessarily be a significant factor in determining BI to use VW for collaborations. It contradicts the findings from past studies that have empirically demonstrated intrinsic motivations of enjoyment as a significant determinant of BI to use new technologies (Childers et al., 2001; van der Heijden, 2004). However, this anomaly was further investigated by a revised model (Table 2, Alternative Model) which showed that the direct effects of extrinsic factors (PU and PEOU) are much stronger than the intrinsic factor of PE. This is in line with Deci's (1975) which suggested that extrinsic reward can diminish the effect of intrinsic motivation like enjoyment on tasks which were originally purely intrinsically motivating (Teo et al., 1999). Thus, the more prominent effects of extrinsic motivations (PU and PEOU), therefore diminish the intrinsic motivations of enjoyment.

5.   IMPLICATIONS

The paper offers several implications for research and practice. *First,* we present a 'VW collaboration model' which can be used as a point of reference for future research in VW. The robustness of the research model is confirmed by conducting post-hoc analyses. The study highlights the critical role of user trust in motivating the users to develop intentions to use VW for collaborations. This key role of trust is confirmed across all the sub groups analyzed. The current study highlights the critical role of user trust in developing such motivations for using VW. Thus, practitioners and VW designers have to understand this key role of user trust while finalizing their VW designs. *Second,* the study establishes the mediating role of both extrinsic (PU and PEOU) and intrinsic (PE) motivations in forming intentions to use VW for collaborations. However, motivating users through extrinsic motivational factors (PU and PEOU) is more pronounced as compared to developing motivations through intrinsic factors like PE and extrinsic motivational factors diminish the role of intrinsic motivational factor like enjoyment. This implies that though VW are enjoyable enough to attract new users, users will lose interest and eventually stop using it, if VW do not fulfil the extrinsic factors of usefulness and ease of use. Also, the VW designers and practitioners should pay special attention to these motivational factors in addition to user trust for facilitating VW usage for workplace collaborations. *Third,* in the proposed research model, the theorized antecedents of user trust explain a significantly high percentage of variance in user trust, highlighting the significance of the identified facilitators. This list of facilitators provides clear guidelines to the VW designers and practitioners on the means to foster 'user trust'. Future research can expand this list of facilitators of user trust. *Fourth*, by examining the differences in the factors influencing user trust for different groups of users, we highlight the differences in the perceptions of the same technology by different user categories. This opens up avenues for future research which can examine user categories in the context of VW in greater detail.

Also, the results indicate that the designers and practitioners should strategize differently to cater to the needs of different user groups.

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